

# **Final Submittal**

DEPARTMENT OF THE NAVY  
ATLANTIC DIVISION, NAVAL FACILITIES ENGINEERING COMMAND  
MARINE COPRS AIR STATION, CHERRY POINT, NORTH CAROLINA

## **REPAIRS TO BEQ BUILDING 4200**

**WO# 6881815 CP1405M**

AT THE

MARINE CORPS AIR STATION  
CHERRY POINT, NORTH CAROLINA

DESIGNED BY:

MAUNE BELANGIA FAULKENBERRY ARCHITECTS, PA  
317-C POLLOCK STREET  
NEW BERN, NORTH CAROLINA 28560

PLUMBING: CRENSHAW CONSULTING ENGINEERS, INC.  
MECHANICAL: CRENSHAW CONSULTING ENGINEERS, INC. ELECTRICAL:  
CRENSHAW CONSULTING ENGINEERS, INC. STRUCTURAL: KAYDOS-  
DANIELS ENGINEERS, PLLC  
LEAD & ASBESTOS TESTING: ECS CAROLINAS, LLP  
FIRE PROTECTION: HUGHES ASSOCIATES, INC.  
CIVIL: AVOLIS ENGINEERING, PA

SPECIFICATION APPROVED BY:

Design Director:



PATRICK FAULKNER PE

Date: 6/10/19

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## LIST OF DRAWINGS

02/11

## PART 1 GENERAL

## 1.1 SUMMARY

This section lists the drawings for the project pursuant to contract clause "DFARS 252.236-7001, Contract Drawings, Maps and Specifications."

## 1.2 CONTRACT DRAWINGS

Contract drawings are as follows:

| NAVFAC No. | TITLE  |
|------------|--|
| 12713571   | G-001 TITLE SHEET  |
| 12713572   | G-002 SHEET INDEX  |
| 12713573   | Not Used   |
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| 12713579   | A-103 ENLARGED FLOOR PLAN: FIRST FLOOR CENTRAL CORE DEMOLITION       |
| 12713580   | A-104 ENLARGED FLOOR PLAN: 2ND & 3RD FLOORS CENTRAL CORE DEMOLITION  |
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| 12713603   | A-603 DOOR & WINDOW DETAILS  |
| 12713604   | A-604 SIGN SCHEDULE & DETAILS  |
| 12713605   | I-101 OVERALL FURNITURE PLANS  |

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| 12713606 | I-102 | FIRST FLOOR FURNITURE PLAN                                |
| 12713607 | I-103 | SECOND FLOOR FURNITURE PLAN                               |
| 12713608 | I-104 | THIRD FLOOR FURNITURE PLAN                                |
| 12713609 | I-105 | FLOOR FINISH PLANS  |
| 12713610 | I-106 | WALL FINISH PLANS   |
| 12713611 | I-601 | FINISH SCHEDULE   |
| 12713612 | I-602 | FINISH LEGEND AND NOTES                                   |
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| 12713631 | PD103 | PARTIAL ENLARGED SECOND FLOOR PLANS - PLUMBING DEMOLITION |
| 12713632 | PD104 | PARTIAL ENLARGED THIRD FLOOR PLANS - PLUMBING DEMOLITION  |
| 12713633 | P-101 | BUILDING FLOOR PLANS - OVERALL PLUMBING LAYOUT            |
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| 12713646 | MD104 | PARTIAL THIRD FLOOR PLANS - MECHANICAL DEMOLITION         |
| 12713647 | MD105 | COMPREHENSIVE FLOOR PLANS - MECHANICAL PIPING DEMOLITION  |
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| 12713649 | M-101 | COMPREHENSIVE FLOOR PLANS - MECHANICAL CONSTRUCTION       |
| 12713650 | M-102 | PARTIAL FIRST FLOOR PLANS - MECHANICAL CONSTRUCTION       |
| 12713651 | M-103 | PARTIAL FIRST FLOOR PLANS - MECHANICAL CONSTRUCTION       |
| 12713652 | M-104 | PARTIAL SECOND FLOOR PLANS - MECHANICAL CONSTRUCTION      |
| 12713653 | M-105 | PARTIAL SECOND FLOOR PLANS - MECHANICAL CONSTRUCTION      |
| 12713654 | M-106 | PARTIAL THIRD FLOOR PLANS - MECHANICAL CONSTRUCTION       |
| 12713655 | M-107 | PARTIAL THIRD FLOOR PLANS - MECHANICAL CONSTRUCTION       |
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| 12713657 | M-109 | COMPREHENSIVE FLOOR PLANS - MECHANICAL PIPING             |
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| 12713659 | M-502 | MECHANICAL DETAILS  |
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| 12713689 | E-604 | ELECTRICAL SCHEDULES                               |

### 1.3 Drawing Revisions

The Following NAVFAC Drawings have revisions, which are addressed below:

NAVFAC Drawing #12713571 Title Sheet and Index of Drawings:

A supplemental sketch to identify proposed contractor laydown/staging area is attached to the end of this section.

NAVFAC Drawing #12713687 Electrical Schedules:

A supplemental Sketch to identify NL-53 Lighting cut sheet is attached at the end of this section.

NAVFAC Drawing #12713576 (CU501):

Detail "E": Amend Detail "E" to include Note: "Provide joint restraints where thrust blocks don't rest against undisturbed soil. See specifications section 33 11 00 Para 3.1.2.1C"

NAVFAC Drawing #12713577 (A101):

Keyed Demolition Notes: Delete Keyed Demolition Notes 1 and 6. EXISTING CONCRETE PLANK EXTERIOR WALKWAYS AND GUARDRAILS ARE TO REMAIN. ALL REFERENCES TO DEMOLITION AND REPLACEMENT OF EXTERIOR WALKWAYS AND GUARD RAILS AT EXTERIOR WALKWAYS IN DRAWINGS & SPECIFICATIONS SHALL BE DELETED FROM THIS CONTRACT.

NAVFAC Drawing #'s 12713606, 12713607, 12713608 (I102, I103, I104):

Add note below Furniture Schedule - NOTE: Furniture quantities depicted in this schedule and on this sheet have changed. New furniture requirements shall be based on double occupancy for each living quarters. Contractor's Interior designer shall validate all FF&E

requirements with the Activity per specifications section 01 30 01.00  
22 Para 1.4.2.

On Sheet NO. I602:

Title Block: Change NAVFAC #12713605 to 12713612 and change Sheet 35 of 119 to sheet 42 of 119.

On Sheet No. S101:

Title Block: Add NAVFAC #12713613 and Sheet 43 of 119.

EXISTING CONCRETE PLANK EXTERIOR WALKWAYS AND GUARDRAILS ARE TO REMAIN. ALL REFERENCES TO DEMOLITION AND REPLACEMENT OF EXTERIOR WALKWAYS AND GUARD RAILS AT EXTERIOR WALKWAYS IN DRAWINGS & SPECIFICATIONS SHALL BE DELETED FROM THIS CONTRACT.

On Sheet No. S102:

Add NAVFAC #12713614 and Sheet 44 of 119.

Add NAVFAC #12713617 (FA001):

Delete Fire Alarm Demolition Note #1.

NAVFAC Drawing #'s 12713618, 12713619, 12713620 (FA101, FA102, FA103):

Amend Sheet Note #1 to "Remove, store and reinstall existing heat/smoke detectors. Relocate heat/smoke detectors as applicable".

NAVFAC Drawing #12713621 (FA401):

Amend Sheet Notes #7 & #8 to "Remove, store and reinstall existing heat/smoke detectors. Relocate heat/smoke detectors as applicable".

NAVFAC Drawing #12713624 (FP101):

Add Sheet Note 11. Provide a 10 pound ABC fire extinguisher and cabinet in Lounge 143. Installation location shall be in close proximity to entrance/exit.

NAVFAC Drawing #12713625 (FP102):

Add Sheet Note 6. Provide a 10 pound ABC fire extinguisher and cabinet in Laundry 243. Installation location shall be in close proximity to entrance/exit.

NAVFAC Drawing #12713626 (FP103):

Add Sheet Note 7. Provide a 10 pound ABC fire extinguisher and cabinet in Lounge 343. Installation location shall be in close proximity to entrance/exit.

NAVFAC Drawing #12713642 (M001):

Add General Note #7 - "Unless otherwise indicated, all mechanical piping shall be run in the designated or main service chases. Piping shall not be run overhead in rooms".

Add General Note #8 - "At all instances where condensate drain lines are required the contractor shall ensure that positive drainage to a suitable drain line is established. In instances where positive drainage cannot be established the contractor shall install adequately rated condensate pumps."

NAVFAC Drawing #12713647, 12713657 (MD105, M109):

Plan Note 1: Amend Plan Note #1 to include "Existing chiller and disconnect to be returned to the Government."



NAVFAC Drawing #12713672 (ED101):

Plan Note #1. Delete the requirement to demolish existing XD2 exterior wall sconce light.

NAVFAC Drawing #12713676 (E101):

Plan Note #1. Delete the requirement to install Fixture "B" exterior wall sconce light fixtures.

NAVFAC Drawing #12713679 (E104):

Change the Lighting layout requirements for Lounge 134 and Kitchen 133 to replace Lighting Fixture "G" with Lighting Fixture "P" as shown in the sketch attached to the end of this section. Include dimmable switches and any additional conductors required to perform this work.

NAVFAC Drawing #12713683 (E108):

Change the Lighting layout requirements for Lounge 333 to replace Lighting Fixture "G" with Lighting Fixture "P" as shown in the sketch attached to the end of this section. Include dimmable switches and any additional conductors required to perform this work.

NAVFAC Drawing #12713687 (E602):

Light Fixture Schedule.

Delete "Type "B" exterior wall sconce fixtures.

Add light fixture "P" Pendant Mounted Fluorescent Fixture (NL-53)

Manufacturer: Spectrum

Lighting # SPC1207CF-226-DAI-8310-SG-PM-MW

Description: 12" Flour. Cylinger Fixture (Pendant mounted with bottom of fixture at 7'-6").

Voltage 120

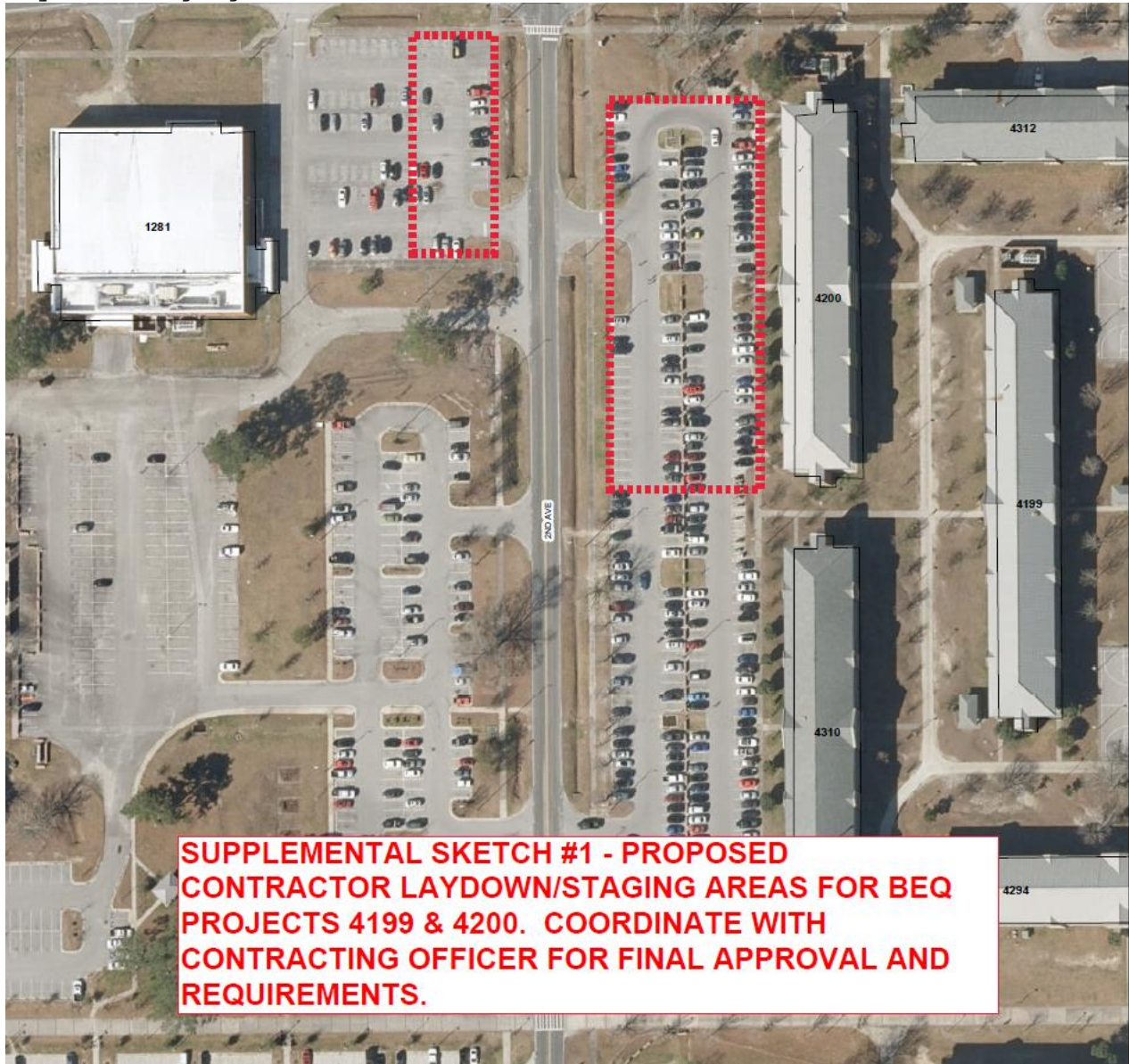
Ballast Type/Quantity: 1 - Elec Dimming (10%)

Number of Lamps: 2-26W DTT

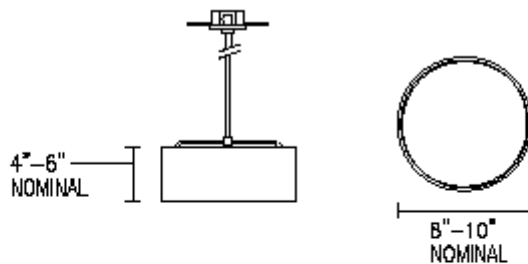
Total Watts: 55

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NAVFAC drawing # 12713571 Title Sheet and Index of Drawings. Add the following supplemental sketch to identify proposed contractor laydown/staging area:



NAVFAC drawing # 12713687 Electrical Schedules. Add the following supplemental sketch to identify NL-53 lighting cut sheet:



LUMINAIRE REQUIREMENTS:

1. HOUSING - COLD-ROLLED STEEL FORMED INTO A ONE-PIECE, ROUND HOUSING WITH NO VISIBLE WELD MARKS OR HARDWARE.
2. FINISH - MULTI-STAGE PRE-TREATMENT FINISHED WITH BAKED-ON POLYESTER POWDER COAT.
3. LAMPS - LIGHT EMITTING DIODES (LEDs), 3500°K. REFER TO FIXTURE SCHEDULE FOR LUMEN VALUES.
4. REFLECTOR - SYMMETRICAL, DIE-CUT POLISHED AND ANODIZED CLEAR SPECULAR ALUMINUM.
5. DRIVER - HIGH-EFFICIENCY LED DRIVER, 120 VOLT.
6. CERTIFICATION - UL LISTED AND LABELED.
7. MOUNTING - MINIMUM 1/8" DIAMETER, MOUNTING STEM FOR PENDANT MOUNTING. PROVIDE ONE-PIECE CANOPY COVER FOR TOP OF STEM IN MATCHING FIXTURE FINISH.

PENDENT-MOUNTED, SHALLOW DEPTH DIRECT LED FIXTURE

REVISED:

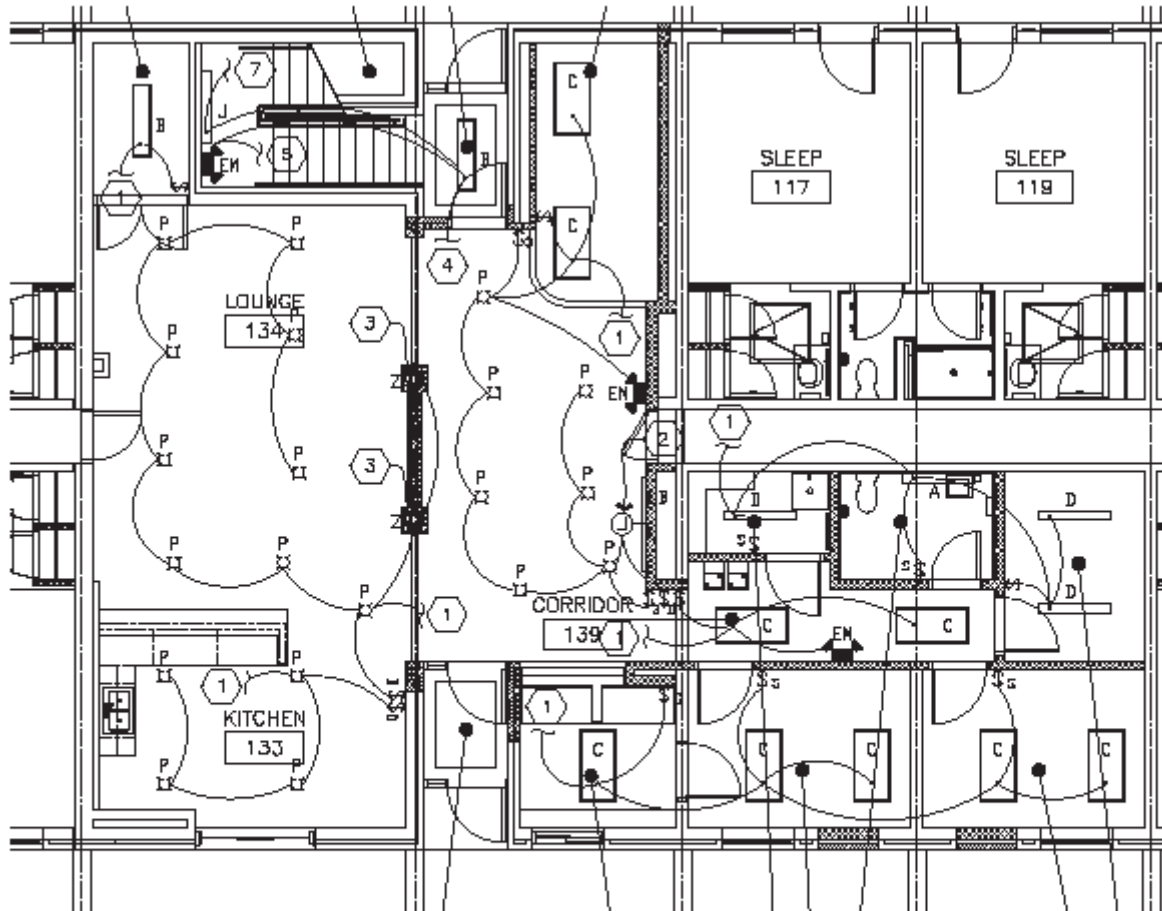
AUGUST 2004

LIGHTING PLATE:

NL-53

On NAVFAC Dwg No. 12713679 (E104)

Change the Lighting layout requirements for Lounge 134 and Kitchen 133 to replace Lighting Fixture "G" with Lighting Fixture "P" as shown in the sketch below. Include dimmable switches and any additional conductors required to perform this work.

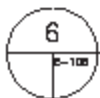
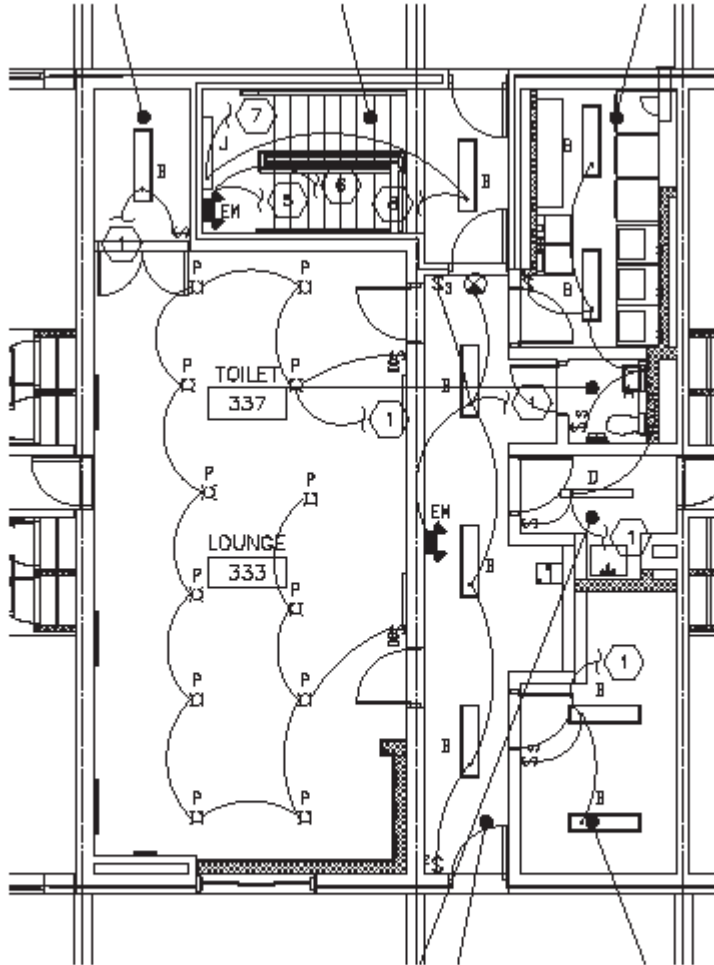


CENTRAL CORE CONSTRUCTION: 1ST FLOOR LIGHTING

SCALE: 1/8"=1'-0"

On NAVFAC Dwg No. 12713683 (E108)

Change the Lighting layout requirements for Lounge 333 to replace Lighting Fixture "G" with Lighting Fixture "P" as shown in the sketch below. Include dimmable switches and any additional conductors required to perform this work.



CENTRAL CORE CONSTRUCTION: 3RD FLOOR LIGHTING

SCALE: 1/8" = 1'-0"

DOCUMENT 00 22 13.00 20

## SUPPLEMENTARY INSTRUCTIONS TO OFFERORS

02/14

## PART 1 GENERAL

## 1.1 CONTRACT LINE ITEMS

The terms Offeror and Bidder and versions thereof (offer/bid) have the same definition as used within this contract.

Provide the Contract Line Item (CLIN) lump sum price for the following items:

CLIN 0001 - BASE PRICE. Price includes the following:

CLIN 0001AA. Price for the entire work for Facility BEQ 4200, complete to the 5 foot line outside of the building, in accordance with the drawings and specifications, but excluding work described in Contract Line Item (CLIN) 0001AB and 0002.

| CLIN   | DESCRIPTION                       | TOTAL PRICE FOR<br>CLIN 0001AA |
|--------|-----------------------------------|--------------------------------|
| 0001AA | Entire Work for Facility BEQ 4200 | \$_____                        |

CLIN 0001AB. Price for the entire FF&E Design Service for Facility BEQ 4200, complete to the 5 foot line outside of the building, in accordance with the drawings and specifications, but excluding work described in CLIN 0001AA and 0002.

| CLIN   | DESCRIPTION          | TOTAL PRICE FOR<br>CLIN 0001AB |
|--------|----------------------|--------------------------------|
| 0001AB | FF&E Design Services | \$_____                        |

CLIN 0002 Planned Modification Item 1 - Price includes the following:

Price to procure and supervise installation of the Furniture, Fixtures, and Equipment (FF&E) complete in accordance with the plans and specifications and in accordance with the following schedule:

| CLIN | ITEM | GOVERNMENT<br>FF&E ESTIMATE | HAR<br>(NTE<br>5%) | HAR AMOUNT<br>(GOVT FF&E<br>ESTIMATE x<br>HAR%) | TOTAL FF&E<br>ESTIMATED AMOUNT<br>FOR CLIN 0004<br>(GOVT FF&E<br>ESTIMATE + HAR<br>AMOUNT) |
|------|------|-----------------------------|--------------------|---|--|
| 0002 | FF&E | \$1,860,042.05              |                    |   |  |

## 1.2 GENERAL BID NOTES

- a. Award will be made on the total sum of Contract Line Items 0001AA, 0001AB, and the sum of the extensions under Contract Line Item 0002. If there is a difference between a unit price and the extended total, the unit price will be held to be the intended bid and the total recomputed accordingly. If an Offeror provides a total but fails to enter a unit price, the total divided by the specified quantity will be held to be the intended unit price.
- b. A firm fixed proposed price is required for CLIN 0001AA, CLIN 0001AB and CLIN 0002. No provision is made for economic price adjustment.
- c. The Government may reject an offer as nonresponsive if it is materially unbalanced as to prices for the basic requirement. An offer is unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated for other work.

## 1.3 PLANNED MODIFICATION BID NOTES

These notes apply to Planned Modification CLINs.

- a. The estimated amount for FF&E has been supplied by the Government, to provide offerors with the projected magnitude of effort. The estimated amount includes the actual cost of the FF&E including freight and installation charges. The Government FF&E Estimate is only an estimated amount.
- b. If awarded, line items will be funded separately after completion of FF&E design package review by the Government, and receipt of appropriate funding by the Government. Requirements and details are provided in Section 01 30 01.00 20 DESIGN PROCUREMENT AND INSTALLATION OF FURNITURE, FIXTURES, AND EQUIPMENT.
- c. Bonding is not required for the design, procurement and installation of FF&E .
- d. Offerors may propose a Handling and Administration Rate (HAR) for the FF&E not to exceed 5 percent. This fee will account for all administrative costs, overhead, bonding fees, administration of subcontracts, profit, and any other costs associated with and related to the coordination and processing of the procurement and installation of FF&E . The proposed HAR percentage will be incorporated into the contract award and will not be adjusted regardless of fluctuations from the estimate amount for the FF&E . The proposed HAR is a fixed rate.
- e. The Government is not obligated to award the Planned Modification line

item(s). Should the Government choose to award the Planned Modification, the line item will be awarded as a negotiated modification to the contract/task order. The Contractor's proposed HAR will be applied to all vendor/supplier costs for the FF&E.

- f. If awarded, the FF&E modification will be awarded at least six months prior to the contract completion date. A minimum of six months is required for the Contractor to purchase, deliver and install the FF&E without impacting the overall completion date of the project. The Contractor's schedule must assume the award of the FF&E as a modification. No schedule extensions will be granted if the modification is awarded at least six months prior to the contract completion date. If the Government decides to negotiate and award the furniture modification with less than six months prior to the contract completion date, the Contractor may be entitled to a contract extension and extended field overhead. A contract extension and extended field overhead will only be granted in those cases where the Contractor demonstrates that an accepted Final FF&E package was submitted within the approved schedule deadlines and sufficient lead time for the FF&E is not available and the Government's award of the modification is in the last six months of the contract.

## PART 2 PRODUCTS

Not used.

## PART 3 EXECUTION

Not used.

-- End of Document --



## SECTION 01 11 00

## SUMMARY OF WORK

08/15

## PART 1 GENERAL

## 1.1 WORK COVERED BY CONTRACT DOCUMENTS

## 1.1.1 Project Description

The contract provides improvements and repairs to existing BEQ 4200 at MCAS, Cherry Point, N.C. The work includes but is not limited to replacing windows and doors, replacing exterior concrete balconies, replacing exterior guardrails, replacing and providing new interior finishes; minor structural modifications; providing a sprinkler fire suppression system; fire alarm system modifications; replacement and repair of plumbing, mechanical, and electrical systems; repairs and resurfacing of existing parking areas; and incidental related work. The contract also addresses lead in construction and provides for procurement and installation of a FF&E package by planned modification.

## 1.1.2 Location

The work is located at the BEQ, Building 4200, MCAS Cherry Point, approximately as indicated. The exact location will be shown by the Contracting Officer.

## 1.2 OCCUPANCY OF PREMISES

The building will not be occupied during performance of work under this Contract. Occupancy notifications will be posted in a prominent location in the work area.

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

## 1.3 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 must be in a condition equal to or better than that which existed before new work started.

## 1.4 LOCATION OF UNDERGROUND UTILITIES

It shall be the responsibility of the contractor to locate all existing underground utilities that are within the limits of work, prior to any excavation activities. These include but are not limited to the following buried utilities: water lines, sanitary and storm sewers, steam condensate,

fuel lines, gas lines, electrical ducts and direct buried conductors, commercial telephone, Base telephone, commercial cable TV, Base instructional cable TV, EMCS, and fire alarm. The contractor shall employ the services of a qualified Utility locating company to locate, identify, and mark all underground utilities. The entire construction limits shall be thoroughly scanned and researched to determine existing utility locations. Any existing utilities that are indicated on the project drawings shall be considered for reference use by the locating company and shall be verified. All underground utilities shall be clearly marked with flags, paint or stakes prior to any digging operation except that required to determine exact utility location and depth. CAUTION shall be used when trenching or excavating around or near buried utilities. The contractor shall be responsible for the timely repair and/or replacement of direct and collateral damage on any and all underground utilities that are severed, crushed, broken, displaced or otherwise disturbed by the construction operation. The Government shall not incur any additional cost for such repair or replacement. The contractor shall notify the FEAD a minimum of three working days prior to utility location. Do not continue with excavation or installation of new work without resolving elevation discrepancies and conflicts.

#### 1.4.1 Notification Prior to Excavation

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

### 1.5 NAVY AND MARINE CORPS (NMCI) COORDINATION REQUIREMENTS

#### 1.5.1 NMCI Contractor Access

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

## PART 2 PRODUCTS

Not used.

## PART 3 EXECUTION

Not used.

-- End of Section --

## SECTION 01 14 00

## WORK RESTRICTIONS

11/11

## PART 1 GENERAL

## 1.1 SUBMITTALS

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

SD-01 Preconstruction Submittals

List of Contact Personnel

## 1.2 SPECIAL SCHEDULING REQUIREMENTS

- a. Have materials, equipment, and personnel required to perform the work at the site prior to the commencement of the work. Specific items of work to which this requirement applies include:
- b. Permission to interrupt any Activity roads, railroads, or utility service must be requested in writing a minimum of 15 calendar days prior to the desired date of interruption.

## 1.3 CONTRACTOR ACCESS AND USE OF PREMISES

DBIDS has gone live at MCAS Cherry Point. In order to reduce wait time when exchanging your RapidGate credential, it is highly recommended each applicant pre-register at <https://dbids-global.dmdc.mil/enroll#!/>

Non-DoD cardholding visitors to Marine Corps Installations with a driver's license or ID issued by a state that is not compliant with the Real ID Act of 2005 will now need to provide an alternate form of acceptable identification to gain entry, or be escorted by an authorized patron of the air station.

North Carolina now issues REAL ID compliant drivers licenses, but many drivers have yet to be issued the new license. Drivers may get a North Carolina REAL ID driver's license at any NCDMV driver's license office.

The Act established minimum security standards for license issuance and production and prohibits Federal agencies from accepting driver's licenses and identification cards from states not meeting the Act's minimum standards.

In absence of a compliant state issued driver's license or ID, one of the following federally approved forms of identification must also be provided in addition to the non-compliant driver's license or ID:

1. U.S. Passport
2. U.S. Passport Card
3. U.S. Coast Guard Merchant Mariner Card
4. Personal Identity Verification (PIV) Card
5. Personal Identity Verification - Interoperable (PIV-I)
6. U.S. State Department Driver's License
7. Veteran's Health Identification Card (Issued by the U.S. Department of Veterans Affairs)
8. U.S. Permanent Resident Card (Form I-551)
9. U.S. Certificate of Naturalization or Certificate of Citizenship (Form N-550)
10. Department of Homeland Security Employment Authorization Document (Form I-766)

#### 1.3.1 Activity Regulations

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

##### 1.3.1.1 Subcontractors and Personnel Contacts

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

##### 1.3.1.2 Installation Access

Obtain access to Navy and Marine Corps installations through participation in the Defense Biometrics Identification System (DBIDS). Requirements for Contractor employee registration, and transition for employees currently under Navy Commercial Access Control System (NCACS), are available at <https://www.cnmc.navy.mil/om/dbids.html>. No fees are associated with obtaining a DBIDS credential.

Participation in DBIDS is not mandatory, and Contractor personnel may apply for One-Day Passes at the Base Visitor Control Office to access an installation.

##### 1.3.1.2.1 Registration for DBIDS

Registration for DBIDS is available at <https://www.cnmc.navy.mil/om/dbids.html>. Procedure includes:

- a. Present a letter or official award document (i.e. DD Form 1155 or SF 1442) from the Contracting Officer, that provides the purpose for access, to the base Visitor Control Center representative.
- b. Present valid identification, such as a passport or Real ID Act-compliant state driver's license.
- c. Provide completed SECNAV FORM 5512/1 to the base Visitor Control Center representative to obtain a background check. This form is available for download at <https://www.cnmc.navy.mil/om/dbids.html>.

- d. Upon successful completion of the background check, the Government will complete the DBIDS enrollment process, which includes Contractor employee photo, finger prints, base restriction and several other assessments.
- e. Upon successful completion of the enrollment process, the Contractor employee will be issued a DBIDS credential, and will be allowed to proceed to worksite.

#### 1.3.1.2.2 DBIDS Eligibility Requirements

Throughout the length of the contract, the Contractor employee must continue to meet background screen standards. Periodic background screenings are conducted to verify continued DBIDS participation and installation access privileges. DBIDS access privileges will be immediately suspended or revoked if at any time a Contractor employee becomes ineligible.

An adjudication process may be initiated when a background screen failure results in disqualification from participation in the DBIDS, and Contractor employee does not agree with the reason for disqualification. The Government is the final authority.

#### 1.3.1.2.3 DBIDS Notification Requirements

- a. Immediately report instances of lost or stolen badges to the Contracting Officer.
- b. Immediately collect DBIDS credentials and notify the Contracting Officer in writing under the following circumstances:
  - (1) An employee has departed the company without having properly returned or surrendered their DBIDS credentials.
  - (2) There is a reasonable basis to conclude that an employee, or former employee, might pose a risk, compromise, or threat to the safety or security of the Installation or anyone therein.

#### 1.3.1.2.4 One-Day Passes

Personnel applying for One-Day passes at the Base Visitor Control Office are subject to daily mandatory vehicle inspection, and will have limited access to the installation. The Government is not responsible for any cost or lost time associated with obtaining daily passes or added vehicle inspections incurred by non-participants in DBIDS.

#### 1.3.1.3 No Smoking Policy

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

#### 1.3.2 Working Hours

Regular working hours must consist of an 8 1/2 hour period, between 7:00

a.m. and 3:30 p.m., Monday through Friday, excluding Government holidays.

#### 1.3.3 Work Outside Regular Hours

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

#### 1.3.4 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 paragraph WORK OUTSIDE REGULAR HOURS.
- b. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.
- c. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, compressed air, and data communication are considered utility cutovers pursuant to the paragraph WORK OUTSIDE REGULAR HOURS.
- d. Operation of Station Utilities: The Contractor must not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor must notify the Contracting Officer giving reasonable advance notice when such operation is required.

### 1.4 SECURITY REQUIREMENTS

#### 1.4.1 Station Regulations

No employee or representative of the contractor will be admitted to the work site without an Identification Badge or is specifically authorized admittance to the work site by the FEAD, Facilities Engineering & Acquisition Division.

IMPORTANT NOTE: FEAD personnel (Construction Managers, Engineers/Architects, Engineering Technicians, Contract Specialists, or Contract Surveillance Representatives) will not receive, process, re-transmit or otherwise handle IN ANY WAY Personally Identifiable Information (PII) related to the badging process. Do NOT forward any of this information to the FEAD.

#### 1.4.2 Contractor Access to MCAS Cherry Point and Outlying Areas

1. Documentation requirements for granting access to MCAS Cherry Point for commercial and contract employers and employees. This document is an aid in meeting ASO 5560.6A requirements and is not a substitute for the order.
2. The Pass & Identification Office at Building 251 will issue credentials

to authorized contractors. Sub-Contractors and suppliers must coordinate through the Prime-Contractor:

3. Criminal Activity. In accordance with ASO 5560.6A, the below list of criminal activities within an applicant's record are considered not in the best interest of the Marine Corps and will be grounds for automatic denial of access aboard the Installation:

- a. Conviction of any felony offense.
- b. Conviction of any misdemeanor offense, which was the result of a plea bargain of a felony offense.
- c. Conviction of any offense involving a weapon.
- d. Conviction of any drug offense involving manufacturing or trafficking.
- e. More than one misdemeanor conviction of drug related offenses over the applicant's lifetime or one misdemeanor drug related offense within the last five years.
- f. Conviction of any assault charge.
- g. Conviction of any offense involving theft or larceny.
- h. Conviction of any offense of domestic violence.
- i. Conviction of any offense related to the abuse/neglect of a child.
- j. Conviction of any sexual in nature related offense or registration as a sex offender.
- k. Commission of any grievous criminal offense/misconduct while aboard any Federal installation, including blatant disregard for rules and regulations of the Installation, but excluding minor traffic offenses.
- l. Other than Honorable, Bad Conduct, and Dishonorable discharges from the U.S. Military.
- m. Those identified as undocumented citizens.
- n. Those on the National Terrorist Watch List.
- o. Any individual who attempts to hide or purposely fails to disclose all past criminal history during the vetting process.
- p. Any individual that the Provost Marshal's Office determines to present a risk to the security and safety of the Installation and whose access is deemed not in the best interest of the Marine Corps.
- q. Any individual who has been debarred from the Installation by the Installation Commander or is currently listed as debarred from any other Federal installation.
- r. Any individual with an outstanding warrant for their arrest or

apprehension.

s. Any individual with a pending criminal court case that, if convicted, would result in access denial in accordance with the criteria listed above.

#### 1.4.3 Staging Area

As indicated on the plans, the Contractor staging area will be (PM to coordinate). Amount of material on site shall be kept to a minimum and shall only be material that is pertinent to the work currently being performed. All stockpiling of equipment and materials shall be closely coordinated with the Government and shall not disrupt activities at the site.

#### PART 2 PRODUCTS

Not Used

#### PART 3 EXECUTION

Not Used

-- End of Section --



## SECTION 01 20 00.00 20

## PRICE AND PAYMENT PROCEDURES

11/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## U.S. ARMY CORPS OF ENGINEERS (USACE)

EP-1110-1-8 (2009) Construction Equipment Ownership  
and Operating Expense Schedule

## 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 the Contracting Officer a Schedule of Prices (construction contract) as directed by the Contracting Officer. Provide a detailed breakdown of the contract price, giving quantities for each of the various kinds of work, unit prices, and extended prices. Costs shall be summarized and totals provided for each construction category.

## 1.3.2 Schedule Instructions

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

## 1.3.3 Real Property Assets

The Government will provide the Draft DD Form 1354, Transfer and Acceptance of Military Real Property filled in with the appropriate Real Property Unique Identifiers (RPUID) and related construction Category Codes to summarize the designed real property assets that apply to this contract. The Contractor shall meet with the Contracting Officer and the Real Property Accounting Officer during the Pre Construction Meeting and the Project Closeout Meetings to modify and include any necessary changes to

the DD Form 1354. The Contractor shall provide the Interim DD Form 1354 that uses the appropriate division of the RPUIDs/Category Codes to represent the final constructed facility and include all associated cost. Coordinate the Contractor's Price and Payment structure with the structure of the RPUIDs/Category Codes.

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

Cost data accumulated under this section are required in the preparation of DD Form 1354.

#### 1.3.4 Schedule Requirements for HVAC TAB

The field work Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC shall be broken down in the Schedule of Prices and in the Construction Progress Documentation by separate line items which reflect measurable deliverables. Specific payment percentages for each line item shall be determined on a case by case basis for each contract. The line items shall be as follows:

- a. Approval of Design Review Report: The TABS Agency is required to conduct a review of the project plans and specifications to identify any feature, or the lack thereof, that would preclude successful testing and balancing of the project HVAC systems. The resulting findings shall be submitted to the Government to allow correction of the design. The progress payment shall be issued after review and approval of the report.
- b. Approval of the pre-field engineering report: The TABS Agency submits a report which outlines the scope of field work. The report shall contain details of what systems will be tested, procedures to be used, sample report forms for reporting test results and a quality control checklist of work items that must be completed before TABS field work commences.
- c. Season I field work: Incremental payments are issued as the TABS field work progresses. The TABS Agency mobilizes to the project site and executes the field work as outlined in the pre-field engineering report. The HVAC water and air systems are balanced and operational data shall be collected for one seasonal condition (either summer or winter depending on project timing).
- d. Approval of Season I report: On completion of the Season I field work, the data is compiled into a report and submitted to the Government. The report is reviewed, and approved, after ensuring compliance with the pre-field engineering report scope of work.
- e. Completion of Season I field QA check: Contract QC and Government representatives meet the TABS Agency at the jobsite to retest portions of the systems reported in the Season I report. The purpose of these tests are to validate the accuracy and completeness of the previously submitted Season I report.

- f. Approval of Season II report: The TABS Agency completes all Season II field work, which is normally comprised mainly of taking heat transfer temperature readings, in the season opposite of that under which Season I performance data was compiled. This data shall be compiled into a report and submitted to the Government. On completion of submittal review to ensure compliance with the pre-field engineering report scope, progress payment is issued. Progress payment is less than that issued for the Season I report since most of the water and air balancing work effort is completed under Season I.

#### 1.4 CONTRACT MODIFICATIONS

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

#### 1.5 CONTRACTOR'S INVOICE AND CONTRACT PERFORMANCE STATEMENT

##### 1.5.1 Content of Invoice

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

- a. The Contractor's invoice, on NAVFAC Form 7300/30 furnished by the Government, showing in summary form, the basis for arriving at the amount of the invoice. Form 7300/30 shall include certification by Contractor and Quality Control (QC) Manager.
- b. The Estimate for Voucher/Contract Performance Statement on NAVFAC Form 4330/54 furnished by the Government, showing in detail: the estimated cost, percentage of completion, and value of completed performance. Use NAVFAC Form 4330/54 on NAVFAC contracts when a Monthly Estimate for Voucher is required.
- c. Updated Project Schedule and reports required by the contract.
- d. Contractor Safety Self Evaluation Checklist.
- e. Other supporting documents as requested.
- f. Updated copy of submittal register.
- g. Invoices not completed in accordance with contract requirements will be returned to the Contractor for correction of the deficiencies.
- h. Contractor's Monthly Estimate for Voucher and Contractors Certification (NAVFAC Form 4330/54) with Subcontractor and supplier payment certification.
- i. Materials on Site.

##### 1.5.2 Submission of Invoices

If DFARS Clause 5252.232-7006 is included in the contract, provide the

documents listed in paragraph CONTENT OF INVOICE in their entirety as attachments in Wide Area Work Flow (WAWF) for each invoice submitted. The maximum size of each WAWF attachment is two megabytes, but there are no limits on the number of attachments. If a document cannot be attached in WAWF due to system or size restriction, provide it as instructed by the Contracting Officer.

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

#### 1.5.3 Final Invoice

- a. A final invoice shall be accompanied by the certification required by DFARS 252.247.7023 TRANSPORTATION OF SUPPLIES BY SEA, and the Contractor's Final Release. If the Contractor is incorporated, the Final Release shall contain the corporate seal. An officer of the corporation shall sign and the corporate secretary shall certify the Final Release.
- b. For final invoices being submitted via WAWF, the original Contractor's Final Release Form and required certification of Transportation of Supplies by Sea must be provided directly to the respective Contracting Officer prior to submission of the final invoice. Once receipt of the original Final Release Form and required certification of Transportation of Supplies by Sea has been confirmed by the Contracting Officer, the Contractor shall then submit final invoice and attach a copy of the Final Release Form and required certification of Transportation of Supplies by Sea in WAWF.
- c. Final invoices not accompanied by the Contractor's Final Release and required certification of Transportation of Supplies by Sea will be considered incomplete and will be returned to the Contractor.

#### 1.6 PAYMENTS TO THE CONTRACTOR

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

##### 1.6.1 Obligation of Government Payments

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

- a. Reasonable deductions due to defects in material or workmanship;
- b. Claims which the Government may have against the Contractor under or in connection with this contract;
- c. Unless otherwise adjusted, repayment to the Government upon demand for overpayments made to the Contractor; and

- d. Failure to provide up to date record drawings not current as stated in Contract Clause "FAC 5252.236-9310, Record Drawings."

#### 1.6.2 Payment for Onsite and Offsite Materials

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

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

#### PART 2 PRODUCTS

Not Used

#### PART 3 EXECUTION

Not Used

-- End of Section --

## SECTION 01 30 00

## ADMINISTRATIVE REQUIREMENTS

08/15

## PART 1 GENERAL

## 1.1 REFERENCES

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

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

## 1.2 SUBMITTALS

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

SD-01 Preconstruction Submittals

List of contact personnel

## 1.2.1 Contract 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.

## 1.3 MINIMUM INSURANCE REQUIREMENTS

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

## 1.4 SUPERVISION

## 1.4.1 Minimum Communication Requirements

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

## 1.4.2 Superintendent Qualifications

The project superintendent must have a minimum of 10 years experience in construction with at least 5 of those years as a superintendent on projects similar in size and complexity. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification and safety compliance. The individual must be capable of

interpreting a critical path schedule and construction drawings. The qualification requirements for the alternate superintendent are the same as for the project superintendent. The Contracting Officer may request proof of the superintendent's qualifications at any point in the project if the performance of the superintendent is in question.

#### 1.4.2.1 Duties

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

#### 1.4.3 Non-Compliance Actions

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

#### 1.5 PRECONSTRUCTION MEETING

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

#### 1.6 PARTNERING

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

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

##### 1.6.1 Informal Partnering

The Contracting Officer will organize the Partnering Sessions with key personnel of the project team, including Contractor personnel and Government personnel.

The Initial Partnering session should be a part of the Pre-Construction

Meeting. Partnering sessions will be held at a location agreed to by the Contracting Officer and the Contractor (typically a conference room provided by the PWD FEAD office or the Contractor). The Initial Informal Partnering Session will be conducted and facilitated using electronic media (a video and accompanying forms) provided by the Contracting Officer. The Partners will determine the frequency of the follow-on sessions, at no more than 3 to six month intervals.

#### 1.7 ELECTRONIC MAIL (E-MAIL) ADDRESS

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

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

#### PART 2 PRODUCTS

Not Used

#### PART 3 EXECUTION

Not Used

-- End of Section --



## SECTION 01 30 01.00 22

DESIGN, PROCUREMENT, AND INSTALLATION OF FURNITURE, FIXTURES, AND EQUIPMENT  
02/15

## PART 1 GENERAL

## 1.1 REFERENCES

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

## UNIFIED FACILITIES CRITERIA (UFC)

UFC 3-120-10 (2006; Change 1, 2007) Interior Design

## 1.2 SUBMITTALS

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

## SD-02 Shop Drawings

Preliminary (Pre-Final) FF&E Package; GNAVFAC MidLant Interior Design  
Final FF&E Package; G, ID NAVFAC MidLant Interior Design  
Best Value Determination; G, ID NAVFAC MidLant Interior Design

Final FF&E Mock-Up; G, ID NAVFAC MidLant Interior Design

## SD-07 Certificates

Contractor's Interior Designer's Qualifications; G, ID NAVFAC MidLant Interior Design

## 1.3 GENERAL REQUIREMENTS

Furnishings, Fixtures, and Equipment (FF&E) shall include, but is not limited to; furniture, shop equipment, specialty equipment, appliances, soft window treatments (draperies, valances, and cornices), artwork, accessories, and other miscellaneous items to support facility functions. Weapon racks, drying cages, and lockers are not considered FF&E. FF&E shall be fully integrated with the building systems and finishes. FF&E may also include specialty items for which the customer activity shall be responsible for specifying.

The design and documentation of the FF&E shall be funded as the Interior Design Services Option. The purchase and installation of the FF&E Package shall be funded separately as the FF&E Planned Modification. The Government FF&E budgets on the Bid Schedule/Price Proposal Form for the FF&E Planned Modifications are \$2,107,619.49 for BEQ 4199 and \$1,860,042.05 for BEQ 4200 and does NOT include the Contractor's Handling and Administration Rate (HAR). This Government FF&E estimate shall not be altered by Contractors during the bid process.

All FF&E items are subject to the Buy American Act.

#### 1.4 INTERIOR DESIGN SERVICES OPTION

##### 1.4.1 Qualifications and Affiliations

Per UFC 3-120-10, The Interior Designer of Record, hereafter referred to as the Prime Contractor's Interior Designer, shall be certified by the National Council for Interior Design Qualification (NCIDQ). The Prime Contractor's Interior Designer, Design Firm owners, and any Specialists shall NOT have any affiliation with any furniture, fixture, or equipment products, any furniture dealership or manufacturers. Provide documentation of the Prime Contractor's Interior Designer's qualifications and significant interior design experience. The Government reserves the right to approve/disapprove the Prime Contractor's Interior Designer.

##### 1.4.2 Concept FF&E package

A Concept FF&E package, prepared by the A/E's Interior Designer, indicating the salient characteristics of all required FF&E items and CADD drawings, will be provided to the Prime Contractor. As a separately priced option, the Prime Contractor shall provide the services of a Certified Interior Designer, other than the A/E's Interior Designer, to function as Prime Contractor's Interior Designer, to prepare and provide the Final, Best Valued FF&E Package and procurement data based on the Concept FF&E package.

All fixed and movable furnishings selections shall be closely coordinated with the final construction documents and interior finishes. The Prime Contractor's Interior Designer shall be required to validate all FF&E requirements with the Activity, make any necessary changes to the FF&E and interior building finishes. Per UFC 3-120-10, the (FF&E) includes the design, selection, specification, color coordination, and procurement documentation of the required items necessary to meet the functional, operational, sustainability, and aesthetic needs of the facility. The FF&E package shall be fully integrated with the design, construction, and schedule of all building finishes and all building systems (HVAC, Plumbing, Fire Protection, Communications, Electrical, Data, Architecture, etc. All outlets, switches, fire extinguishers, thermostats, etc. shall be fully accessible. All sprinkler heads, ADA, etc. clearances shall be accommodated.

The Prime Contractor's Interior Designer shall also attend walk-throughs, coordinate mock-ups, and attend any and all required meetings to accomplish this task. The Contractor's Interior Designer and equipment specialists shall be responsible for designing and providing specifications for procurement of all FF&E, to include delivery and installation, for the facilities built under this contract as directed by the NAVFAC Interior Designer. FF&E specifications shall be based on NAVSUP Blanket Purchase Agreements (BPA's), GSA schedules, and other Federal contracts and complying with priorities found in FAR Part 8.404. The utilization of the current NAVSUP BPA list is required for BVD Analysis Request for Pricing. The current NAVSUP BPA list is available at:

[https://acquisition.navy.mil/rda/home/acquisition\\_one\\_source/strategic\\_sourcing/don\\_furniture\\_acquisition](https://acquisition.navy.mil/rda/home/acquisition_one_source/strategic_sourcing/don_furniture_acquisition)

#### 1.5 FURNISHINGS, FIXTURES, AND EQUIPMENT (FF&E) SUBMITTALS FOR THE INTERIOR DESIGN SERVICES OPTION

Develop design as described and in accordance with the Activity

requirements. Include in the design all loose furnishings required to produce an optimum functional facility, consistent with quality commercial design. This project also includes the preparation of specific detailed information for each selected item. Each submittal shall demonstrate thorough interaction with the Activity requirements and complete coordination with the facility design and the Structural Interior Design (SID).

- a. For all projects, including fast track projects, the Prime Contractor shall be responsible for sufficiently scheduling all FF&E and any revisions to SID submittals early enough to obtain the required government approvals, and meet all ordering and installation lead times to complete the project by the contract completion date.

These are minimum requirements and the Prime Contractor shall be prepared to provide any/all additional meetings and submittals that may be necessary to support the Interior Design effort/ and FF&E coordination.

#### 1.5.1 FF&E Requirements (Interior Design Orientation) Meeting

This meeting shall occur at the Pre-Construction meeting or NAVFAC MIDLANT, located in Norfolk, VA prior to the FF&E "Over the Shoulder" Review and the development of the FF&E package. The NAVFAC Interior Designer will provide the Contractor's Interior Designer a sample format of the FF&E submittal, review the Best Value Determination (BVD) process, discuss the number of Best Value Determinations required and discuss Blanket Purchase Agreement (BPAs), GSA or other mandatory sources to consider. Minutes of this meeting shall be submitted to the NAVFAC Interior Designer within 7 business days.

#### 1.5.2 FF&E "Over the Shoulder" Review

Prior to the FF&E Concept Presentation and Best Value Determination (BVD) Analysis, the Contractor's Interior Designer shall meet with the NAVFAC Interior Designer for an "over-the-shoulder" review to present preliminary FF&E options. These can be presented in a "loose" format for preliminary approval prior to the Activity presentation. The "over-the-shoulder" review meeting shall be held at NAVFAC, located in Norfolk, VA or via conference call.

#### 1.5.3 FF&E Concept Presentation

The Prime Contractor's Interior Designer shall present the NAVFAC approved Preliminary (Pre-final) FF&E package to the Activity, located at Cherry Point MCAS Havelock, NC, for approval. This presentation shall include loose format samples and catalog cuts. Sample boards are not required.

#### 1.5.4 Best Value Determination(BVD) Analysis "Over the Shoulder Review"

Prior to issuing the best value determination (BVD) Analysis, the Prime Contractor's Interior Designer shall meet with the NAVFAC Interior Designer for an "over-the-shoulder" review of the solicitation package and request a copy of the most current NAVSUP BPA vendor list. The "over-the-shoulder" review meeting shall be held at NAVFAC MIDLANT, located in Norfolk, VA or via conference call. The Contractor's Interior Designer must provide a copy of the BVD Analysis Request for Pricing cover letter to the Contractor for review and comment prior to the BVD Analysis "Over the Shoulder Review" meeting.

BVD Analysis Solicitation shall include the following;

- a. Copy of the BVD Analysis Request for Pricing cover letter.
- b. BVD Analysis Request for Pricing Spreadsheet/Questionnaire with "basis of design" item product numbers, photos & descriptions.
- c. Technical Specification to establish minimum acceptable FF&E requirements.
- d. Project Specific Room/Furniture Typical.
- e. Furniture Plans with Legends coded to the BVD Analysis RFP (PDF format).

#### 1.5.5 BVD Submittal and "Over the Shoulder Review"

The Prime Contractor's Interior Designer shall submit one (1) copy of the Preliminary BVA BVD package to the NAVFAC Interior Designer and one (1) copy to IDD/Base Property for Marine Corps projects. An electronic copy shall be sent to the NAVFAC Contracting Officer. The "over-the-shoulder" review meeting shall be held at NAVFAC, located in Norfolk, VA or via conference call to review the results of the solicitation and determine a best value recommendation. The BVD Submittal shall be in a 3-ring binder and shall include the following items for review and approval:

- a. Cover Title Page (project name, project #, location, submittal date, submittal title)
- b. Table of Contents.
- c. Point of Contact List.
- d. Narrative of Interior Designer Objectives.
- e. BVD Analysis Request for Pricing Spreadsheet/Questionnaire completed by all bidders and completed Questionnaire.
- f. Copy of all information sent to bidders and documentation that all required sources were contacted.
- g. Back-up Information submitted by each bidder (cut sheets/highlighted pricing sheets/technical specifications, pricing, dealer and manufacturer qualification for each product showing that products meets all requirements). Provide in CD format and include within each binder.
- h. Response(s) from UNICOR.
- i. BVD Analysis Pricing Evaluation Spreadsheet comparing bidder quotes/responses.
- j. Contractor's Interior Designer recommendation for the Best Value vendor and justifications.

#### 1.5.6 Preliminary FF&E Submittal

The Preliminary FF&E submittal shall be presented to the Activity in loose format at a meeting to occur at the Activity, located at Cherry Point MCAS Havelock, NC. Five (5) submittals will be required; (1) for the NAVFAC Project Manager, (3) for the FEAD/ROICC and IDD/Base Property, and (1) for

the Activity.

Submit the following in a 3-ring binder for review and approval:

- a. Cover Title Page (project name and number, submittal date and title).
- b. Table of Contents.
- c. Point of Contact List (includes contact info for recommended Best Value BPA Holder(s) vendors and subcontractors).
- d. Preliminary FF&E list (Cost Summary) to include shipping, freight, handling, professional installation, project management, HAR and applicable sales tax.
- e. Preliminary Procurement Data Spec Sheets for each product indicating general appearance as well as proposed finish and fabric selections.
- f. Furniture placement plans coded to the FF&E list and Procurement Data Spec Sheets.
- g. Technical Specifications used in bid request for all furniture, fixtures and equipment etc..
- h. Final Finish/Fabric Selections and Samples attached to boards in 8" x 10" binder format inusing edge-reinforced, heavy-duty plastic sheet protectors for each board/sheet.
- i. Copy of Quote(s)/Bill of Materials (BOM) on letterhead from the vendor(s) determined to be the best value. Code BOM line items to FF&E Cost Summary Item Codes.

#### 1.5.7 Final FF&E Mock-Up

The Prime Contractor and his Interior Designer shall coordinate an on-site mock-up and review of furniture typicals with the selected, best-valued BPA vendor(s). Building finishes and fixtures shall be installed in the affected area(s) to the greatest extent practicable in order to assess building systems/fixture coordination. The reviewers shall include the NAVFAC Interior Designer and Construction Manager, The Prime Contractor's Interior Designer, IDD, Base Property, and the Activity. The BPA vendor(s) shall be available on-site to respond to questions. The mock-up exercise shall be completed prior to the submittal of the Final FF&E submittal and award of the modification for turnkey furniture procurement.

#### 1.5.8 Final FF&E Submittal

The Final FF&E submittal shall be due 10 months prior to BOD following the receipt of review comments on the preliminary FF&E submittal and shall include furniture, furnishings, artwork, and equipment and shall be in the format described below or the format provided by the NAVFAC Interior Designer and the UFC 3-120-10 Interior Design.

These are minimum requirements and the Contractor shall be prepared to provide any additional meetings and submittals that may be necessary to support the Interior Design effort and FF&E coordination.

The Final FF&E Submittal shall be submitted in a 3-ring binder for review and approval. The number of final submittals required shall be;

Five (5) total; One each for the NAVFAC Project Manager and the Activity. Three to be shared between the FEAD/ROICC and IDD/Base Property.

The Final FF&E Submittal and shall include the following;

- a. Cover Title Page with project name, project #, submittal date, submittal title identified on binder cover and spine.
- b. Table of Contents.
- c. Point of Contact List which includes contact info for recommended Best Value BPA Holder(s) vendors and subcontractors.
- d. Final FF&E list (Cost Summary) to include shipping, handling, freight, professional installation, project management, HAR and any applicable sales tax.
- e. Final Procurement Data Spec Sheets for each product indicating final finish and fabric selections.
- f. Final Finish Selections and Memo Samples for the FF&E submitted in 8 x 10 binder format, using heavy-duty plastic sheet protectors.
- g. Copy of Final Quote(s)/Bill of Materials (BOM) on letterhead from the vendor(s) determined to be the Best Value. Code BOM line items to FF&E Cost Summary Item Codes.
- h. Best Value Determination Guidelines sheets; completed and signed by the Contactor's Interior Designer.
- i. Final Furniture Placement Plans coded to the FF&E list, Procurement Data Sheets and specifications.
- j. CD copy of the final FF&E binder.

#### 1.5.9 Punch List:

See section 2.1.13 Punch List.

#### 1.5.10 FF&E and Interior Finish Construction Submittals

Submit any revisions or deviations caused by discontinued items or NAVFAC required changes to the Contracting Officer for approval by the NAVFAC Interior Designer. All submittal due dates for the FF&E shall be reflected in the Contractor's construction schedule. Changes to the FF&E schedule shall be submitted to the government Interior Designer for approval. The Final FF&E package shall be submitted no later than 9 months prior to the contract completion date.

#### 1.6 BEST VALUE DETERMINATION

A Best Value Determination (BVD) is required by FAR 8.404 when placing orders against Federal Supply Schedules for the selection of furniture and furnishings. Best Value is defined in FAR 2.101 as ensuring that the order to be placed under a Federal Supply Schedule results in the lowest overall cost alternative (considering price, special features, administrative costs and client's needs) to meet the government's needs.

- a. A (BVD) shall be performed on a minimum of three manufacturers for orders exceeding a total procurement of \$3000 from an individual manufacturer. Multiple BVDs may be required in order to complete the final FF&E and A/V packages.
- b. The required quantity of BVD's to be performed will be determined by the NAVFAC Interior Designer during the design phase and is dependent on the appropriate NAVSUP BPA category(s) to be utilized and specific project requirements.
- c. Documentation shall be provided to the Government with the final FF&E package. Specific Documentation is indicated in the Preliminary BVA Submittal and "Over the Shoulder Review." The BVD Statement shall be completed and signed by the contractor's interior designer.

The Prime Contractor's Interior Designer is responsible for the following written BVD justifications:

#### 1.6.1 Total procurement of \$3,000 or less

For any procurement in the FF&E package with a value of \$3,000 or less, the Interior Designer may utilize any BPA holder. If the BPA holders cannot supply the item, then any other manufacturer may be utilized.

#### 1.6.2 Total procurement greater than \$3,000 and less than \$150,000

For any procurement in the FF&E package with a value greater than \$3,000 and \$150,000 or less, the Prime Contractor's Interior Designer shall always review pricing from at least three manufacturers as well as UNICOR. In addition to the review of published list prices, the Contractor's Interior Designer must confirm the pricing with the vendor. Manufacturer's quotes are NOT required. The BVD form must be completed and submitted for all FF&E procurements greater than \$3,000 and \$150,000 or less.

#### 1.6.3 Total procurement greater than \$150,000

From all BPA holders under the applicable group for FF&E procurements greater than \$150,000, UNICOR must always be solicited. The Prime Contractor's Interior Designer shall develop performance criteria and project requirements based on a generic design for the BPA holders and UNICOR to develop a price and performance proposal. The BVD form must be completed and submitted for all FF&E procurements greater than \$100,000 and manufacturer's quotes and a summary of all proposals must be attached.

#### 1.6.4 UNICOR

Federal Prison Industries (UNICOR) must be considered as part of all BVDs. This must be done by sending an email with the requirements and evaluation criteria. If they are not comparable in one or more areas of price, quality, and time of delivery, the designer can specify product under NAVSUP BPA or GSA schedule.

#### 1.6.5 Evaluation Factors

The Best Value determination Determination shall address issues such as:

- a. Space planning; human factors data related to anthropometrics (reach, clearance, adjustability), space, and acoustics.

- b. Ergonomics.
- c. Product quality (including construction and materials); sustainability features, product warranties; history of the product and/or manufacturer.
- d. Ability to service products through dealers or others within a certain geographical range of the project.
- e. Price (including freight).
- f. Aesthetics.
- g. Appropriateness; and lighting, power and telecommunications systems management and/or coordination as related to the facility (when applicable); and other project specific factors as identified and/or required.
- h. Emphasis shall be to create a fully integrated design solution by providing quality products to meet the functional needs of the customer. Customer preferences shall be considered. The focus shall be on the best overall value. Use the NAVFAC Best Value Determination forms provided by the NAVFAC Interior Designer.

## PART 2 FF&E TURNKEY EFFORT

### 2.1 FF&E PLANNED MODIFICATION

FF&E Planned Modification: As a planned modification, provide procurement and installation coordination of the complete and usable Final FF&E package. The FF&E Package must include shipping, freight, handling, installation and the Prime Contractor's FF&E Handling and Administration Rate (HAR) percentage as applied to the final FF&E total cost.

#### 2.1.1 Authorization

The Government will provide separate funding for procurement and installation coordination of the FF&E package. Construction funds will not be used. Upon receipt of required funding, the Prime Contractor shall be authorized by the Contracting Officer, as a planned modification to the construction contract, to procure and install all Final FF&E utilizing NAVSUP Blanket Purchase Agreements (BPA's), GSA schedules, and other Federal contracts and complying with priorities found in FAR Part 8.404. The Prime Contractor will be expected to procure and coordinate the installation of the approved Final FF&E package exactly as specified. The amount of the modification will be the actual cost of these items from the Federal Government price schedules (NAVSUP BPAs and/or GSA), including any freight and installation charges from the furniture supplier as well as the Prime Contractor's HAR and any applicable state sales tax. The HAR includes all of the Prime Contractor's effort related to storage, coordination, handling, administration of subcontractors, and all other associated costs and profit for the procurement of FF&E.

The Government will indicate the FF&E estimates based on the Concept Design in the contract solicitation Price Proposal Form (Bid Schedule). These Government estimates shall not be altered by Prime Contractors during the bid process.



Prime Contractors shall propose a Handling and Administration Rate (HAR) only. The Prime Contractor will propose the FF&E HAR in the contract solicitation. The Prime Contractor's proposed HAR may not exceed 5 percent of the total FF&E costs, as noted on the bid schedule. The HAR shall not include costs associated with the Interior Design Services required in the Interior Design Services Option.

FF&E items are subject to the Buy American Act.

#### 2.1.2 Procurement and Installation

The Prime Contractor shall coordinate the building completion date with the installation dealer(s) specified in the FF&E Package. The Prime Contractor shall anticipate possible manufacturer price increases if order placement is delayed. It is recommended to order the FF&E product once the planned modification is awarded and funds are received to avoid incurring additional costs. Delayed production and delivery dates can be noted at the time of order placement to coincide with the contract completion date. Any costs incurred due to manufacturer price increases will be the burden of the Prime Contractor.

#### 2.1.3 Use of Blanket Purchase Agreements (BPA) and GSA Schedules

The Prime Contractor will receive a letter of authorization from the Contracting Officer citing the name of the furniture dealer(s) and other information to use when accessing the Federal Government supply sources.

#### 2.1.4 Deposits

The Prime Contractor should anticipate providing a deposit of between 30 percent and 50 percent of the FF&E costs when placing the orders with the manufacturer's dealerships.

The Contractor shall also anticipate possible manufacturer price increases. Recommend ordering FF&E product once funds are received to avoid incurring additional cost. Delayed production and delivery dates can be noted at the time of order placement to coincide with building completion dates. Any cost incurred due to manufacturer price increases will be the burden of the Contractor.

#### 2.1.5 Davis Bacon Wages

Davis Bacon wages do not apply to the FF&E installer from the Government supply sources. The workforce for the FF&E installation and delivery shall be separate and distinct from the labor workforce performing under the construction contract.

#### 2.1.6 Sales Tax

The Prime Contractor shall take maximum advantage of all exemptions from State and Local taxation authorities whether available to it directly or available to the Prime Contractor based on an exemption afforded the Government. The responsibility for paying applicable taxes rests with the Prime Contractor. Any state and local taxes applicable to the FF&E shall be included within the FF&E Dealer's quote. Any items purchased as building materials such as carpet are taxable.

### 2.1.7 Bonds

FF&E items are not considered construction and the prime contractor shall not be required to secure any additional bond for the award of the FF&E line item unless otherwise indicated in the contract. If any additional bond is required for the FF&E line item it is to be included in the prime contractor's FF&E HAR.

### 2.1.8 Unique Item Identification (IUID) and Valuation

Unique item identification and valuation is a system of marking and valuing items delivered to DoD that enhances logistics, contracting, and financial business transactions. The IUID policy is mandatory for all DoD contracts that require the delivery of items. An item is a single article or a single unit formed by a grouping of subassemblies, components, or constituent parts. The Prime Contractor shall provide DoD Unique item identification, valuation and delivery of data for all required FF&E items for which the government's unit acquisition cost is \$5,000 or more.

## PART 3 EXECUTION

### 3.1 Installation

The FF&E package includes the installation of all furniture and furnishings as specified in the FF&E package. The installation dealer(s) specified in the FF&E package shall receive, store as required, transport to the project site, off load, inside deliver, unpack, assemble, place/install, clean, and dispose of all the trash for all furniture and furnishings. It is the Prime Contractor's responsibility to coordinate the building completion, occupancy, and furniture installation dates with the installation dealer(s) specified in the FF&E package. Any costs associated with or delaying furniture shipments is the responsibility of the Prime Contractor.

The Prime Contractor shall provide and coordinate all Building Systems (HVAC, Plumbing, Fire Protection, Communications, Electrical, Data, Architectural, etc. with the furniture plans and furniture installation. All outlets, switches, thermostats, etc. shall be fully accessible. All sprinkler heads, fire extinguishers, ADA, etc., clearances shall be accommodated.

### 3.2 Installation Warranty

All movable furnishings shall be installed in accordance with the manufacturer's instructions and warranty requirements. All movable furnishings shall be level and aligned. All doors, drawers and accessories shall be level and aligned to open, close and otherwise operate smoothly and securely.

All furniture shall be installed by the furniture manufacturer's dealer of record and not the Prime Contractor. The Government reserves the right to approve/disapprove the Prime Contractor's FF&E installers. In addition, installation dealer(s) must be located within a 100 mile radius of the project site unless approved by the Government Interior Designer. The Prime Contractor shall repair, to the Government's satisfaction, any/all damage to any facility finish that is a result of the furniture installation and correct all punch list items for the furniture/furnishings. The Prime Contractor shall obtain services of equipment specialists to install the electrical equipment, to include but not limited to televisions, Video Teleconference Equipment, ceiling mounted

projectors, and mission essential electronic equipment included in the FF&E package.

### 3.3 Ordering Documentation

After award of the FF&E packages, three CD copies and one binder copy for Marine Corps projects of all ordering documentation, including Factory Order number (FO) and warranty information for all products, shall be provided to the Contracting Officer at the final FF&E walk-thru.

### 3.4 Post Award Changes

After award of the FF&E turnkey modification, any request to change the FF&E items must be submitted to the Contracting Officer. The FF&E turnkey modification will have been accepted, priced, and negotiated as detailed in the final package. Those items will have been agreed to considering color, specific type and quality of material, price, sustainability, life cycle, and dealership service. The Government will require the Prime Contractor to provide exactly those items. Should changes become necessary, careful consideration shall be essential to assure that equivalent quality, price and other aspects of the item are maintained. Otherwise, price adjustments must be negotiated. Coordination with building finishes and other FF&E items is required for all proposed and approved substitutions. The Prime Contractor shall obtain approval from the Contracting Officer and NAVFAC Interior Designer for any changes to the FF&E Package.

Post award FF&E manufacturer's price increases, beyond the pricing guarantee date, are the responsibility of the Prime Contractor and shall not be transferred to the Government.

### 3.5 Punch List

The Contractor and his Interior Designer shall attend at least two punch list site visits with the installation dealer(s), NAVFAC Interior Designer and the Base Representative/Activity Contact. The first site visit shall identify all punch list items (at installation dealer's 98 percent completion) and the second (at 100 percent completion) will confirm that all punch list items have been resolved.

### 3.6 Best Value Determination

A best value determination has been performed on the final FF&E package. A best value determination is required by FAR 8.404 when placing orders against Federal Supply Schedules for the selection of furniture and furnishings. Best Value is defined in FAR 2.101 as ensuring that the order to be placed under a Federal Supply Schedule results in the lowest overall cost alternative (considering price, special features, administrative costs and client's needs) to meet the government's needs.

-- End of Section --

## SECTION 01 31 23.13 20

ELECTRONIC CONSTRUCTION AND FACILITY SUPPORT CONTRACT MANAGEMENT SYSTEM  
05/17

## PART 1 GENERAL

## 1.1 CONTRACT ADMINISTRATION

Utilize the Naval Facilities Engineering Command's (NAVFAC's) Electronic Construction and Facility Support Contract Management System (eCMS) for the transfer, sharing and management of electronic technical submittals and documents. The web-based eCMS is the designated means of transferring technical documents between the Contractor and the Government. Paper media or e-mail submission, including originals or copies, of the documents identified in Table 1 are not permitted, except where eCMS is unavailable or non-functional. Contact the Contracting Officer's Representative (COR) regarding availability of eCMS training and reference materials.

## 1.2 USER PRIVILEGES

The Contractor will be provided access to eCMS. All technical submittals and documents must be transmitted to the Government via the COR. Project roles and system roles will be established to control each user's menu, application, and software privileges, including the ability to create, edit, or delete objects.

## 1.3 SUBMITTALS

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

## SD-01 Preconstruction Submittals

## List of Contractor's Personnel

## 1.4 SYSTEM REQUIREMENTS AND CONNECTIVITY

## 1.4.1 General

The eCMS requires a web-browser (platform-neutral) and Internet connection. Obtain from an approved vendor an External Certification Authority (ECA), Primary Key Infrastructure (PKI) certificate, or other similar digital identification to support two-factor authentication and access to eCMS. Provide and maintain computer hardware and software for the eCMS access throughout the duration of the contract for all Contractor-designated users. Provide connectivity, speed, bandwidth, and access to the Internet to ensure adequate functionality. Neither upgrading of the Contractor's computer system nor delays associated from the usage of the eCMS will be justification or grounds for a time extension or cost adjustment to the Contract.

## 1.4.2 Contractor Personnel List

Within 20 calendar days of contract award, provide to the Contracting Officer a list of Contractor's personnel who will have the responsibility for the transfer, sharing and management of electronic design, technical submittals and documents and will require access to the eCMS. Project

personnel roles to be filled in the eCMS include the Contractor's Project Manager, Designer of Record, Superintendent, Quality Control (QC) Manager, and Site Safety and Health Officer (SSHO). Personnel must be capable of electronic document management. Notify the COR immediately of any personnel changes to the project. The Contracting Officer reserves the right to perform a security check on all potential users. Provide the following information:

First Name  
Last Name  
E-mail Address  
Office Address  
Project Role (e.g. Project Manager, QC Manager, Superintendent)

#### 1.4.3 Field Administration

Provide a tablet computer with a Common Access Card (CAC) reader at the job site for Government use only. The tablet computer must have a web-browser, built-in camera, and cellular data connectivity. The tablet computer must be fully charged and made available at all times for Government use to facilitate the input of construction data at the job site. After completion of the work, reset the tablet computer to factory default settings. The tablet computer remains the property of the Contractor and must be removed from the site.

#### 1.5 SECURITY CLASSIFICATION

In accordance with Department of Navy guidance, all military construction contract data are unclassified, unless specified otherwise by a properly designated Original Classification Authority (OCA) and in accordance with an established Security Classification Guide (SCG). Refer to the project's OCA when questions arise about the proper classification of information.

The eCMS and tablet computer must only be used for the transaction of unclassified information associated with construction projects. In conformance with the Freedom of Information Act (FOIA), Department of Defense Manual 5200.01-V4: DoD Information Security Program: Controlled Unclassified Information (CUI), and DoD requirements, any unclassified project documentation uploaded into the eCMS must be designated either "U - UNCLASSIFIED" (U) or "FOUO - UNCLASSIFIED-FOR OFFICIAL USE ONLY" (FOUO).

#### 1.6 ECMS UTILIZATION

Establish, maintain, and update data and documentation in the eCMS throughout the duration of the contract.

##### 1.6.1 Information Security Classification/Identification

The eCMS must be used for the transmittal of the following documents. This requirement supersedes conflicting requirements in other sections), however, submittal review times in Section 01 33 00 SUBMITTAL PROCEDURES remain applicable. Table 1 - Project Documentation Types provides the appropriate U and FOUO designations for various types of project documents. Construction documents requiring FOUO status must be marked accordingly. Apply the appropriate markings before any document is uploaded into eCMS. Markings are not required on U documents.

Table 1 also identifies which eCMS application is to be used in the transmittal of data (these are subject to change based on the latest

software configuration). If a designated application is not functional within 4 hours of initial attempt, defer to the Submittal application and submit the required data as an uploaded portable document (e.g. PDF), word processor, spreadsheet, drawing, or other appropriate format. Hard copy or e-mail submission of these items is acceptable only if eCMS is documented to be not available or not functional. For Submittals, select the following:

Preparation by = Contractor personnel assigned to prepare the submittal  
 Approval by = Contracting Officer Representative (COR)  
 Returned by = Design Lead/Manager  
 Forwarded to = Contractor project manager

Table 1 - Project Documentation Types

| SUBJECT/NAME                        | CLASS | REMARKS  | ECMS APPLICATION                           |
|-------------------------------------|-------|--|--|
| As-Built Drawings                   | U     | Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager  | Document management, documents, submittals |
| Base Access Request/Approval        | FOUO  | 1. Verify applicability with local installation security procedures via the Administrative Contracting Office<br>2. Redact Social Security Numbers (SSNs) prior to upload into eCMS, unless SSNs are required by the local security office to support security clearance investigations or verifications | Communications management, communications  |
| Building Information Modeling (BIM) | U     | 1. Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager<br>2. Design reviews will be performed in existing "Dr Checks"  | Document management, documents, submittals |
| Construction Permits                | U     | Refer to rules of the issuing activity, state or jurisdiction  | Document management, documents, submittals |

| SUBJECT/NAME  | CLASS | REMARKS   | ECMS APPLICATION                           |
|---|-------|---|--|
| Construction Schedules (Activities and Milestones)              | U     | After the schedule submittal is approved by the COR, import the schedule file into the scheduling application, and select "Approve" to establish a new schedule baseline  | Document management, documents, submittals |
| Construction Schedules (Cost-Loaded)                            | FOUO  |   | Document management, documents, submittals |
| DD 1354 Transfer of Real Property                               | U     |   | Document management, documents, submittals |
| Daily Production Reports  | FOUO  | Provide weather conditions, crew size, man-hours, equipment, and materials information  | Site management, Daily Report              |
| Daily Quality Control (QC) Reports                              | FOUO  | Provide QC Phase, Definable Features of Work<br>Identify visitors   | Site management, Daily Report              |
| Designs and Specifications                                      | U     | 1. Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager<br>2. Design reviews will be performed in existing "Dr Checks" | Document management, documents, submittals |
| Environmental Notice of Violation (NOV), Corrective Action Plan | U     | Refer to rules of the issuing activity, state or jurisdiction   | Document management, documents, submittals |
| Environmental Protection Plan (EPP)                             | FOUO  |   | Document management, documents, submittals |
| Jobsite Documentation, Bulletin Board, Labor Laws, SDS          | U     |   | Document management, documents, submittals |

| SUBJECT/NAME   | CLASS | REMARKS   | ECMS APPLICATION                           |
|--|-------|---|--|
| Meeting Minutes  | FOUO  |   | Communication management, meeting minutes  |
| Operations & Maintenance Support Information (OMSI/eOMSI), Facility Data Worksheet | U     | 1. Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager<br>2. Design reviews will be performed in existing "Dr Checks" | Document management, documents, submittals |
| Photographs  | U     | Subject to base/installation restrictions   | Document management, documents, submittals |
| QCM Initial Phase Checklists   | FOUO  |   | Site management, Checklists                |
| QCM Preparatory Phase Checklists   | FOUO  |   | Site management, Checklists                |
| Quality Control Plans  | FOUO  |   | Document management, documents, submittals |
| QC Certifications  | U     |   | Document management, documents, submittals |
| QC Punch List  | U     |   | Site management, Punch lists               |
| Red-Zone Checklist   | U     |   | Site management, Checklists                |
| Rework Items List  | FOUO  |   | Site management, Punch lists               |
| Request for Information (RFI) Post-Award   | FOUO  |   | Communications management, RFIs            |



| SUBJECT/NAME  | CLASS | REMARKS   | ECMS APPLICATION                                |
|---|-------|---|---|
| Safety Plan   | FOUO  |   | Site management, Daily Report                   |
| Safety - Activity Hazard Analyses (AHA)                                     | FOUO  |   | Site management, Daily Report                   |
| Safety - Mishap Reports   | FOUO  |   | Site management, Daily Report                   |
| SCIF/SAPF Accreditation Support Documents                                   | FOUO  | Note: Some Construction Security plans may be classified as Secret. Classified information must not be uploaded into eCMS. Refer to the Site Security Manager, as applicable.         | Document management, documents, submittals      |
| Shop Drawings   | U     | Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager | Document management, documents, submittals      |
| Storm Water Pollution Prevention (Notice of Intent - Notice of Termination) | U     | Refer to rules of the issuing activity, state or jurisdiction   | Document management, documents, submittals      |
| Submittals and Submittal Log  | U     |   | Document management, documents, submittals      |
| Testing Plans, Logs, and Reports  | FOUO  |   | Site management, QC inspection and testing plan |
| Training/Reference Materials  | U     |   | Document management, documents, submittals      |
| Training Records (Personnel)  | FOUO  |   | Document management, documents, submittals      |

| SUBJECT/NAME                                     | CLASS | REMARKS  | ECMS APPLICATION                           |
|--|-------|--|--|
| Utility Outage/Tie-In Request/Approval           | FOUO  |  | Document management, documents, submittals |
| Warranties/BOD Letter                            | FOUO  |  | Document management, documents, submittals |
| Quality Assurance Reports and Compliance Notices | FOUO  |  | GOV ONLY                                   |
| Other Government-prepared documents              | FOUO  |  | GOV ONLY                                   |
| All Other Documents                              | FOUO  | Refer to FOIA guidelines and contact the FOIA official to determine whether exemptions exist | As applicable                              |

#### 1.6.2 Markings on FOUO documents

- a. Only FOUO documents being electronically uploaded into the eCMS (.docx, .xlsx, .pptx and others as appropriate), and associated paper documents described in the paragraph CONTRACT ADMINISTRATION require FOUO markings as indicated in the subparagraphs below.
- b. FOUO documents that are originally created within the eCMS application using the web-based forms (RFIs, Daily Reports, and others as appropriate) will be automatically watermarked by the eCMS software, and these do not require additional markings.
- c. FOUO documents must be marked "UNCLASSIFIED//FOR OFFICIAL USE ONLY" at the bottom of the outside of the front cover (if there is one), the title page, the first page, and the outside of the back cover (if there is one).
- d. FOUO documents must be marked on the internal pages of the document as "UNCLASSIFIED//FOR OFFICIAL USE ONLY" at top and bottom.
- e. Where Installations require digital photographs to be designated FOUO, place the markings on the face of the photograph.
- f. For visual documentation, other than photographs and audio documentation, mark with either visual or audio statements as appropriate at both the beginning and end of the file.

Repairs to BEQ 4200

6170183

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

## SECTION 01 33 00

## SUBMITTAL PROCEDURES

05/11

## PART 1 GENERAL

## 1.1 DEFINITIONS

## 1.1.1 Submittal Descriptions (SD)

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

## SD-01 Preconstruction Submittals

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

- Certificates of insurance
- Surety bonds
- List of proposed Subcontractors
- List of proposed products
- Construction progress schedule
- Submittal register
- Schedule of prices
- Health and safety plan
- Work plan
- Quality Control (QC) plan
- Environmental protection plan

## SD-02 Shop Drawings

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

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

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

## SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

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

## SD-04 Samples

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

judged.

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

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

#### SD-05 Design Data

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

#### SD-06 Test Reports

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

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

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

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

#### SD-07 Certificates

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

Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor. The document purpose is to further promote the orderly progression of a portion of the work by documenting procedures, acceptability of methods, or personnel qualifications.

Confined space entry permits.

Text of posted operating instructions.

#### SD-08 Manufacturer's Instructions

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

#### SD-09 Manufacturer's Field Reports

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

Factory test reports.

#### SD-10 Operation and Maintenance Data

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

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

#### SD-11 Closeout Submittals

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

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

##### 1.1.2 Approving Authority

Office or designated person authorized to approve submittal.

##### 1.1.3 Work

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

#### 1.2 SUBMITTALS

Submit the following in accordance with this section.

##### SD-01 Preconstruction Submittals

Submittal Register

#### 1.3 FORWARDING SUBMITTALS REQUIRING GOVERNMENT APPROVAL

##### 1.3.1 Submittals Required from the Contractor

As soon as practicable after award of contract, and before procurement of

fabrication, forward to the Architect-Engineer: MBF Architects PA, 317-C Pollock Street, New Bern, North Carolina, 28560, submittals required in the technical sections of this specification, including shop drawings, product data and samples. Forward one copy of the transmittal form for all submittals to the Contracting Officer, PSC Box 8006, Building 163, Cherry Point, North Carolina, 28533.

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

#### 1.3.1.1 O&M Data

The Design Management and Engineering Branch will review and approve for the Contracting Officer O&M Data to verify the submittals comply with the contract requirements; submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

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

#### 1.3.1.2 Submittals Reserved for NAVFAC Mid-Atlantic Approval

As an exception to the standard submittal procedure specified above, submit the following to the Commander, NAVFAC Mid-Atlantic, 9742 Maryland Avenue, Building Z-140, Room 219, Norfolk, Virginia, 23511-3095, Attn: Code COFP:

- a. All fire protection system submittals
- b. All fire alarm system submittals
- c. Section 23 09 23.13 22 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC: SD-06 field test report submittals
- d. Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC: All submittals
- e. Section 26 12 19.10 THREE-PHASE PAD-MOUNTED TRANSFORMERS: All submittals

#### 1.4 PREPARATION

##### 1.4.1 Transmittal Form

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

##### 1.4.2 Identifying Submittals

When submittals are provided by a Subcontractor, the Prime Contractor is to prepare, review and stamp with Contractor's certification all specified submittals prior to submitting for approval.

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

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

#### 1.4.3 Format for SD-02 Shop Drawings

Shop drawings are not to be less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless other form is required. Drawings are to be suitable for reproduction and be of a quality to produce clear, distinct lines and letters with dark lines on a white background.

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.

Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph IDENTIFYING SUBMITTALS.

Number drawings in a logical sequence. Contractors may use their own number system. Each drawing is to bear the number of the submittal in a uniform location adjacent to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

Reserve a blank space, no smaller than four inches on the right hand side of each sheet for the Government disposition stamp.

Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Include the nameplate data, size and capacity on drawings. Also include applicable federal, military, industry and technical society publication references.

Submit drawings in PDF format.



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

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.

Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.

Supplement product data with material prepared for project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for project, with information and format as required for submission of SD-07 Certificates.

Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry and technical society publication references. Should manufacturer's data require supplemental information for clarification, submit as specified for SD-07 Certificates.

Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal and marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will be accepted for expedition of construction effort.

Submit manufacturer's instructions prior to installation.

#### 1.4.5 Format of SD-04 Samples

Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:

- a. Sample of Equipment or Device: Full size.
- b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.
- c. 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.
- d. 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.

- e. Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.
- f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.
- g. Sample Panel: 4 by 4 feet.
- h. Sample Installation: 100 square feet.

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at time of use.

Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final clean up of project.

When color, texture or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

#### 1.4.6 Format of SD-05 Design Data and SD-07 Certificates

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

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

Provide reports on 8 1/2 by 11 inches paper in a complete bound volume.

Indicate by prominent notation, each report in the submittal. Indicate specification number and paragraph number to which it pertains.

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

Comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA for O&M Data format.

#### 1.4.9 Format of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

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

#### 1.4.10 Source Drawings for Shop Drawings

The entire set of Source Drawing files (DWG) will not be provided to the Contractor. Only those requested by the Contractor to prepare shop drawings may be provided. Request the specific Drawing Number only for the preparation of Shop Drawings. These drawings may only be provided after award.

##### 1.4.10.1 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse shall be at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim and waives to the fullest extent permitted by law, any claim or cause of action of any nature against the Government, its agents or sub consultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic Source Drawing files are not construction documents. Differences may exist between the Source Drawing files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic Source Drawing files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished Source Drawing files, the signed and sealed construction documents govern. The Contractor is responsible for determining if any conflict exists. Use of these Source Drawing files does not relieve the Contractor of duty to fully comply with the contract documents, including and without limitation, the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic Source Drawing files for use in producing construction data related to this contract, remove all previous indicia of ownership (seals, logos, signatures, initials and dates).

#### 1.5 QUANTITY OF SUBMITTALS

##### 1.5.1 Number of Copies of SD-02 Shop Drawings

Submit six copies of submittals of shop drawings requiring review and approval by Contracting Officer.

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

Submit in compliance with quantity requirements specified for shop drawings.

##### 1.5.3 Number of Samples SD-04 Samples

- a. Submit two samples, or two sets of samples showing range of variation, of each required item. One approved sample or set of samples will be retained by approving authority and one will be returned to Contractor.

- b. Submit one sample panel or provide one sample installation where directed. Include components listed in technical section or as directed.
- c. Submit one sample installation, where directed.
- d. Submit one sample of non-solid materials.

#### 1.5.4 Number of Copies SD-05 Design Data and SD-07 Certificates

Submit in compliance with quantity requirements specified for shop drawings.

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

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

#### 1.5.6 Number of Copies of SD-10 Operation and Maintenance Data

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

#### 1.5.7 Number of Copies of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

Unless otherwise specified, submit three sets of administrative submittals.

### 1.6 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

### 1.7 SUBMITTAL REGISTER

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

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

Column (d): Lists each submittal description (SD No. and type,

e.g. SD-02 Shop Drawings) required in each specification section.

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

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

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

#### 1.7.1 Use of Submittal Register

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

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

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

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

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

#### 1.7.2 Contractor Use of Submittal Register

Update the following fields in the Government-furnished submittal register with each submittal throughout contract.

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

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

Column (l) List date of submittal transmission.

Column (q) List date approval received.

#### 1.7.3 Approving Authority 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 (l) List date of submittal receipt.

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

Column (q) List date returned to Contractor.

#### 1.7.4 Action Codes

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

##### 1.7.4.1 Government Review Action Codes

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

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

"C" - "Approved, except as noted on drawings; resubmission required"; "Resubmit"

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

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

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

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

"X" - "Receipt acknowledged, does not comply with contract requirements"; "Resubmit"

##### 1.7.4.1.1 Contractor Action Codes

NR - Not Received

AN - Approved as Noted

A - Approved

RR - Disapproved, Revise, and Resubmit

#### 1.7.5 Copies Delivered to the Government

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

#### 1.8 VARIATIONS

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

##### 1.8.1 Considering Variations

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

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

### 1.8.2 Proposing Variations

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

### 1.8.3 Warranting that Variations are Compatible

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

### 1.8.4 Review Schedule Extension

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

## 1.9 SCHEDULING

Schedule and submit concurrently submittals covering component items forming a system or items that are interrelated. Include certifications to be submitted with the pertinent drawings at the same time. No delay damages or time extensions will be allowed for time lost in late submittals.

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

organization, of 30 working days for return of submittal to the Contractor.

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

#### 1.9.1 Reviewing, Certifying, Approving Authority

The QC organization is responsible for reviewing and certifying that submittals are in compliance with contract requirements. Approving authority on submittals is the Government unless otherwise specified for specific submittal.

#### 1.9.2 Constraints

Conform to provisions of this section, unless explicitly stated otherwise for submittals listed or specified in this contract.

Submit complete submittals for each definable feature of work. Submit at the same time components of definable feature interrelated as a system.

When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, submittal will be returned without review.

Approval of a separate material, product, or component does not imply approval of assembly in which item functions.

#### 1.9.3 QC Organization Responsibilities

- a. Note date on which submittal was received from Contractor on each submittal.
- b. Review each submittal; and check and coordinate each submittal with requirements of work and contract documents.
- c. Review submittals for conformance with project design concepts and compliance with contract documents.
- d. Act on submittals, determining appropriate action based on QC organization's review of submittal.
  - (1) When 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, 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 (\_\_\_\_), 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. The QC organization member designated in the approved QC plan is the person signing certifying statements. The use of original ink for signatures is required. Stamped signatures are not acceptable.
- h. Update submittal register as submittal actions occur and maintain the submittal register at project site until final acceptance of all work by Contracting Officer.
- i. Retain a copy of approved submittals at project site, including Contractor's copy of approved samples.

#### 1.10 GOVERNMENT APPROVING AUTHORITY

When approving authority is Contracting Officer, the Government will:

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

Upon completion of review of submittals requiring Government approval, stamp and date submittals. 3 copies of the submittal will be retained by the Contracting Officer and 3 copies of the submittal will be returned to the Contractor.

##### 1.10.1 Review Notations

Submittals will be returned to the Contractor with the following notations:

- a. Submittals marked "approved" or "accepted" authorize the Contractor to proceed with the work covered.
- b. Submittals marked "approved as noted" or "approved, except as noted, resubmittal not required", authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.
- c. Submittals marked "not approved" or "disapproved", or "revise and resubmit", indicate noncompliance with the contract requirements or design concept, or that submittal is incomplete. Resubmit with appropriate changes. No work shall proceed for this item until resubmittal is approved.

- d. Submittals marked "not reviewed" will indicate submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and certified by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

#### 1.11 DISAPPROVED OR REJECTED SUBMITTALS

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

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

#### 1.12 APPROVED/ACCEPTED SUBMITTALS

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

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

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

#### 1.13 APPROVED SAMPLES

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

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

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of

the same brand or make of that material. Government reserves the right to disapprove any material or equipment which previously has proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Contractor to replace such materials or equipment to meet contract requirements.

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

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

Not Used

-- End of Section --

SUBMITTAL REGISTER

CONTRACT NO.

| TITLE AND LOCATION  |          |                               |                                    | CONTRACTOR                |                            |                    |                    |                   |                     |  |                            |                            |  | CONTRACT NO. |                |     |     |
|---------------------|----------|-------------------------------|------------------------------------|---------------------------|----------------------------|--------------------|--------------------|-------------------|---------------------|--|----------------------------|----------------------------|--|--------------|----------------|-----|-----|
| Repairs to BEQ 4200 |          |                               |                                    |                           |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
| TRANSMITTAL NO      | RECEIVED | DESCRIPTION<br>ITEM SUBMITTED | PARAGRAPH #                        | GOVERNOR'S OFFICE / CLERK | CONTRACTOR: SCHEDULE DATES |                    |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |  |                            |                            | MAILED TO CONTR/ DATE RCD FROM APPR AUTH | REMARKS      |                |     |     |
|                     |          |                               |                                    |                           | SUBMIT                     | APPROVAL NEEDED BY | MATERIAL NEEDED BY |                   | DATE OF ACTION      | DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR | DATE FWD TO OTHER REVIEWER | DATE RCD FROM OTH REVIEWER |  |              | DATE OF ACTION |     |     |
| (a)                 | (b)      | (c)                           | (d)                                | (e)                       | (f)                        | (g)                | (h)                | (i)               | (j)                 | (k)  | (l)                        | (m)                        | (n)                                      | (o)          | (p)            | (q) | (r) |
|                     |          | 01 20 00.00 20                | SD-01 Preconstruction Submittals   |                           |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | Schedule of Prices                 | 1.3                       |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          | 01 30 00                      | SD-01 Preconstruction Submittals   |                           |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | List of contact personnel          | 1.2.1                     |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          | 01 30 01.00 22                | SD-02 Shop Drawings                |                           |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | Preliminary (Pre-Final) FF&E       | 1.5.3                     | G                          |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | Package                            |                           |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | Final FF&E Package                 | 1.5.10                    | G ID                       |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | Best Value Determination           | 1.5.4                     | G ID                       |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | Final FF&E Mock-Up                 | 1.5.7                     | G ID                       |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | SD-07 Certificates                 |                           |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | Contractor's Interior Designer's   | 1.4.1                     | G ID                       |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | Qualifications                     |                           |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          | 01 31 23.13 20                | SD-01 Preconstruction Submittals   |                           |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | List of Contractor's Personnel     | 1.4.2                     |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          | 01 33 00                      | SD-01 Preconstruction Submittals   |                           |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | Submittal Register                 | 1.7                       |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          | 01 33 29                      | SD-01 Preconstruction Submittals   |                           |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | Preliminary High Performance       | 1.5.3.1                   |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | and Sustainable Building Checklist |                           |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | Sustainability Action Plan         | 1.4.1                     |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | Preliminary Sustainability         | 1.5.3.1                   |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | eNotebook                          |                           |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | SD-11 Closeout Submittals          |                           |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | Final High Performance and         | 1.5.3.1                   |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |
|                     |          |                               | Sustainable Building Checklist     |                           |                            |                    |                    |                   |                     |  |                            |                            |  |              |                |     |     |

SUBMITTAL REGISTER

CONTRACT NO.

| TITLE AND LOCATION  |   |                               | CONTRACTOR |        |                         |                            |                    |                    |                   |  |                            |                            | CONTRACT NO. |   |         |          |
|---------------------|---|-------------------------------|------------|--------|-------------------------|----------------------------|--------------------|--------------------|-------------------|--|----------------------------|----------------------------|--------------|---|---------|----------|
| Repairs to BEQ 4200 |   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
| (a)                 | (b)   | (c)                           | (d)        | (e)    | (f)                     | CONTRACTOR: SCHEDULE DATES |                    |                    | CONTRACTOR ACTION | APPROVING AUTHORITY                        |                            |                            |              | REMARKS                                 |         |          |
|                     |   |                               |            |        |                         | (g)                        | (h)                | (i)                |                   | (j)  | (k)                        | (l)                        | (m)          |   | (n)     | (o)      |
| TRANSMITTAL NO      | SPESCT  | DESCRIPTION<br>ITEM SUBMITTED |            | PARAG# | GOVERNOR CLASSIFICATION | SUBMIT                     | APPROVAL NEEDED BY | MATERIAL NEEDED BY | ACTION            | DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR | DATE FWD TO OTHER REVIEWER | DATE RCD FROM OTH REVIEWER | ACTION       | MAILED TO CONTR/ DATE RCD FRM APPR AUTH | REMARKS |          |
|                     |   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     |   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     |   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     |   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     |   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     |   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     |   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     |   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     |   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     |   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     |   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     |   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     |   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     |   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         | 01 33 29 |
|                     | Amended Final Sustainability eNotebook                            | 1.5.3.1                       |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | Amended Final High Performance and Sustainable Building Checklist | 1.5.3.1                       |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
| 01 35 26            | SD-01 Preconstruction Submittals                                  |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | Accident Prevention Plan (APP)                                    | 1.8                           |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | SD-06 Test Reports  |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | Monthly Exposure Reports  | 1.4                           |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | Notifications and Reports   | 1.13                          |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | Accident Reports  | 1.13.2                        |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | LHE Inspection Reports  | 1.13.3                        |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | SD-07 Certificates  |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | Contractor Safety Self-Evaluation                                 | 1.5                           |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | Checklist   |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | Crane Operators/Riggers   | 1.7.1.4                       |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | Standard Lift Plan  | 1.8.2.2                       |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | Critical Lift Plan  | 1.8.2.3                       |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | Activiy Hazard Analysis (AHA)                                     | 1.9                           |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | Confined Space Entry Permit                                       | 1.10.1                        |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | Hot Work Permit   | 1.10.1                        |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | Certificate of Compliance   | 1.13.4                        |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | 01 45 00.00 20  |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | SD-01 Preconstruction Submittals                                  |                               |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |
|                     | Construction Quality Control (QC) Plan                            | 1.6.1                         |            |        |                         |                            |                    |                    |                   |  |                            |                            |              |   |         |          |

# SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION  
Repairs to BEQ 4200

CONTRACTOR

| TRANSMITTAL NO | SPEC | DESCRIPTION<br>ITEM SUBMITTED | PARAGRAPH                        | GOVERNOR<br>CLASSIFICATION | CONTRACTOR:<br>SCHEDULE DATES |                          | CONTRACTOR<br>ACTION | DATE FWD<br>TO APPR<br>AUTH/ | APPROVING AUTHORITY      |      |                   | MAILED<br>TO<br>CONTR/<br>DATE RCD<br>FRM APPR<br>AUTH | REMARKS |                                  |                                  |                     |                      |
|----------------|------|-------------------------------|----------------------------------|----------------------------|-------------------------------|--------------------------|----------------------|------------------------------|--------------------------|------|-------------------|--|---------|----------------------------------|----------------------------------|---------------------|----------------------|
|                |      |                               |                                  |                            | SUBMIT                        | APPROVAL<br>NEEDED<br>BY |                      |                              | MATERIAL<br>NEEDED<br>BY | CONC | DATE OF<br>ACTION |  |         | DATE FWD<br>TO OTHER<br>REVIEWER | DATE RCD<br>FROM OTH<br>REVIEWER | CONC<br>O<br>D<br>E | DATE<br>OF<br>ACTION |
| (a)            | (b)  | (c)                           | (d)                              | (e)                        | (f)                           | (g)                      | (h)                  | (i)                          | (j)                      | (k)  | (l)               | (m)  | (n)     | (o)                              | (p)                              | (q)                 | (r)                  |
|                |      | 01 45 00.00 20                | Contract Document Review         | 1.9.3                      |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | SD-07 Certificates               |                            |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | CA Resume                        | 1.5.2.2                    |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      | 01 50 00                      | SD-01 Preconstruction Submittals |                            |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | Construction Site Plan           | 1.3                        |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | Traffic Control Plan             | 3.4.1                      |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | SD-07 Certificates               |                            |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | Backflow Tester                  | 1.4.1                      |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | Backflow Preventers              | 1.4                        |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      | 01 57 19                      | SD-01 Preconstruction Submittals |                            |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | Preconstruction Survey           | 1.5.1                      |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | Solid Waste Management Permit    | 1.9                        |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | Regulatory Notifications         | 1.5.2                      |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | Environmental Protection Plan    | 1.6                        |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | Dirt and Dust Control Plan       | 1.6.9.1                    |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | Employee Training Records        | 1.5.5                      |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | Environmental Manager            | 1.5.4                      |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | Qualifications                   |                            |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | SD-06 Test Reports               |                            |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | Solid Waste Management Report    | 3.6.2.1                    |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | SD-07 Certificates               |                            |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | Employee Training Records        | 1.5.5                      |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | ECATTS Certificate Of            | 1.4.1.2                    |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | Completion                       |                            |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |
|                |      |                               | SD-11 Closeout Submittals        |                            |                               |                          |                      |                              |                          |      |                   |  |         |                                  |                                  |                     |                      |

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CONTRACT NO.

| TITLE AND LOCATION  |          |                                      | CONTRACTOR  |            |                               |                          |                          |                      |                      |   |                                  |                                  | CONTRACT NO.   |         |                      |     |     |
|---------------------|----------|--------------------------------------|-------------|------------|-------------------------------|--------------------------|--------------------------|----------------------|----------------------|---|----------------------------------|----------------------------------|--|---------|----------------------|-----|-----|
| Repairs to BEQ 4200 |          |                                      |             |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
| TRANSMITTAL NO      | SPECIES  | DESCRIPTION<br>ITEM SUBMITTED        | PARAGRAPH # | GOVERNANCE | CONTRACTOR:<br>SCHEDULE DATES |                          |                          | CONTRACTOR<br>ACTION | APPROVING AUTHORITY  |   |                                  |                                  | MAILED<br>TO<br>CONTR/<br>DATE RCD<br>FRM APPR<br>AUTH | REMARKS |                      |     |     |
|                     |          |                                      |             |            | SUBMIT                        | APPROVAL<br>NEEDED<br>BY | MATERIAL<br>NEEDED<br>BY |                      | DATE<br>OF<br>ACTION | DATE FWD<br>TO APPR<br>AUTH/<br>DATE RCD<br>FROM<br>CONTR | DATE FWD<br>TO OTHER<br>REVIEWER | DATE RCD<br>FROM OTH<br>REVIEWER |  |         | DATE<br>OF<br>ACTION |     |     |
| (a)                 | (b)      | (c)                                  | (d)         | (e)        | (f)                           | (g)                      | (h)                      | (i)                  | (j)                  | (k)   | (l)                              | (m)                              | (n)  | (o)     | (p)                  | (q) | (r) |
|                     | 01 57 19 | Waste Determination<br>Documentation | 3.6.1       |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Disposal Documentation for           | 3.6.3.6     |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Hazardous and Regulated Waste        |             |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Assembled Employee Training          | 1.5.5       |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Records                              |             |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Solid Waste Management Permit        | 1.9         |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Solid Waste Management Report        | 3.6.2.1     |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Contractor Hazardous Material        | 3.7.1       |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Inventory Log                        |             |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Hazardous Waste/Debris               | 3.6.3.1     |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Management                           |             |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Regulatory Notifications             | 1.5.2       |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Sales Documentation                  | 3.6.2.1     |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Contractor Certification             | 3.6.2.1     |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     | 01 78 00 | SD-03 Product Data                   |             |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Warranty Management Plan             | 1.5.1       |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Warranty Tags                        | 1.5.4       |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Final Cleaning                       | 3.3         |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Spare Parts Data                     | 1.4         |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | SD-08 Manufacturer's Instructions    |             |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Instructions                         | 1.5.1       |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | SD-10 Operation and Maintenance      |             |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Data                                 |             |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Operation and Maintenance            | 3.2         |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |
|                     |          | Manuals                              |             |            |                               |                          |                          |                      |                      |   |                                  |                                  |  |         |                      |     |     |

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CONTRACT NO.

TITLE AND LOCATION

CONTRACTOR

Repairs to BEQ 4200

| TRANSMITTAL NO | SPESCT      | DESCRIPTION<br>ITEM SUBMITTED     | PARAGRAPH # | GOVERNOR CLASSIFICATION / REVIEW | CONTRACTOR: SCHEDULE DATES |                    |                    | CONTRACTOR ACTION |                | APPROVING AUTHORITY    |                            |                            |        |                |   | REMARKS |     |
|----------------|-------------|-----------------------------------|-------------|----------------------------------|----------------------------|--------------------|--------------------|-------------------|----------------|------------------------|----------------------------|----------------------------|--------|----------------|---|---------|-----|
|                |             |                                   |             |                                  | SUBMIT                     | APPROVAL NEEDED BY | MATERIAL NEEDED BY | ACTION            | DATE OF ACTION | DATE FWD TO APPR AUTH/ | DATE FWD TO OTHER REVIEWER | DATE RCD FROM OTH REVIEWER | ACTION | DATE OF ACTION | MAILED TO CONTR/ DATE RCD FRM APPR AUTH |         |     |
| (a)            | (b)         | (c)                               | (d)         | (e)                              | (f)                        | (g)                | (h)                | (i)               | (j)            | (k)                    | (l)                        | (m)                        | (n)    | (o)            | (p)                                     | (q)     | (r) |
|                | 01 78 00    | SD-11 Closeout Submittals         |             |                                  |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | As-Built Drawings                 |             | 3.1                              |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Certification of EPA Designated   |             | 2.1                              |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Items                             |             |                                  |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Interim DD FORM 1354              |             | 3.4                              |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Checklist for DD FORM 1354        |             | 3.4                              |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | NAVFAC Sustainable & Energy       |             | 3.5                              |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Data Record Card                  |             |                                  |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                | 01 78 23    | SD-10 Operation and Maintenance   |             |                                  |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Data                              |             |                                  |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | O&M Database                      |             | 1.4                              |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Training Plan                     |             | 3.1.1                            |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Training Outline                  |             | 3.1.3                            |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Training Content                  |             | 3.1.2                            |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | SD-11 Closeout Submittals         |             |                                  |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Validation of Training Completion |             | 3.1.5                            |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                | 01 91 00.15 | SD-01 Preconstruction Submittals  |             |                                  |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Commissioning Firm                |             | 1.7                              |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Lead Commissioning Specialist     |             | 1.7.1                            |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Technical Commissioning           |             | 1.7.2                            |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Specialists                       |             |                                  |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Commissioning Firm's Contract     |             | 1.7                              |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | SD-06 Test Reports                |             |                                  |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Interim Construction Phase        |             | 3.1.2.1                          |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |
|                |             | Commissioning Plan                |             |                                  |                            |                    |                    |                   |                |                        |                            |                            |        |                |   |         |     |



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| TITLE AND LOCATION             |          |                                  | CONTRACTOR                           |         |                                    |                            |     |     |                   |                        |                            |                            | CONTRACT NO.   |                  |     |     |
|--------------------------------|----------|----------------------------------|--------------------------------------|---------|------------------------------------|----------------------------|-----|-----|-------------------|------------------------|----------------------------|----------------------------|----------------|------------------|-----|-----|
| Repairs to BEQ 4200            |          |                                  |                                      |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
| (a)                            | (b)      | (c)                              | (d)                                  | (e)     | (f)                                | CONTRACTOR: SCHEDULE DATES |     |     | CONTRACTOR ACTION | APPROVING AUTHORITY    |                            |                            |                | REMARKS          |     |     |
|                                |          |                                  |                                      |         |                                    | (g)                        | (h) | (i) |                   | (j)                    | (k)                        | (l)                        | (m)            |                  | (n) | (o) |
| TRANSMITTALS<br>SPECIFICATIONS |          |                                  | DESCRIPTION<br>ITEM SUBMITTED        | PARRAG# | GOVERNOR<br>CLASS / AREA<br>OFFICE |                            |     |     | ACTION            | DATE FWD TO APPR AUTH/ | DATE FWD TO OTHER REVIEWER | DATE RCD FROM OTH REVIEWER | DATE OF ACTION | MAILED TO CONTR/ |     |     |
|                                |          | 01 91 00.15                      | Final Construction Phase             | 3.1.2.2 |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          |                                  | Commissioning Plan                   |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          |                                  | Pre-Functional Checklists            | 3.1.4.2 |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          |                                  | Issues Log                           | 1.8     |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          |                                  | Commissioning Report                 | 3.2     |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          |                                  | SD-07 Certificates                   |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          |                                  | Certificate of Readiness             | 1.9     |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          |                                  | SD-10 Operation and Maintenance Data |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          |                                  | Training Plan                        | 3.1.5   |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          |                                  | Training Attendance Rosters          | 3.1.5   |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          |                                  | Systems Manual                       | 3.1.6   |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          |                                  | SD-11 Closeout Submittals            |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          |                                  | Construction Phase                   | 3.1.2.1 |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          |                                  | Commissioning Plan                   |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          | Final Commissioning Report       | 3.2                                  |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                | 02 41 00 | SD-01 Preconstruction Submittals |                                      |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          | Existing Conditions              | 1.9                                  |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          | SD-07 Certificates               |                                      |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          | Demolition Plan                  | 1.2.1                                |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          | Notification                     | 1.6                                  |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          | SD-11 Closeout Submittals        |                                      |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          | Receipts                         | 3.3.3                                |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                | 02 50 00 | SD-03 Product Data               |                                      |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          | Pavement                         | 1.4                                  |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |
|                                |          | Tack coat                        | 2.1                                  |         |                                    |                            |     |     |                   |                        |                            |                            |                |                  |     |     |

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|--------------------------------|-----|----------------------------------|--------------------------------|------------|----------------------------|----------------------------|-----|-----|-------------------|---------------------|-----|-----|-----|--------------|-----|-----|-----|-----|
| Repairs to BEQ 4200            |     |                                  |                                |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
| (a)                            | (b) | (c)                              | (d)                            | (e)        | (f)                        | CONTRACTOR: SCHEDULE DATES |     |     | CONTRACTOR ACTION | APPROVING AUTHORITY |     |     |     | REMARKS      |     |     |     |     |
|                                |     |                                  |                                |            |                            | (g)                        | (h) | (i) |                   | (j)                 | (k) | (l) | (m) |              | (n) | (o) | (p) | (q) |
| TRANSMITTALS<br>SPECIFICATIONS |     |                                  | DESCRIPTION<br>ITEM SUBMITTED  | PARRAG#    | GOVERNOR<br>CLASSIFICATION |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     |                                  |                                |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     | 02 50 00                         | Stone                          | 2.4.2      |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     |                                  | SD-05 Design Data              |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     |                                  | Job-mix formula                | 1.2.1      |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     | 02 82 33.13 20                   | SD-03 Product Data             |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     |                                  | Vacuum Filters                 | 1.6.4      |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     |                                  | Respirators                    | 1.6.1      |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     |                                  | SD-06 Test Reports             |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     |                                  | Sampling results               | 1.5.2.3    |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     |                                  | Occupational and Environmental | 1.5.2.3    |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     |                                  | Assessment Data Report         |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     |                                  | SD-07 Certificates             |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     |                                  | Qualifications of CP           | 1.5.1.1    |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     |                                  | Testing Laboratory             | 1.5.1.3    |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     | Training Certification           | 1.5.1.2                        |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     | lead-based paint/paint with lead | 1.5.3                          |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     | removal/control plan             |                                |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     | Rental equipment notification    | 1.6.3                          |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     | Respiratory Protection Program   | 1.5.2.6                        |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     | Hazard Communication Program     | 1.5.2.7                        |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     | Lead Waste Management Plan       | 1.5.2.8                        |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     | Vacuum filters                   | 1.6.4                          |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     | Clearance Certification          | 3.5.1.1                        |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     | SD-11 Closeout Submittals        |                                |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     | hazardous waste manifest         | 3.5.2.1                        |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     | Medical Examinations             | 1.5.2.4                        |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |
|                                |     | Training Certification           | 1.5.1.2                        |            |                            |                            |     |     |                   |                     |     |     |     |              |     |     |     |     |

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|---------------------|----------------|---|-------------------------------|------------|-----------------------------------|----------------------------|--------------------|--------------------|-------------------|---------------------|--|----------------------------|----------------------------|--------------|----------------|---|-----|
| Repairs to BEQ 4200 |                |   |                               |            |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
| (a)                 | (b)            | (c)   | (d)                           | (e)        | (f)                               | CONTRACTOR: SCHEDULE DATES |                    |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |  |                            |                            | REMARKS      |                |   |     |
|                     |                |   |                               |            |                                   | SUBMIT                     | APPROVAL NEEDED BY | MATERIAL NEEDED BY |                   | DATE OF ACTION      | DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR | DATE FWD TO OTHER REVIEWER | DATE RCD FROM OTH REVIEWER |              | DATE OF ACTION | MAILED TO CONTR/ DATE RCD FRM APPR AUTH |     |
| TRANSMITTAL NO      |                | SPESCT  | DESCRIPTION<br>ITEM SUBMITTED | PARRAG#    | GOVERNOR / CLASSE / OFFICE / WORK |                            |                    |                    | ACTION            |                     |  |                            |                            |              |                |   |     |
| (a)                 | (b)            | (c)   | (d)                           | (e)        | (f)                               | (g)                        | (h)                | (i)                | (j)               | (k)                 | (l)  | (m)                        | (n)                        | (o)          | (p)            | (q)                                     | (r) |
|                     | 02 83 13.00 20 | SD-01 Preconstruction Submittals                      |                               |            |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | Occupational and Environmental Assessment Data Report |                               | 1.5.2.3    |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | Lead Compliance Plan                                  |                               | 1.5.2.2    |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | Competent Person                                      |                               | 1.5.1.1    |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | Training Certification                                |                               | 1.5.1.2    |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | lead waste management plan                            |                               | 1.5.2.8    |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | written evidence                                      |                               | 3.5.2.1    |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | Medical Examinations                                  |                               | 1.5.2.4    |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | SD-06 Test Reports                                    |                               |            |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | sampling results                                      |                               | 1.5.2.3    |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | Occupational and Environmental Assessment Data Report |                               | 1.5.2.3    |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | SD-07 Certificates                                    |                               |            |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | Testing laboratory                                    |                               | 1.5.1.3    |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | Third party consultant                                |                               | 1.5.1.4    |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | qualifications  |                               |            |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | Clearance Certification                               |                               | 3.5.1.1    |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | SD-11 Closeout Submittals                             |                               |            |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | hazardous waste manifest                              |                               | 3.5.2.1    |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | turn-in documents or weight tickets                   |                               | 3.5.2.1    |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     | 03 01 30.71    | SD-05 Design Data                                     |                               |            |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | Job mix formula                                       |                               | 1.4.1.1    |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | SD-06 Test Reports                                    |                               |            |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |
|                     |                | aggregate   |                               | 2.1.2      |                                   |                            |                    |                    |                   |                     |  |                            |                            |              |                |   |     |

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| Repairs to BEQ 4200   |   |   |                                   |  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
| A<br>C<br>C<br>E<br>P<br>T<br>I<br>V<br>I<br>T<br>Y<br>N<br>O | T<br>R<br>A<br>N<br>S<br>M<br>I<br>T<br>T<br>A<br>L<br>N<br>O | S<br>P<br>E<br>C<br>I<br>F<br>I<br>C<br>T | DESCRIPTION<br><br>ITEM SUBMITTED | P<br>A<br>R<br>A<br>G<br>#<br>R<br>A<br>P<br>H | G<br>O<br>V<br>T<br>C<br>L<br>A<br>S<br>S<br>I<br>F<br>I<br>C<br>A<br>T<br>I<br>O<br>N<br>A<br>R<br>E<br>I<br>V<br>O<br>R | CONTRACTOR:<br>SCHEDULE DATES |                          |                          | CONTRACTOR<br>ACTION | APPROVING AUTHORITY                                       |                                  |                                  |                                      | MAILED<br>TO<br>CONTR/<br>DATE RCD<br>FRM APPR<br>AUTH | REMARKS |                      |     |
|   |   |   |                                   |  |   | SUBMIT                        | APPROVAL<br>NEEDED<br>BY | MATERIAL<br>NEEDED<br>BY | DATE<br>OF<br>ACTION | DATE FWD<br>TO APPR<br>AUTH/<br>DATE RCD<br>FROM<br>CONTR | DATE FWD<br>TO OTHER<br>REVIEWER | DATE RCD<br>FROM OTH<br>REVIEWER | A<br>C<br>T<br>I<br>O<br>N<br>D<br>E |  |         | DATE<br>OF<br>ACTION |     |
| (a)   | (b)   | (c)                                       | (d)                               | (e)  | (f)   | (g)                           | (h)                      | (i)                      | (j)                  | (k)   | (l)                              | (m)                              | (n)                                  | (o)  | (p)     | (q)                  | (r) |
|   |   | 03 01 30.71                               | Epoxy resin binder                | 2.1.1.1  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | SD-08 Manufacturer's Instructions |  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Epoxy                             | 2.1.1  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   | 03 30 00                                  | SD-05 Design Data                 |  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | mix design                        | 2.1.1  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | SD-06 Test Reports                |  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Concrete mix design               | 1.6.2.1  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Fly ash                           | 1.6.2.2  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Pozzolan                          | 1.6.2.2  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Ground granulated blast-furnace   | 1.6.2.3  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | slag                              |  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Aggregates                        | 1.6.2.4  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Fiber-reinforced concrete         | 1.6.2.5  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Tolerance report                  | 3.10.2.1                                       |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Compressive strength tests        | 3.12.2.3                                       |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Ion concentration                 | 3.12.2.5                                       |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Air Content                       | 3.12.2.4                                       |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Slump                             | 2.6.4  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Air Entrainment                   | 2.6.1  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | SD-08 Manufacturer's Instructions |  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Fly ash                           | 1.6.2.2  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Ground granulated blast-furnace   | 1.6.2.3  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | slag                              |  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Steel Bar                         | 2.3.3  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   | 03 30 53                                  | SD-03 Product Data                |  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |   | Air-Entraining Admixture          | 2.1.3.1  |   |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |

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| Repairs to BEQ 4200 |          |  |     |            |     |                            |                    |                   |                     |                |  |         |                            |
| (a)                 | (b)      | (c)                                      | (d) | (e)        | (f) | CONTRACTOR: SCHEDULE DATES |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |                |  | REMARKS |                            |
|                     |          |  |     |            |     | SUBMIT                     | APPROVAL NEEDED BY |                   | CONCURRENCE         | DATE OF ACTION | DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR |         | DATE FWD TO OTHER REVIEWER |
|                     | 03 30 53 | Water-Reducing or Retarding Admixture    |     | 2.1.3.2    |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Curing Materials                         |     | 2.1.11     |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Expansion Joint Filler Strips, Premolded |     | 2.1.6      |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Joint Sealants - Field Molded            |     | 2.1.7      |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Sealants                                 |     |            |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Conveying and Placing Concrete           |     | 3.2        |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Formwork                                 |     | 2.1.8      |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Forms                                    |     | 2.4        |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Ready-Mix Concrete                       |     | 2.2        |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Mix Design Data                          |     | 2.2        |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Air-Entraining Admixtures                |     | 2.2        |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Fly Ash                                  |     | 2.2        |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Accessories                              |     | 2.5        |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Curing Compound                          |     | 2.5.1      |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | SD-06 Test Reports                       |     |            |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Aggregates                               |     | 2.1.2      |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Concrete Mixture Proportions             |     | 1.3.3      |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Compressive Strength Testing             |     | 3.10       |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Slump                                    |     | 3.10       |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | SD-07 Certificates                       |     |            |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Cementitious Materials                   |     | 2.1.1      |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Aggregates                               |     | 2.1.2      |     |                            |                    |                   |                     |                |  |         |                            |
|                     | 03 45 33 | SD-02 Shop Drawings                      |     |            |     |                            |                    |                   |                     |                |  |         |                            |
|                     |          | Drawings of precast members              |     | 1.2.1.2    |     |                            |                    |                   |                     |                |  |         |                            |

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| Repairs to BEQ 4200 |          |  |     |         |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
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|                     |          |  |     |         |     | SUBMIT                     | APPROVAL NEEDED BY |                   | CONC O D E          | DATE OF ACTION | DATE FWD TO APPR AUTH/ | DATE FWD TO OTHER REVIEWER |         | DATE RCD FROM OTH REVIEWER | DATE OF ACTION |  |
|                     | 04 20 00 | Clay or Shale Brick Anchors, Ties, and Bar Positioners |     | 2.2     |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Expansion-Joint Materials                              |     | 2.11    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | SD-06 Test Reports                                     |     |         |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Fire-rated CMU   |     | 2.3.3   |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | SD-07 Certificates                                     |     |         |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Clay or Shale Brick                                    |     | 2.2     |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Concrete Masonry Units (CMU)                           |     | 2.3     |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Joint Reinforcement                                    |     | 2.8     |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Masonry Cement   |     | 2.5.3   |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Insulation   |     | 3.14    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Insulation   |     | 3.14    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Admixtures for Masonry Mortar                          |     | 2.5.1   |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Admixtures for Grout                                   |     | 2.6.1   |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | SD-08 Manufacturer's Instructions                      |     |         |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Masonry Cement   |     | 2.5.3   |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     | 05 12 00 | SD-02 Shop Drawings                                    |     |         |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Erection Plan  |     | 1.6.2.1 |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Fabrication drawings                                   |     | 1.6.1   |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | SD-03 Product Data                                     |     |         |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Shop primer  |     | 2.4     |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Welding electrodes and rods                            |     | 2.3.1   |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Load indicator washers                                 |     | 2.2.4   |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Non-Shrink Grout                                       |     | 2.3.2   |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | SD-06 Test Reports                                     |     |         |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |

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| Repairs to BEQ 4200 |          |   |     |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
| (a)                 | (b)      | (c)                                       | (d) | (e)        | (f) | CONTRACTOR: SCHEDULE DATES |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |                |                        |                            | REMARKS |                            |                |  |  |
|                     |          |   |     |            |     | SUBMIT                     | APPROVAL NEEDED BY |                   | CONCURRENCE         | DATE OF ACTION | DATE FWD TO APPR AUTH/ | DATE FWD TO OTHER REVIEWER |         | DATE RCD FROM OTH REVIEWER | DATE OF ACTION |  |  |
|                     | 05 12 00 | Class B coating                           |     | 2.4        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | Bolts, nuts, and washers                  |     | 2.2        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | SD-07 Certificates                        |     |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | Steel                                     |     | 2.1        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | Bolts, nuts, and washers                  |     | 2.2        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | Galvanizing                               |     | 2.5        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | AISC Quality Certification                |     | 1.5        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | Welding procedures and qualifications     |     | 1.6,2.2    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     | 05 50 13 | SD-02 Shop Drawings                       |     |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | RETROFIT STAIR TREADS                     |     | 2.4        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | Column Cover                              |     | 2.6        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | Access doors and panels                   |     | 2.3        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | SD-03 Product Data                        |     |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | RETROFIT STAIR TREADS                     |     | 2.4        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | Column Cover                              |     | 2.6        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | Access doors and panels                   |     | 2.3        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     | 05 52 00 | SD-02 Shop Drawings                       |     |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | Fabrication Drawings                      |     | 1.2.1      |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | Iron and Steel Hardware                   |     | 2.1        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | Steel Shapes, Plates, Bars and Strips     |     | 2.1        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | SD-03 Product Data                        |     |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | Structural Steel Plates, Shapes, and Bars |     | 2.3        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |
|                     |          | Structural Steel Tubing                   |     | 2.4        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |



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|---|---|--------------------------------------|---|--|--|-------------------------------|--------------------------|----------------------|--------------------------|----------------------|---|----------------------------------|--|--------------|----------------------------------|----------------------|-----|
| Repairs to BEQ 4200   |   |                                      |   |  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
| A<br>C<br>C<br>E<br>P<br>T<br>I<br>V<br>I<br>T<br>Y<br>N<br>O | T<br>R<br>A<br>N<br>S<br>M<br>I<br>T<br>T<br>A<br>L<br>N<br>O | S<br>P<br>E<br>C<br>S<br>E<br>C<br>T | DESCRIPTION<br><br>ITEM SUBMITTED         | P<br>A<br>R<br>A<br>G<br>#<br><br>R<br>A<br>P<br>H | C<br>O<br>V<br>E<br>R<br>A<br>G<br>E<br>S<br>I<br>F<br>I<br>C<br>A<br>T<br>I<br>O<br>N | CONTRACTOR:<br>SCHEDULE DATES |                          | CONTRACTOR<br>ACTION | APPROVING AUTHORITY      |                      |   |                                  | MAILED<br>TO<br>CONTR/<br>DATE RCD<br>FRM APPR<br>AUTH | REMARKS      |                                  |                      |     |
|   |   |                                      |   |  |  | SUBMIT                        | APPROVAL<br>NEEDED<br>BY |                      | MATERIAL<br>NEEDED<br>BY | DATE<br>OF<br>ACTION | DATE FWD<br>TO APPR<br>AUTH/<br>DATE RCD<br>FROM<br>CONTR | DATE FWD<br>TO OTHER<br>REVIEWER |  |              | DATE RCD<br>FROM OTH<br>REVIEWER | DATE<br>OF<br>ACTION |     |
| (a)   | (b)   | (c)                                  | (d)                                       | (e)  | (f)  | (g)                           | (h)                      | (i)                  | (j)                      | (k)                  | (l)   | (m)                              | (n)  | (o)          | (p)                              | (q)                  | (r) |
|   |   | 06 61 16                             | Clean-up                                  | 3.2  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   | 07 11 13                             | SD-07 Certificates                        |  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Materials                                 | 1.3  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   | 07 19 00                             | SD-03 Product Data                        |  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Water repellents                          | 2.2  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | SD-06 Test Reports                        |  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Water absorption                          | 1.3.2  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Accelerated weathering                    | 2.3.1  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Resistance to chloride ion<br>penetration | 2.3.1  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Moisture vapor transmission               | 1.3.2  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Moisture vapor transmission               | 2.3.1  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Scaling resistance                        | 2.3.1  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Water Penetration and Leakage             | 1.3.2  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | SD-07 Certificates                        |  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Manufacturer's qualifications             | 1.3.1  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Applicator's qualifications               | 1.3.1  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Evidence of acceptable variation          | 1.3.3  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Warranty                                  | 1.12   |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | SD-08 Manufacturer's Instructions         |  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Application                               | 3.4  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | material safety data sheets               | 1.7.1  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   | 07 21 13                             | SD-03 Product Data                        |  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Block or board insulation                 | 2.1  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | Accessories                               | 2.3  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |
|   |   |                                      | SD-08 Manufacturer's Instructions         |  |  |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                      |     |

SUBMITTAL REGISTER

CONTRACT NO.

| TITLE AND LOCATION  |          | CONTRACTOR                |     |        |     |                            |                    |                   |                     |                |                        | CONTRACT NO.               |         |                            |                |  |
|---------------------|----------|---------------------------|-----|--------|-----|----------------------------|--------------------|-------------------|---------------------|----------------|------------------------|----------------------------|---------|----------------------------|----------------|--|
| Repairs to BEQ 4200 |          |                           |     |        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
| (a)                 | (b)      | (c)                       | (d) | (e)    | (f) | CONTRACTOR: SCHEDULE DATES |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |                |                        |                            | REMARKS |                            |                |  |
|                     |          |                           |     |        |     | SUBMIT                     | APPROVAL NEEDED BY |                   | CONC O D E          | DATE OF ACTION | DATE FWD TO APPR AUTH/ | DATE FWD TO OTHER REVIEWER |         | DATE RCD FROM OTH REVIEWER | DATE OF ACTION |  |
|                     | 07 21 13 | Block or Board Insulation |     | 2.1    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Adhesive                  |     | 2.3.1  |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     | 07 60 00 | SD-02 Shop Drawings       |     |        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Gutters                   |     | 3.1.9  |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Downspouts                |     | 3.1.10 |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Counter-flashing          |     | 3.5.1  |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | SD-11 Closeout Submittals |     |        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Quality Control Plan      |     | 3.5    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     | 07 84 00 | SD-02 Shop Drawings       |     |        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Firestopping Materials    |     | 2.1    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | SD-06 Test Reports        |     |        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Inspection                |     | 3.3    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | SD-07 Certificates        |     |        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Inspector Qualifications  |     | 1.4.2  |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Firestopping Materials    |     | 2.1    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Installer Qualifications  |     | 1.4.1  |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     | 07 92 00 | SD-03 Product Data        |     |        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Sealants                  |     | 2.1    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Primers                   |     | 2.2    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Bond breakers             |     | 2.3    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Backstops                 |     | 2.4    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | SD-07 Certificates        |     |        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Sealant                   |     | 3.3.6  |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     | 08 11 13 | SD-02 Shop Drawings       |     |        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Doors                     |     | 2.1    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Doors                     |     | 2.1    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |
|                     |          | Doors                     |     | 2.1    |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |

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CONTRACT NO.

| TITLE AND LOCATION                             |   |                                      |                                   | CONTRACTOR   |   |                               |                          |                          |                                      |                      |   |                                  |                                  | CONTRACT NO.   |         |                                      |                      |
|--|---|--------------------------------------|-----------------------------------|--|---|-------------------------------|--------------------------|--------------------------|--------------------------------------|----------------------|---|----------------------------------|----------------------------------|--|---------|--------------------------------------|----------------------|
| Repairs to BEQ 4200                            |   |                                      |                                   |  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
| A<br>C<br>T<br>I<br>V<br>I<br>T<br>Y<br>N<br>O | T<br>R<br>A<br>N<br>S<br>M<br>I<br>T<br>T<br>A<br>L<br>N<br>O | S<br>P<br>E<br>C<br>S<br>E<br>C<br>T | DESCRIPTION<br><br>ITEM SUBMITTED | P<br>A<br>R<br>A<br>G<br>#<br><br>R<br>A<br>P<br>H | G<br>O<br>V<br>T<br>C<br>L<br>A<br>S<br>S<br>I<br>F<br>I<br>C<br>A<br>T<br>I<br>O<br>N<br>R | CONTRACTOR:<br>SCHEDULE DATES |                          |                          | CONTRACTOR<br>ACTION                 | APPROVING AUTHORITY  |   |                                  |                                  | MAILED<br>TO<br>CONTR/<br>DATE RCD<br>FRM APPR<br>AUTH | REMARKS |                                      |                      |
|  |   |                                      |                                   |  |   | SUBMIT                        | APPROVAL<br>NEEDED<br>BY | MATERIAL<br>NEEDED<br>BY | A<br>C<br>T<br>I<br>O<br>N<br>D<br>E | DATE<br>OF<br>ACTION | DATE FWD<br>TO APPR<br>AUTH/<br>DATE RCD<br>FROM<br>CONTR | DATE FWD<br>TO OTHER<br>REVIEWER | DATE RCD<br>FROM OTH<br>REVIEWER |  |         | A<br>C<br>T<br>I<br>O<br>N<br>D<br>E | DATE<br>OF<br>ACTION |
| (a)  | (b)   | (c)                                  | (d)                               | (e)  | (f)   | (g)                           | (h)                      | (i)                      | (j)                                  | (k)                  | (l)   | (m)                              | (n)                              | (o)  | (p)     | (q)                                  | (r)                  |
|  | 08 11 13  | Frames                               | Frames                            | 2.4  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Frames                               | Frames                            | 2.4  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Accessories                          | Accessories                       | 2.2  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | SD-03 Product Data                   | SD-03 Product Data                |  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Doors                                | Doors                             | 2.1  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Frames                               | Frames                            | 2.4  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Accessories                          | Accessories                       | 2.2  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  | 08 51 13  | SD-02 Shop Drawings                  | SD-02 Shop Drawings               |  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Windows                              | Windows                           | 2.1  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Fabrication Drawings                 | Fabrication Drawings              | 1.9  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | SD-03 Product Data                   | SD-03 Product Data                |  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Windows                              | Windows                           | 2.1  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Hardware                             | Hardware                          | 2.2.6.1  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Fasteners                            | Fasteners                         | 2.2.3  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Window Performance                   | Window Performance                | 1.10   |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Thermal-Barrier Windows              | Thermal-Barrier Windows           | 2.3  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Screens                              | Screens                           | 2.2.8  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Weatherstripping                     | Weatherstripping                  | 2.2.2  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Accessories                          | Accessories                       | 2.2.6  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Adhesives                            | Adhesives                         | 2.2.4  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Thermal Performance                  | Thermal Performance               | 1.10.5   |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | SD-04 Samples                        | SD-04 Samples                     |  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Finish Sample                        | Finish Sample                     | 1.4.2.1  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | SD-05 Design Data                    | SD-05 Design Data                 |  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Structural Calculations for          | Structural Calculations for       |  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |
|  |   | Deflection                           | Deflection                        | 2.1  |   |                               |                          |                          |                                      |                      |   |                                  |                                  |  |         |                                      |                      |

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CONTRACT NO.

| TITLE AND LOCATION  |          |                                      |                               | CONTRACTOR |                        |        |                            |                    |                   |                     |                        |                            |                            | CONTRACT NO. |                |   |         |
|---------------------|----------|--------------------------------------|-------------------------------|------------|------------------------|--------|----------------------------|--------------------|-------------------|---------------------|------------------------|----------------------------|----------------------------|--------------|----------------|---|---------|
| Repairs to BEQ 4200 |          |                                      |                               |            |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          |                                      |                               |            |                        |        | CONTRACTOR: SCHEDULE DATES |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |                        |                            |                            |              |                |   |         |
|                     |          |                                      |                               |            |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
| TRANSMITTAL NO      |          | SPESCT                               | DESCRIPTION<br>ITEM SUBMITTED | PARRAG#    | GOVT CLASS / AREA WORK | SUBMIT | APPROVAL NEEDED BY         | MATERIAL NEEDED BY | CONTION CODE      | DATE OF ACTION      | DATE FWD TO APPR AUTH/ | DATE FWD TO OTHER REVIEWER | DATE RCD FROM OTH REVIEWER | CONTION CODE | DATE OF ACTION | MAILED TO CONTR/ DATE RCD FRM APPR AUTH | REMARKS |
| (a)                 | (b)      | (c)                                  | (d)                           | (e)        | (f)                    | (g)    | (h)                        | (i)                | (j)               | (k)                 | (l)                    | (m)                        | (n)                        | (o)          | (p)            | (q)                                     | (r)     |
|                     | 08 51 13 | SD-06 Test Reports                   |                               |            |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | Minimum Condensation                 |                               | 1.4.3      |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | Resistance Factor                    |                               |            |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | Resistance to Forced Entry           |                               | 1.4.3      |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | SD-10 Operation and Maintenance Data |                               |            |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | Windows                              |                               | 2.1        |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     | 08 71 00 | SD-02 Shop Drawings                  |                               |            |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | Hardware schedule                    |                               | 1.3        |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | Keying system                        |                               | 2.3.5      |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | SD-03 Product Data                   |                               |            |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | Hardware Items                       |                               | 2.3        |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | SD-08 Manufacturer's Instructions    |                               |            |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | Installation                         |                               | 3.1        |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | SD-10 Operation and Maintenance Data |                               |            |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | Hardware Schedule                    |                               | 1.3        |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | SD-11 Closeout Submittals            |                               |            |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | Key Biting                           |                               | 1.4        |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     | 08 81 00 | SD-02 Shop Drawings                  |                               |            |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | Installation                         |                               | 3.2.2      |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | SD-03 Product Data                   |                               |            |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | Insulating Glass                     |                               | 1.6.1      |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | Glazing Accessories                  |                               | 1.3        |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | SD-04 Samples                        |                               |            |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |
|                     |          | Insulating Glass                     |                               | 1.6.1      |                        |        |                            |                    |                   |                     |                        |                            |                            |              |                |   |         |

## SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

Repairs to BEQ 4200

CONTRACTOR

| ACCTIVITY NO | TRANSMITTAL NO | SPEC     | DESCRIPTION<br>ITEM SUBMITTED     | PARAGRAPH # | GOVERNOR<br>CLASS /<br>REFERENCE<br>NO | CONTRACTOR:<br>SCHEDULE DATES |                          |                          | CONTRACTOR<br>ACTION | APPROVING AUTHORITY |                      |                              |                                  | REMARKS |                                  |                 |                      |
|--------------|----------------|----------|-----------------------------------|-------------|--|-------------------------------|--------------------------|--------------------------|----------------------|---------------------|----------------------|------------------------------|----------------------------------|---------|----------------------------------|-----------------|----------------------|
|              |                |          |                                   |             |  | SUBMIT                        | APPROVAL<br>NEEDED<br>BY | MATERIAL<br>NEEDED<br>BY |                      | ACCTION<br>CODE     | DATE<br>OF<br>ACTION | DATE FWD<br>TO APPR<br>AUTH/ | DATE FWD<br>TO OTHER<br>REVIEWER |         | DATE RCD<br>FROM OTH<br>REVIEWER | ACCTION<br>CODE | DATE<br>OF<br>ACTION |
| (a)          | (b)            | (c)      | (d)                               | (e)         | (f)                                    | (g)                           | (h)                      | (i)                      | (j)                  | (k)                 | (l)                  | (m)                          | (n)                              | (o)     | (p)                              | (q)             | (r)                  |
|              |                | 08 81 00 | SD-07 Certificates                |             |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Insulating Glass                  | 1.6.1       |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | SD-08 Manufacturer's Instructions |             |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Setting and sealing materials     | 2.3         |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Glass setting                     | 3.2         |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                | 08 91 00 | SD-02 Shop Drawings               |             |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Wall Louvers                      | 1.4         |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Wall Louvers                      | 1.5         |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | SD-03 Product Data                |             |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Metal Wall Louvers                | 2.2         |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                | 09 29 00 | SD-03 Product Data                |             |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Cementitious backer units         | 2.1.3       |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Impact Resistant Gypsum Board     | 2.1.2       |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Accessories                       | 2.1.6       |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Gypsum Board                      | 2.1.1       |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Joint Treatment Materials         | 2.1.4       |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | SD-07 Certificates                |             |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Asbestos Free Materials           | 2.1         |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | SD-08 Manufacturer's Instructions |             |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Material Safety Data Sheets       | 2.1         |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | SD-10 Operation and Maintenance   |             |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Data                              |             |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Manufacturer maintenance          |             |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | instructions                      | 2.1         |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                |          | Waste Management                  | 3.8         |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |
|              |                | 09 30 13 | SD-03 Product Data                |             |  |                               |                          |                          |                      |                     |                      |                              |                                  |         |                                  |                 |                      |

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| TITLE AND LOCATION  |          |                                    |     | CONTRACTOR |     |                            |                    |                   |                     |                |  |                            |   | CONTRACT NO. |                            |           |                |
|---------------------|----------|------------------------------------|-----|------------|-----|----------------------------|--------------------|-------------------|---------------------|----------------|--|----------------------------|---|--------------|----------------------------|-----------|----------------|
| Repairs to BEQ 4200 |          |                                    |     |            |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
| (a)                 | (b)      | (c)                                | (d) | (e)        | (f) | CONTRACTOR: SCHEDULE DATES |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |                |  |                            | MAILED TO CONTR/ DATE RCD FRM APPR AUTH | REMARKS      |                            |           |                |
|                     |          |                                    |     |            |     | SUBMIT                     | APPROVAL NEEDED BY |                   | CONC TION           | DATE OF ACTION | DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR | DATE FWD TO OTHER REVIEWER |   |              | DATE RCD FROM OTH REVIEWER | CONC TION | DATE OF ACTION |
|                     | 09 30 13 | Tile                               |     | 2.1        |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Tile                               |     | 2.1        |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Setting-Bed                        |     | 2.2        |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Mortar, Grout, and Adhesive        |     | 2.4        |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Reinforcing Wire Fabric            |     | 2.2.6      |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Aluminum Trim                      |     | 2.7        |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | waterproof membrane                |     | 3.4.4      |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | SD-04 Samples                      |     |            |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Tile                               |     | 2.1        |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Accessories                        |     | 2.1        |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Transition Strips                  |     | 2.1        |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Transition Strips                  |     | 2.5        |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Grout                              |     | 2.4.3      |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Aluminum Trim                      |     | 2.7        |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     | 09 51 00 | SD-03 Product Data                 |     |            |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Acoustical Units                   |     | 2.1        |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | SD-04 Samples                      |     |            |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Acoustical Units                   |     | 2.1        |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Acoustic Ceiling Tiles             |     | 2.1.1      |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | SD-06 Test Reports                 |     |            |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Ceiling Attenuation Class and Test |     | 1.2.1      |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | SD-07 Certificates                 |     |            |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Acoustical Units                   |     | 2.1        |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     |          | Acoustic Ceiling Tiles             |     | 2.1.1      |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |
|                     | 09 65 00 | SD-02 Shop Drawings                |     |            |     |                            |                    |                   |                     |                |  |                            |   |              |                            |           |                |

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| TITLE AND LOCATION  |     |                | CONTRACTOR                           |                               |           |                             |                            |                    |                    |                   |                     |                        | CONTRACT NO.               |         |                            |                |
|---------------------|-----|----------------|--------------------------------------|-------------------------------|-----------|-----------------------------|----------------------------|--------------------|--------------------|-------------------|---------------------|------------------------|----------------------------|---------|----------------------------|----------------|
| Repairs to BEQ 4200 |     |                |                                      |                               |           |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     | (a) | (b)            | (c)                                  | (d)                           | (e)       | (f)                         | CONTRACTOR: SCHEDULE DATES |                    |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |                        |                            | REMARKS |                            |                |
|                     |     |                |                                      |                               |           |                             | SUBMIT                     | APPROVAL NEEDED BY | MATERIAL NEEDED BY |                   | DATE OF ACTION      | DATE FWD TO APPR AUTH/ | DATE FWD TO OTHER REVIEWER |         | DATE RCD FROM OTH REVIEWER | DATE OF ACTION |
| TRANSMITTAL NO      |     |                | SPESCT                               | DESCRIPTION<br>ITEM SUBMITTED | PARAGRAPH | GOVERNOR / CLASSES / OFFICE |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     | 09 65 00       | Resilient Flooring and Accessories   |                               | 2.6       |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | SD-03 Product Data                   |                               |           |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | Resilient Flooring and Accessories   |                               | 2.6       |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | Adhesives                            |                               | 2.3       |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | Solid Vinyl Planks                   |                               | 2.1       |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | Wall Base                            |                               | 2.2       |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | SD-04 Samples                        |                               |           |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | Resilient Flooring and Accessories   |                               | 2.6       |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | SD-06 Test Reports                   |                               |           |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | Moisture, Alkalinity and Bond Tests  |                               | 3.3       |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | SD-08 Manufacturer's Instructions    |                               |           |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | Surface Preparation                  |                               | 3.2       |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | Installation                         |                               | 3.1       |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | SD-10 Operation and Maintenance Data |                               |           |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | Resilient Flooring and Accessories   |                               | 2.6       |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | SD-11 Closeout Submittals            |                               |           |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | Resilient Flooring and Accessories   |                               | 2.6       |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     |                | Adhesives                            |                               | 2.3       |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |
|                     |     | 09 66 23.00 22 | SD-02 Shop Drawings                  |                               |           |                             |                            |                    |                    |                   |                     |                        |                            |         |                            |                |



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|---|---|--------------------------------------|-----------------------------------|--|---|-------------------------------|--------------------------|--------------------------|----------------------|---|----------------------------------|----------------------------------|--|--|---------|----------------------|-----|
| Repairs to BEQ 4200   |   |                                      |                                   |  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
| A<br>C<br>C<br>E<br>P<br>T<br>I<br>V<br>I<br>T<br>Y<br>N<br>O | T<br>R<br>A<br>N<br>S<br>M<br>I<br>T<br>T<br>A<br>L<br>N<br>O | S<br>P<br>E<br>C<br>S<br>E<br>C<br>T | DESCRIPTION<br><br>ITEM SUBMITTED | P<br>A<br>R<br>A<br>G<br>#<br><br>R<br>A<br>P<br>H | G<br>O<br>V<br>T<br>C<br>L<br>A<br>S<br>S<br>I<br>F<br>I<br>C<br>A<br>T<br>I<br>O<br>N<br>R | CONTRACTOR:<br>SCHEDULE DATES |                          |                          | CONTRACTOR<br>ACTION | APPROVING AUTHORITY                                       |                                  |                                  |  | MAILED<br>TO<br>CONTR/<br>DATE RCD<br>FRM APPR<br>AUTH | REMARKS |                      |     |
|   |   |                                      |                                   |  |   | SUBMIT                        | APPROVAL<br>NEEDED<br>BY | MATERIAL<br>NEEDED<br>BY | DATE<br>OF<br>ACTION | DATE FWD<br>TO APPR<br>AUTH/<br>DATE RCD<br>FROM<br>CONTR | DATE FWD<br>TO OTHER<br>REVIEWER | DATE RCD<br>FROM OTH<br>REVIEWER | A<br>C<br>T<br>I<br>O<br>N<br>C<br>O<br>D<br>E |  |         | DATE<br>OF<br>ACTION |     |
| (a)   | (b)   | (c)                                  | (d)                               | (e)  | (f)   | (g)                           | (h)                      | (i)                      | (j)                  | (k)   | (l)                              | (m)                              | (n)  | (o)  | (p)     | (q)                  | (r) |
|   |   | 09 66 23.00 22                       | Approved Detail Drawings          | 1.2  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Strips                            | 2.5  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Divider Strips                    | 2.5.1  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | SD-03 Product Data                |  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Epoxy Resin                       | 2.2  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Mixing, Proportioning, and        | 3.2  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Installation                      |  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Cleaning and Protection           | 3.5  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | SD-04 Samples                     |  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Resinous Terrazzo Flooring        | 1.2  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | SD-07 Certificates                |  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | NTMA                              | 1.4.2  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   | 09 67 23.13                          | SD-02 Shop Drawings               |  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Installation Drawings             | 1.3  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | SD-03 Product Data                |  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Manufacturer's Catalog Data       | 1.3.1  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Urethane Mortar                   | 1.3.1  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Quartz Aggregate                  | 1.3.1  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Quartz Aggregate                  | 2.1  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Epoxy grout coat                  | 1.3.1  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Epoxy grout coat                  | 2.1  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Urethane Sealer                   | 1.3.1  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | SD-04 Samples                     |  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Hardboard Mounted Epoxy           | 1.4.2  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | Flooring                          |  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |
|   |   |                                      | SD-05 Design Data                 |  |   |                               |                          |                          |                      |   |                                  |                                  |  |  |         |                      |     |

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|---------------------|-------------|-----------------------------------|-------------|---------------------------|----------------------------|--------------------|--------------------|-------------------|---------------------|--|----------------------------|----------------------------|---|--------------|--------|-----|-----|
| Repairs to BEQ 4200 |             |                                   |             |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
| TRANSMITTAL NO      | SPESCT      | DESCRIPTION<br>ITEM SUBMITTED     | PARAGRAPH # | GOVERNOR / CLASSIFICATION | CONTRACTOR: SCHEDULE DATES |                    |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |  |                            |                            | MAILED TO CONTR/ DATE RCD FRM APPR AUTH | REMARKS      |        |     |     |
|                     |             |                                   |             |                           | SUBMIT                     | APPROVAL NEEDED BY | MATERIAL NEEDED BY |                   | DATE OF ACTION      | DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR | DATE FWD TO OTHER REVIEWER | DATE RCD FROM OTH REVIEWER |   |              | ACTION |     |     |
| (a)                 | (b)         | (c)                               | (d)         | (e)                       | (f)                        | (g)                | (h)                | (i)               | (j)                 | (k)  | (l)                        | (m)                        | (n)                                     | (o)          | (p)    | (q) | (r) |
|                     | 09 67 23.13 | Design Mix Data                   | 1.3.2       |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Urethane Mortar                   | 1.3.1       |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | SD-06 Test Reports                |             |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Records of Inspection             | 1.4         |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | SD-07 Certificates                |             |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Listing of Product Installations  | 1.4.1       |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Referenced Standards              | 1.4         |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Certificates                      |             |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Warranty                          | 3.6         |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     | 09 68 00    | SD-02 Shop Drawings               |             |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Installation Drawings             | 3.4         |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Moldings                          | 2.4         |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | SD-03 Product Data                |             |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Carpet                            | 2.1         |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Moldings                          | 2.4         |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Physical Characteristics          | 2.1.1       |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | SD-04 Samples                     |             |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Carpet                            | 2.1         |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Moldings                          | 2.4         |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | SD-06 Test Reports                |             |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Moisture and Alkalinity Tests     | 3.2         |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | SD-07 Certificates                |             |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Carpet                            | 2.1         |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Regulatory Requirements           | 1.4         |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | SD-08 Manufacturer's Instructions |             |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |
|                     |             | Surface Preparation               | 3.1         |                           |                            |                    |                    |                   |                     |  |                            |                            |   |              |        |     |     |

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| TITLE AND LOCATION  |             |   | CONTRACTOR                    |             |                                      |        |                          |                          |                                |                              |                                  |                                  | CONTRACT NO.                  |                      |                      |                     |     |  |  |  |         |
|---------------------|-------------|---|-------------------------------|-------------|--------------------------------------|--------|--------------------------|--------------------------|--------------------------------|------------------------------|----------------------------------|----------------------------------|-------------------------------|----------------------|----------------------|---------------------|-----|--|--|--|---------|
| Repairs to BEQ 4200 |             |   |                               |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |
|                     |             |   |                               |             |                                      |        |                          |                          |                                |                              |                                  |                                  | CONTRACTOR:<br>SCHEDULE DATES |                      | CONTRACTOR<br>ACTION | APPROVING AUTHORITY |     |  |  | MAILED<br>TO<br>CONTR/<br>DATE RCD<br>FRM APPR<br>AUTH | REMARKS |
|                     |             |   |                               |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |
| TRANSMITTAL NO      |             | SPESC T   | DESCRIPTION<br>ITEM SUBMITTED | PARAGRAPH # | GOVT<br>CLASS /<br>OFFICE<br>ADDRESS | SUBMIT | APPROVAL<br>NEEDED<br>BY | MATERIAL<br>NEEDED<br>BY | ACTION<br>DATE<br>OF<br>ACTION | DATE FWD<br>TO APPR<br>AUTH/ | DATE FWD<br>TO OTHER<br>REVIEWER | DATE RCD<br>FROM OTH<br>REVIEWER | CONC<br>OD E                  | DATE<br>OF<br>ACTION |                      |                     |     |  |  |  |         |
| (a)                 | (b)         | (c)   | (d)                           | (e)         | (f)                                  | (g)    | (h)                      | (i)                      | (j)                            | (k)                          | (l)                              | (m)                              | (n)                           | (o)                  | (p)                  | (q)                 | (r) |  |  |  |         |
|                     | 09 90 00    | Manufacturer's Material Safety<br>Data Sheets                 | 1.7.2                         |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |
|                     |             | SD-10 Operation and Maintenance<br>Data                       |                               |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |
|                     |             | Coatings:   | 2.1                           |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |
|                     |             | SD-11 Closeout Submittals<br>Materials                        | 2.1                           |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |
|                     | 09 96 60    | SD-03 Product Data<br>Corner Bead                             | 2.4                           |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |
|                     |             | High Performance Filling<br>Compound                          | 2.3                           |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |
|                     |             | SD-04 Samples<br>Textured Acrylic Coating                     | 2.1                           |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |
|                     |             | High Performance Filling<br>Compound                          | 2.3                           |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |
|                     |             | SD-07 Certificates<br>Corner Bead                             | 2.4                           |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |
|                     |             | SD-08 Manufacturer's Instructions<br>Textured Acrylic Coating | 2.1                           |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |
|                     |             | High Performance Filling<br>Compound                          | 2.3                           |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |
|                     | 10 10 00    | SD-03 Product Data<br>Visual Display Board                    | 1.2                           |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |
|                     | 10 14 00.20 | SD-02 Shop Drawings<br>Detail Drawings                        | 1.4.2                         |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |
|                     |             | Sign Schedule   | 1.4.2                         |             |                                      |        |                          |                          |                                |                              |                                  |                                  |                               |                      |                      |                     |     |  |  |  |         |

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|--|---|--------------------------------------|--------------------------------------|---|---|-----|-----|-----|-----|-----|-----|-----|----------------------------|-----|-------------------|---------------------|-----|--|--|---|---------|
| Repairs to BEQ 4200  |   |                                      |                                      |   |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      |                                      |   |   |     |     |     |     |     |     |     | CONTRACTOR: SCHEDULE DATES |     | CONTRACTOR ACTION | APPROVING AUTHORITY |     |  |  | MAILED TO CONTR/ DATE RCD FRM APPR AUTH | REMARKS |
|  |   |                                      |                                      |   |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
| A<br>C<br>C<br>E<br>S<br>S<br>O<br>R<br>Y<br>I<br>T<br>E<br>M<br>S | T<br>R<br>A<br>N<br>S<br>M<br>I<br>T<br>T<br>A<br>L<br>N<br>O | S<br>P<br>E<br>C<br>S<br>E<br>C<br>T | DESCRIPTION<br>ITEM SUBMITTED        | P<br>A<br>R<br>A<br>G<br>R<br>A<br>P<br>H | C<br>O<br>V<br>E<br>R<br>A<br>G<br>E<br>S<br>/<br>I<br>T<br>E<br>M<br>S |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
| (a)  | (b)   | (c)                                  | (d)                                  | (e)                                       | (f)   | (g) | (h) | (i) | (j) | (k) | (l) | (m) | (n)                        | (o) | (p)               | (q)                 | (r) |  |  |   |         |
|  |   | 10 14 00.20                          | SD-03 Product Data                   |   |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | Installation                         | 3.1                                       |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | Warranty                             | 1.6                                       |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | SD-04 Samples                        |   |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | Interior Signage                     | 1.4.1                                     |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | SD-10 Operation and Maintenance Data |   |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | Approved Manufacturer's Instructions | 3.1                                       |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | Protection and Cleaning              | 3.1.2                                     |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   | 10 26 13                             | SD-02 Shop Drawings                  |   |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | Corner Guards                        | 2.2                                       |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | SD-03 Product Data                   |   |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | Corner Guards                        | 2.2                                       |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | SD-04 Samples                        |   |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | Finish                               | 2.3                                       |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   | 10 28 13                             | SD-03 Product Data                   |   |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | Finishes                             | 2.1.2                                     |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | Accessory Items                      | 2.2                                       |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | SD-07 Certificates                   |   |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | Accessory Items                      | 2.2                                       |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   | 10 44 16                             | SD-02 Shop Drawings                  |   |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | Cabinets                             | Part 2                                    |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | Wall Brackets                        | 2.1.2                                     |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | SD-03 Product Data                   |   |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |
|  |   |                                      | Cabinets                             | Part 2                                    |   |     |     |     |     |     |     |     |                            |     |                   |                     |     |  |  |   |         |

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|---------------------|----------------|-----------------------------------|-------------|--------------------------|----------------------------|--------------------|--------------------|-------------------|---------------------|----------------|--|----------------------------|---|---------|----------------------------|-------------|----------------|
| Repairs to BEQ 4200 |                |                                   |             |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
| TRANSMITTAL NO      | SPECIES        | DESCRIPTION<br>ITEM SUBMITTED     | PARAGRAPH # | GOVT CLASS / FICARE WORK | CONTRACTOR: SCHEDULE DATES |                    |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |                |  |                            | MAILED TO CONTR/ DATE RCD FRM APPR AUTH | REMARKS |                            |             |                |
|                     |                |                                   |             |                          | SUBMIT                     | APPROVAL NEEDED BY | MATERIAL NEEDED BY |                   | CONCURRENCE         | DATE OF ACTION | DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR | DATE FWD TO OTHER REVIEWER |   |         | DATE RCD FROM OTH REVIEWER | CONCURRENCE | DATE OF ACTION |
| (a)                 | (b)            | (c)                               | (d)         | (e)                      | (f)                        | (g)                | (h)                | (i)               | (j)                 | (k)            | (l)  | (m)                        | (n)                                     | (o)     | (p)                        | (q)         | (r)            |
|                     | 10 44 16       | Wall Brackets                     |             | 2.1.2                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     | 12 48 13       | SD-03 Product Data                |             |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Entrance Floor Mats and Frames    |             | 2.1                      |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Adhesives and Concrete Primers    |             | 2.2                      |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Manufacturer's Standard Color     |             | 2.1.1                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Charts                            |             |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | SD-04 Samples                     |             |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Entrance Floor Mats and Frames    |             | 2.1                      |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | SD-08 Manufacturer's Instructions |             |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Manufacturer's Instructions       |             | 3.2                      |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | SD-10 Operation and Maintenance   |             |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Data                              |             |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Protection, Maintenance, and      |             | 3.2                      |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Repair Information                |             |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     | 21 13 13.00 20 | SD-02 Shop Drawings               |             |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Shop Drawings                     |             | 1.5.1                    | G                          |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | SD-03 Product Data                |             |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Pipe                              |             | 2.2.1                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Fittings                          |             | 2.2.1                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Valves                            |             | 2.2.4                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Sprinklers                        |             | 2.2.3                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Pipe hangers and supports         |             | 2.2.5                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Sprinkler Alarm Switches          |             | 2.3.1                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Fire department connections       |             | 2.2.6                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Mechanical couplings              |             | 2.2.1                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Backflow Prevention Assembly      |             | 2.2.7                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |

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|---------------------|---------|---|-------------|---------------------------|----------------------------|--------------------|-------------------|---------------------|----------------|------------------------|----------------------------|----------------------------|----------------|--------------|---|-----|-----|
| Repairs to BEQ 4200 |         |   |             |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
| TRANSMITTAL NO      | SPECIES | DESCRIPTION<br>ITEM SUBMITTED             | PARAGRAPH # | GOVERNOR / CLASSIFICATION | CONTRACTOR: SCHEDULE DATES |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |                |                        |                            |                            |                | REMARKS      |   |     |     |
|                     |         |   |             |                           | SUBMIT                     | APPROVAL NEEDED BY |                   | MATERIAL NEEDED BY  | DATE OF ACTION | DATE FWD TO APPR AUTH/ | DATE FWD TO OTHER REVIEWER | DATE RCD FROM OTH REVIEWER | DATE OF ACTION |              | MAILED TO CONTR/ DATE RCD FRM APPR AUTH |     |     |
| (a)                 | (b)     | (c)                                       | (d)         | (e)                       | (f)                        | (g)                | (h)               | (i)                 | (j)            | (k)                    | (l)                        | (m)                        | (n)            | (o)          | (p)                                     | (q) | (r) |
|                     |         | SD-05 Design Data                         |             |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | Hydraulic Calculations                    |             | 1.3                       |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | SD-06 Test Reports                        |             |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | Request to Schedule Preliminary Tests     |             | 3.5                       |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | Preliminary Test Report                   |             | 3.5                       |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | Request to Schedule Final Acceptance Test |             | 3.6                       |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | Final Acceptance Test Report              |             | 3.6                       |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | SD-07 Certificates                        |             |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | Sprinkler System Installer                |             | 1.5.1                     |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | SD-10 Operation and Maintenance Data      |             |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | Operating and Maintenance Instructions    |             | 3.7                       |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | SD-11 Closeout Submittals                 |             |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | As-built drawings                         |             | 1.5.1                     |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | On-site training                          |             | 3.7                       |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | SD-02 Shop Drawings                       |             |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | Plumbing System                           |             | 3.7.1                     |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | SD-03 Product Data                        |             |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | Fixtures                                  |             | 2.4                       |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | Flush valve water closets                 |             | 2.4.1                     |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | Wall hung lavatories                      |             | 2.4.2                     |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | Undermount lavatories                     |             | 2.4.3                     |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |         | Kitchen sinks                             |             | 2.4.4                     |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |

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|---|---|--------------------------------------|-----------------------------------|--|--|-------------------------------|--------------------------|--------------------------|----------------------|---|----------------------------------|----------------------------------|--------------------------------------|--|---------|----------------------|-----|
| Repairs to BEQ 4200   |   |                                      |                                   |  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
| A<br>C<br>C<br>E<br>P<br>T<br>I<br>V<br>I<br>T<br>Y<br>N<br>O | T<br>R<br>A<br>N<br>S<br>M<br>I<br>T<br>T<br>A<br>L<br>N<br>O | S<br>P<br>E<br>C<br>S<br>E<br>C<br>T | DESCRIPTION<br><br>ITEM SUBMITTED | P<br>A<br>R<br>A<br>G<br>#<br>R<br>A<br>P<br>H | C<br>O<br>V<br>E<br>R<br>A<br>G<br>E<br>S<br>I<br>N<br>F<br>I<br>E<br>R<br>I<br>O<br>R | CONTRACTOR:<br>SCHEDULE DATES |                          |                          | CONTRACTOR<br>ACTION | APPROVING AUTHORITY                                       |                                  |                                  |                                      | MAILED<br>TO<br>CONTR/<br>DATE RCD<br>FRM APPR<br>AUTH | REMARKS |                      |     |
|   |   |                                      |                                   |  |  | SUBMIT                        | APPROVAL<br>NEEDED<br>BY | MATERIAL<br>NEEDED<br>BY | DATE<br>OF<br>ACTION | DATE FWD<br>TO APPR<br>AUTH/<br>DATE RCD<br>FROM<br>CONTR | DATE FWD<br>TO OTHER<br>REVIEWER | DATE RCD<br>FROM OTH<br>REVIEWER | A<br>C<br>T<br>I<br>O<br>N<br>D<br>E |  |         | DATE<br>OF<br>ACTION |     |
| (a)   | (b)   | (c)                                  | (d)                               | (e)  | (f)  | (g)                           | (h)                      | (i)                      | (j)                  | (k)   | (l)                              | (m)                              | (n)                                  | (o)  | (p)     | (q)                  | (r) |
|   | 22 00 00  |                                      | Service sinks                     | 2.4.5  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Drinking-water coolers            | 2.4.6  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Shower pan                        | 2.4.8  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Water heaters                     | 2.10   |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Backflow prevention assemblies    | 3.7.1.1  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Vibration-Absorbing Features      | 3.3  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | SD-06 Test Reports                |  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Tests, Flushing and Disinfection  | 3.7  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Test of Backflow Prevention       | 3.7.1.1  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Assemblies                        |  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | SD-07 Certificates                |  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Materials and Equipment           | 1.3  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Bolts                             | 2.1.1  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | SD-10 Operation and Maintenance   |  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Data                              |  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Plumbing System                   | 3.7.1  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   | 23 00 00  |                                      | SD-03 Product Data                |  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Metallic Flexible Duct            | 2.9.1.1  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Insulated Nonmetallic Flexible    | 2.9.1.2  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Duct Runouts                      |  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Duct Connectors                   | 2.9.1.2  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Duct Access Doors                 | 2.9.2  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Fire Dampers                      | 2.9.3  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Manual Balancing Dampers          | 2.9.4  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Diffusers                         | 2.9.5.1  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |
|   |   |                                      | Registers and Grilles             | 2.9.5.2  |  |                               |                          |                          |                      |   |                                  |                                  |                                      |  |         |                      |     |



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| TITLE AND LOCATION  |          | CONTRACTOR     |                               |             |                              |                            |                    |                    |                     |  |                            | CONTRACT NO.               |        |                       |         |  |  |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---------------------|----------|----------------|-------------------------------|-------------|------------------------------|----------------------------|--------------------|--------------------|---------------------|--|----------------------------|----------------------------|--------|-----------------------|---------|--|--|-----|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Repairs to BEQ 4200 |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         |  |  |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (a)                 | (b)      | (c)            | (d)                           | (e)         | (f)                          | CONTRACTOR: SCHEDULE DATES |                    | CONTRACTOR ACTION  | APPROVING AUTHORITY |  |                            |                            | (q)    | (r)                   |         |  |  |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              | (g)                        | (h)                |                    | (i)                 | (j)  | (k)                        | (l)                        |        |                       | (m)     | (n)                                      | (o)                                    | (p) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TRANSMITTAL NO      | 23 00 00 | SPECIFICATIONS | DESCRIPTION<br>ITEM SUBMITTED | PARAGRAPH # | GOVERNOR CLASSIFICATION WORK | SUBMIT                     | APPROVAL NEEDED BY | MATERIAL NEEDED BY | ACTION              | DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR | DATE FWD TO OTHER REVIEWER | DATE RCD FROM OTH REVIEWER | ACTION | DATE OF FRM APPR AUTH | REMARKS |  |  |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         |  |  |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         | Louvers                                  | 2.9.6                                  |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         | Air Vents, Penthouses, and Goose-necks   | 2.9.7                                  |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         | In-Line Centrifugal Fans                 | 2.10.1.1                               |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         | Air Handling Units                       | 2.11                                   |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         | Room Fan-Coil Units                      | 2.12.1                                 |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         | Energy Recovery Devices                  | 2.13                                   |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         | Test Procedures                          | 1.4.5                                  |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         | SD-08 Manufacturer's Instructions        |  |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         | Manufacturer's Installation Instructions | 3.2                                    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         | SD-10 Operation and Maintenance Data     |  |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         | Operation and Maintenance Manuals        | 3.11.1                                 |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         | Air Handling Units                       | 2.11                                   |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         | Room Fan-Coil Units                      | 2.12.1                                 |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         | Energy Recovery Devices                  | 2.13                                   |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         | 23 05 15                                 | SD-01 Preconstruction Submittals       |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         |  | Material, Equipment, and Fixture Lists | 1.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         |  | SD-02 Shop Drawings                    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         |  | Record Drawings                        | 1.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         |  | Connection Diagrams                    | 1.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         |  | Coordination Drawings                  | 1.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                     |          |                |                               |             |                              |                            |                    |                    |                     |  |                            |                            |        |                       |         |  | Fabrication Drawings                   | 1.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION  
Repairs to BEQ 4200

CONTRACTOR

| TRANSMITTAL NO | SPECIES | DESCRIPTION<br>ITEM SUBMITTED | PARAGRAPH #                      | GOVERNOR<br>CLASSIFICATION | CONTRACTOR:<br>SCHEDULE DATES |                          |                          | CONTRACTOR<br>ACTION | APPROVING AUTHORITY |                      |  | MAILED<br>TO CONTR/<br>DATE RCD<br>FRM APPR<br>AUTH | REMARKS |                                  |                                  |         |                      |
|----------------|---------|-------------------------------|----------------------------------|----------------------------|-------------------------------|--------------------------|--------------------------|----------------------|---------------------|----------------------|--|---|---------|----------------------------------|----------------------------------|---------|----------------------|
|                |         |                               |                                  |                            | SUBMIT                        | APPROVAL<br>NEEDED<br>BY | MATERIAL<br>NEEDED<br>BY |                      | CONTION             | DATE<br>OF<br>ACTION | DATE FWD<br>TO APPR<br>AUTH/<br>DATE RCD<br>FROM CONTR |   |         | DATE FWD<br>TO OTHER<br>REVIEWER | DATE RCD<br>FROM OTH<br>REVIEWER | CONTION | DATE<br>OF<br>ACTION |
| (a)            | (b)     | (c)                           | (d)                              | (e)                        | (f)                           | (g)                      | (h)                      | (i)                  | (j)                 | (k)                  | (l)  | (m)   | (n)     | (o)                              | (p)                              | (q)     | (r)                  |
|                |         | 23 05 15                      | Installation Drawings            | 3.1                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | SD-03 Product Data               |                            |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Pipe and Fittings                | 2.2                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Piping Specialties               | 2.3                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Valves                           | 2.4                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Miscellaneous Materials          | 2.5                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Supporting Elements              | 2.6                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Equipment Foundation Data        | 1.2                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | SD-04 Samples                    |                            |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Manufacturer's Standard Color    | 1.2                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Charts                           |                            |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | SD-06 Test Reports               |                            |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Hydrostatic Tests                | 3.1                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Air Tests                        | 3.1                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | SD-07 Certificates               |                            |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Listing of Product Installations | 1.2                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Records of Existing Conditions   | 1.2                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Surface Resistance               | 3.1                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Shear and Tensile Strengths      | 3.1                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Temperature Ratings              | 3.1                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Bending Tests                    | 3.1                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Flattening Tests                 | 3.1                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Transverse Guided Weld Bend      | 3.1                        |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Tests                            |                            |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | SD-10 Operation and Maintenance  |                            |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |
|                |         |                               | Data                             |                            |                               |                          |                          |                      |                     |                      |  |   |         |                                  |                                  |         |                      |

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CONTRACT NO.

| TITLE AND LOCATION  |                |   |             | CONTRACTOR                |                            |                    |                   |                     |                |                        |                            |                            |                | CONTRACT NO. |   |     |     |
|---------------------|----------------|---|-------------|---------------------------|----------------------------|--------------------|-------------------|---------------------|----------------|------------------------|----------------------------|----------------------------|----------------|--------------|---|-----|-----|
| Repairs to BEQ 4200 |                |   |             |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
| TRANSMITTAL NO      | SPICES         | DESCRIPTION<br>ITEM SUBMITTED                       | PARAGRAPH # | GOVERNOR / CLASSIFICATION | CONTRACTOR: SCHEDULE DATES |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |                |                        |                            |                            |                | REMARKS      |   |     |     |
|                     |                |   |             |                           | SUBMIT                     | APPROVAL NEEDED BY |                   | MATERIAL NEEDED BY  | DATE OF ACTION | DATE FWD TO APPR AUTH/ | DATE FWD TO OTHER REVIEWER | DATE RCD FROM OTH REVIEWER | DATE OF ACTION |              | MAILED TO CONTR/ DATE RCD FRM APPR AUTH |     |     |
| (a)                 | (b)            | (c)   | (d)         | (e)                       | (f)                        | (g)                | (h)               | (i)                 | (j)            | (k)                    | (l)                        | (m)                        | (n)            | (o)          | (p)                                     | (q) | (r) |
|                     | 23 05 15       | Operation and Maintenance Manuals                   | 3.11        |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     | 23 05 48.00 40 | SD-03 Product Data Equipment and Performance Data   | 1.2         |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |                | SD-06 Test Reports                                  |             |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |                | Type of Isolator                                    | 2.1         |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |                | Type of Base  | 2.1         |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |                | Allowable Deflection                                | 2.1         |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |                | Measured Deflection                                 | 2.1         |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     | 23 05 93       | SD-07 Certificates                                  |             |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |                | Independent TAB agency and personnel qualifications | 1.5.1       |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |                | Advance Notice of Season 1 TAB Field Work           | 3.6         |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |                | Completed Season 1 Pre-TAB Work Checklist           | 3.6         |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     | 23 09 13.34 40 | SD-03 Product Data                                  |             |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |                | Self-Contained Temperature Control Valves           | 2.1         |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |                | Rate-of-Flow Controller                             | 2.2         |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |                | Water Pressure Regulating Valve                     | 2.3         |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |                | Water Pressure Relief Valve                         | 2.4         |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |                | Pilot-Operated Pressure-Relief Valve                | 2.5         |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |
|                     |                | Sample Warranty                                     | 1.4         |                           |                            |                    |                   |                     |                |                        |                            |                            |                |              |   |     |     |

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|---|-----|-----------------------------------|---|------------|-----|----------------------------|--------------------|--------------------|-------------------|---------------------|------------------------|----------------------------|----------------------------|--------------|----------------|--|--|--|
| Repairs to BEQ 4200                         |     |                                   |   |            |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
| (a)   | (b) | (c)                               | (d)   | (e)        | (f) | CONTRACTOR: SCHEDULE DATES |                    |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |                        |                            |                            | REMARKS      |                |  |  |  |
|   |     |                                   |   |            |     | SUBMIT                     | APPROVAL NEEDED BY | MATERIAL NEEDED BY |                   | DATE OF ACTION      | DATE FWD TO APPR AUTH/ | DATE FWD TO OTHER REVIEWER | DATE RCD FROM OTH REVIEWER |              | DATE OF ACTION |  |  |  |
| TRANSMISSIONS<br>VERTICAL<br>TYPING<br>NONO |     |                                   |   |            |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     | 23 09 13.34 40                    | SD-07 Certificates                          |            |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     |                                   | Listing of Product Installation             | 1.3        |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     |                                   | Certificates of Conformance                 | 1.4        |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     |                                   | Manufacturer's Warranty                     | 3.3        |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     | 23 09 23.13 22                    | SD-02 Shop Drawings                         |            |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     |                                   | Control system drawings title sheet         | 1.4.1.1    |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     |                                   | List of I/O Points                          | 1.4.1.2    |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     |                                   | Control System Components List              | 1.4.1.3    |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     |                                   | Control system schematics                   | 1.4.1.4    |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     |                                   | HVAC Equipment Electrical                   | 1.4.1.5    |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     |                                   | Ladder diagrams                             |            |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     |                                   | Component wiring diagrams                   | 1.4.1.6    |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     |                                   | Terminal strip diagrams                     | 1.4.1.7    |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     |                                   | BAcnet communication architecture schematic | 1.4.1.8    |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     | SD-03 Product Data                |   |            |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     | Direct Digital Controllers        | 2.1.2                                       |            |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     | BAcnet Gateways                   | 2.1.2.13                                    |            |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     | Notebook Computer                 | 2.1.3                                       |            |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     | Sensors and Input Hardware        | 2.2   |            |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     | Output Hardware                   | 2.3   |            |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     | Surge and transient protection    | 2.4.2                                       |            |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     | Duct smoke detectors              | 2.5.1                                       |            |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     | Variable frequency (motor) drives | 2.6   |            |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |
|   |     | SD-05 Design Data                 |   |            |     |                            |                    |                    |                   |                     |                        |                            |                            |              |                |  |  |  |

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CONTRACT NO.

| TITLE AND LOCATION  |         |                               | CONTRACTOR                              |                          |                            |                    |                    |                   |                     |                |  |                            | CONTRACT NO.                            |         |                            |             |                |
|---------------------|---------|-------------------------------|---|--------------------------|----------------------------|--------------------|--------------------|-------------------|---------------------|----------------|--|----------------------------|---|---------|----------------------------|-------------|----------------|
| Repairs to BEQ 4200 |         |                               |   |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
| TRANSMITTAL NO      | SPECIES | DESCRIPTION<br>ITEM SUBMITTED | PARAGRAPH #                             | GOVERNANCE / FISCAL YEAR | CONTRACTOR: SCHEDULE DATES |                    |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |                |  |                            | MAILED TO CONTR/ DATE RCD FRM APPR AUTH | REMARKS |                            |             |                |
|                     |         |                               |   |                          | SUBMIT                     | APPROVAL NEEDED BY | MATERIAL NEEDED BY |                   | CONCURRENCE         | DATE OF ACTION | DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR | DATE FWD TO OTHER REVIEWER |   |         | DATE RCD FROM OTH REVIEWER | CONCURRENCE | DATE OF ACTION |
| (a)                 | (b)     | (c)                           | (d)                                     | (e)                      | (f)                        | (g)                | (h)                | (i)               | (j)                 | (k)            | (l)  | (m)                        | (n)                                     | (o)     | (p)                        | (q)         | (r)            |
|                     |         | 23 09 23.13 22                | Performance Verification Testing Plan   | 3.5.2                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | Pre-Performance Verification            | 3.5.4                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | Testing Checklist                       |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | SD-06 Test Reports                      |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | Performance Verification Testing Report | 3.5.11                   |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | SD-07 Certificates                      |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | Contractor's Qualifications             | 1.6.6                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | SD-09 Manufacturer's Field Reports      |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | Pre-PVT Checklist                       | 3.5.1                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | SD-10 Operation and Maintenance Data    |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | BACnet Direct Digital Control Systems   | 1.4                      |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | Controls System Operators Manuals       | 3.4                      |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | VFD Service Manuals                     | 2.6.2                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | SD-11 Closeout Submittals               |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | DDC Software                            | 2.1.5                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | Training documentation                  | 3.6.1                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | 23 21 13.00 20                          |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | SD-03 Product Data                      |                          |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | Pumps                                   | 2.3.1                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | Expansion tanks                         | 2.3.2                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |         |                               | Flow measuring equipment                | 2.3.4                    |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |

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| TITLE AND LOCATION  |                |                                   |                    | CONTRACTOR |     |                            |                    |                   |                     |                |                        |                            |         | CONTRACT NO.               |                |  |  |  |  |
|---|----------------|-----------------------------------|--------------------|------------|-----|----------------------------|--------------------|-------------------|---------------------|----------------|------------------------|----------------------------|---------|----------------------------|----------------|--|--|--|--|
| Repairs to BEQ 4200   |                |                                   |                    |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
| (a)   | (b)            | (c)                               | (d)                | (e)        | (f) | CONTRACTOR: SCHEDULE DATES |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |                |                        |                            | REMARKS |                            |                |  |  |  |  |
|   |                |                                   |                    |            |     | SUBMIT                     | APPROVAL NEEDED BY |                   | MATERIAL NEEDED BY  | DATE OF ACTION | DATE FWD TO APPR AUTH/ | DATE FWD TO OTHER REVIEWER |         | DATE RCD FROM OTH REVIEWER | DATE OF ACTION |  |  |  |  |
| TRANSMITTERS<br>ANTENNA<br>SPEECH<br>TELETYPE<br>ALLOY<br>NON |                |                                   |                    |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   | 23 22 25.00 40 | Globe And Angle Valves            | 2.2.2              |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Check Valves                      | 2.2.3              |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   | 23 22 26.00 20 | SD-03 Product Data                |                    |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Convertors                        | 2.2                |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Condensate return pumping units   | 2.3.1              |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Traps                             | 2.1.11.2           |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Flash Tanks                       | 2.1.11.6           |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | SD-06 Test Reports                |                    |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Steam piping                      | 2.1.1              |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | SD-07 Certificates                |                    |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Welding procedure                 | 1.4.1              |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Welder's Performance              | 1.4.2              |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Qualification Record              |                    |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | SD-08 Manufacturer's Instructions |                    |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Convertors                        | 2.2                |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Condensate return pumping units   | 2.3.1              |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | 23 25 00                          | SD-03 Product Data |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                |                                   | Field Instructions | 3.4        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                |                                   | Tests              | 3.5        |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Training Course                   | 3.4                |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   | 23 64 10       | SD-03 Product Data                |                    |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Water Chiller                     | 3.1                |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Water Chiller                     | 3.1                |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Manufacturer's Multi-Year         | 1.7                |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   |                | Compressor Warranty               |                    |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |
|   | 23 64 26       | SD-03 Product Data                |                    |            |     |                            |                    |                   |                     |                |                        |                            |         |                            |                |  |  |  |  |

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| TITLE AND LOCATION  |   |                                      |  | CONTRACTOR                                     |   |                               |                          |                      |                          |                      |   |                                  |  | CONTRACT NO. |                                  |                                      |                      |
|---|---|--------------------------------------|--|--|---|-------------------------------|--------------------------|----------------------|--------------------------|----------------------|---|----------------------------------|--|--------------|----------------------------------|--------------------------------------|----------------------|
| Repairs to BEQ 4200   |   |                                      |  |  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
| A<br>C<br>C<br>E<br>P<br>T<br>I<br>V<br>I<br>T<br>Y<br>N<br>O | T<br>R<br>A<br>N<br>S<br>M<br>I<br>T<br>T<br>A<br>L<br>N<br>O | S<br>P<br>E<br>C<br>S<br>E<br>C<br>T | DESCRIPTION<br><br>ITEM SUBMITTED                  | P<br>A<br>R<br>A<br>G<br>#<br>R<br>A<br>P<br>H | G<br>O<br>V<br>T<br>C<br>L<br>A<br>S<br>S<br>I<br>F<br>I<br>C<br>A<br>T<br>I<br>O<br>N<br>N | CONTRACTOR:<br>SCHEDULE DATES |                          | CONTRACTOR<br>ACTION | APPROVING AUTHORITY      |                      |   |                                  | MAILED<br>TO<br>CONTR/<br>DATE RCD<br>FRM APPR<br>AUTH | REMARKS      |                                  |                                      |                      |
|   |   |                                      |  |  |   | SUBMIT                        | APPROVAL<br>NEEDED<br>BY |                      | MATERIAL<br>NEEDED<br>BY | DATE<br>OF<br>ACTION | DATE FWD<br>TO APPR<br>AUTH/<br>DATE RCD<br>FROM<br>CONTR | DATE FWD<br>TO OTHER<br>REVIEWER |  |              | DATE RCD<br>FROM OTH<br>REVIEWER | A<br>C<br>T<br>I<br>O<br>N<br>D<br>E | DATE<br>OF<br>ACTION |
| (a)   | (b)   | (c)                                  | (d)  | (e)  | (f)   | (g)                           | (h)                      | (i)                  | (j)                      | (k)                  | (l)   | (m)                              | (n)  | (o)          | (p)                              | (q)                                  | (r)                  |
|   | 23 64 26  |                                      | Grooved Mechanical                                 | 2.2.2.4  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Connections For Steel                              |  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Grooved Mechanical                                 | 2.3.3  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Connections For Copper                             |  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Calibrated Balancing Valves                        | 2.4.8  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Automatic Flow Control Valves                      | 2.4.9  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Pump Discharge Valve                               | 2.4.10   |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Water Temperature Mixing Valve                     | 2.4.11   |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Water Temperature Regulating Valves                | 2.4.12   |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Water Pressure Reducing Valve                      | 2.4.13   |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Pressure Relief Valve                              | 2.4.14   |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Combination Pressure and Temperature Relief Valves | 2.4.15   |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Expansion Joints                                   | 2.5.9  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Pumps  | 2.6  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Combination Strainer and Pump                      | 2.5.3  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Suction Diffuser                                   |  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Expansion Tanks                                    | 2.7  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Air Separator Tanks                                | 2.8  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Water Treatment Systems                            | 2.9  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | SD-06 Test Reports                                 |  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Piping welds NDE report                            | 3.1.1.3  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | Pressure tests reports                             | 3.4.2  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |
|   |   |                                      | SD-07 Certificates                                 |  |   |                               |                          |                      |                          |                      |   |                                  |  |              |                                  |                                      |                      |



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| TITLE AND LOCATION             |                               |                                 | CONTRACTOR                   |                               |                          |                          |                      |                      |  |                                  |                                  |   | CONTRACT NO. |                      |     |     |     |
|--------------------------------|-------------------------------|---------------------------------|------------------------------|-------------------------------|--------------------------|--------------------------|----------------------|----------------------|--|----------------------------------|----------------------------------|---|--------------|----------------------|-----|-----|-----|
| Repairs to BEQ 4200            |                               |                                 |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
| TRANSMITTER<br>ANTENNA<br>SITE | DESCRIPTION<br>ITEM SUBMITTED | PARAGRAPH #                     | GOVERNANCE<br>CLASSIFICATION | CONTRACTOR:<br>SCHEDULE DATES |                          |                          | CONTRACTOR<br>ACTION | APPROVING AUTHORITY  |  |                                  |                                  | MAILED<br>TO CONTR/<br>DATE RCD<br>FRM APPR<br>AUTH | REMARKS      |                      |     |     |     |
|                                |                               |                                 |                              | SUBMIT                        | APPROVAL<br>NEEDED<br>BY | MATERIAL<br>NEEDED<br>BY |                      | DATE<br>OF<br>ACTION | DATE FWD<br>TO APPR<br>AUTH/<br>DATE RCD<br>FROM CONTR | DATE FWD<br>TO OTHER<br>REVIEWER | DATE RCD<br>FROM OTH<br>REVIEWER |   |              | DATE<br>OF<br>ACTION |     |     |     |
| (a)                            | (b)                           | (c)                             | (d)                          | (e)                           | (f)                      | (g)                      | (h)                  | (i)                  | (j)  | (k)                              | (l)                              | (m)   | (n)          | (o)                  | (p) | (q) | (r) |
|                                | 23 73 13.00 40                | Equipment and Performance       | 2.1                          |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Data                            |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Sample Warranty                 | 1.3.2                        |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | SD-10 Operation and Maintenance |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Data                            |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Operation and Maintenance       | 3.5                          |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Manuals                         |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                | 23 82 19.00 40                | SD-03 Product Data              |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Equipment and Performance       | 1.3                          |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Data                            |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Filters                         | 2.7                          |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | SD-10 Operation and Maintenance |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Data                            |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Operation and Maintenance       | 3.3                          |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Manuals                         |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                | 23 84 16.00 20                | SD-03 Product Data              |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Desiccant Dehumidification Unit | 2.1                          |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | SD-10 Operation and Maintenance |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Data                            |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Desiccant dehumidification unit | 2.1                          |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                | 26 12 19.10                   | SD-02 Shop Drawings             |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Pad-mounted transformer         | 1.4.1                        |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | drawings                        |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | SD-03 Product Data              |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | Pad-mounted transformers        |                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |
|                                |                               | SD-06 Test Reports              | 2.2                          |                               |                          |                          |                      |                      |  |                                  |                                  |   |              |                      |     |     |     |

## SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

CONTRACTOR

Repairs to BEQ 4200

| TRANSMISSIONS<br>SPECIFICATIONS<br>DESCRIPTION<br>ITEM SUBMITTED | PARAGRAPH # | GOVT<br>CLASS /<br>CATEGORY<br>NUMBER | CONTRACTOR:<br>SCHEDULE DATES |                          |                          | CONTRACTOR<br>ACTION | APPROVING AUTHORITY                                       |                                  |                                  |             | MAILED<br>TO<br>CONTR/<br>DATE RCD<br>FRM APPR<br>AUTH | REMARKS |
|--|-------------|---------------------------------------|-------------------------------|--------------------------|--------------------------|----------------------|---|----------------------------------|----------------------------------|-------------|--|---------|
|  |             |                                       | SUBMIT                        | APPROVAL<br>NEEDED<br>BY | MATERIAL<br>NEEDED<br>BY |                      | DATE FWD<br>TO APPR<br>AUTH/<br>DATE RCD<br>FROM<br>CONTR | DATE FWD<br>TO OTHER<br>REVIEWER | DATE RCD<br>FROM OTH<br>REVIEWER | CONC<br>ODE |  |         |
| Acceptance checks and tests                                      | 3.6.1       |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| SD-07 Certificates   |             |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| Transformer losses   | 1.4.2       |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| SD-09 Manufacturer's Field Reports                               |             |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| design tests   | 2.6.2       |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| routine and other tests  | 2.6.3       |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| SD-10 Operation and Maintenance Data                             |             |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| Transformer(s)   | 1.5.1       |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| SD-11 Closeout Submittals  |             |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| Transformer test schedule  | 2.6.1       |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| SD-02 Shop Drawings  |             |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| Panelboards  | 2.9         |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| SD-03 Product Data   |             |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| Receptacles  | 2.8         |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| Circuit breakers   | 2.9.2       |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| Switches   | 2.7         |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| Enclosed circuit breakers  | 2.10        |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| Manual motor starters  | 2.12        |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| SD-06 Test Reports   |             |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| 600-volt wiring test   | 3.2.2       |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| Grounding system test  | 3.2.4       |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| Ground-fault receptacle test                                     | 3.2.3       |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| SD-07 Certificates   |             |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |
| Fuses  | 2.11        |                                       |                               |                          |                          |                      |   |                                  |                                  |             |  |         |

SUBMITTAL REGISTER

CONTRACT NO.

| TITLE AND LOCATION                             |   |                                      |                                   | CONTRACTOR   |   |                               |                          |                      |                          |                                      |                      |   |  | CONTRACT NO. |                                  |                                  |                                      |
|--|---|--------------------------------------|-----------------------------------|--|---|-------------------------------|--------------------------|----------------------|--------------------------|--------------------------------------|----------------------|---|--|--------------|----------------------------------|----------------------------------|--------------------------------------|
| Repairs to BEQ 4200                            |   |                                      |                                   |  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
| A<br>C<br>T<br>I<br>V<br>I<br>T<br>Y<br>N<br>O | T<br>R<br>A<br>N<br>S<br>M<br>I<br>T<br>T<br>A<br>L<br>N<br>O | S<br>P<br>E<br>C<br>S<br>E<br>C<br>T | DESCRIPTION<br><br>ITEM SUBMITTED | P<br>A<br>R<br>A<br>G<br>#<br><br>R<br>A<br>P<br>H | C<br>O<br>V<br>E<br>R<br>A<br>G<br>E<br>S<br>I<br>F<br>A<br>P<br>P<br>L<br>I<br>C<br>A<br>T<br>I<br>O<br>N<br>N | CONTRACTOR:<br>SCHEDULE DATES |                          | CONTRACTOR<br>ACTION | APPROVING AUTHORITY      |                                      |                      |   | MAILED<br>TO<br>CONTR/<br>DATE RCD<br>FRM APPR<br>AUTH | REMARKS      |                                  |                                  |                                      |
|  |   |                                      |                                   |  |   | SUBMIT                        | APPROVAL<br>NEEDED<br>BY |                      | MATERIAL<br>NEEDED<br>BY | A<br>C<br>T<br>I<br>O<br>N<br>D<br>E | DATE<br>OF<br>ACTION | DATE FWD<br>TO APPR<br>AUTH/<br>DATE RCD<br>FROM<br>CONTR |  |              | DATE FWD<br>TO OTHER<br>REVIEWER | DATE RCD<br>FROM OTH<br>REVIEWER | A<br>C<br>T<br>I<br>O<br>N<br>D<br>E |
| (a)  | (b)   | (c)                                  | (d)                               | (e)  | (f)   | (g)                           | (h)                      | (i)                  | (j)                      | (k)                                  | (l)                  | (m)   | (n)  | (o)          | (p)                              | (q)                              | (r)                                  |
|  | 26 23 00  | SD-02 Shop Drawings                  |                                   |  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Switchboard Drawings                 |                                   | 1.4.2  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | SD-03 Product Data                   |                                   |  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Switchboard                          |                                   | 2.2  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | SD-06 Test Reports                   |                                   |  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Acceptance checks and tests          |                                   | 3.5.1  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | SD-10 Operation and Maintenance      |                                   |  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Data                                 |                                   |  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Switchboard Operation and            |                                   | 1.5.1  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Maintenance                          |                                   |  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | SD-11 Closeout Submittals            |                                   |  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Assembled Operation and              |                                   | 1.5.2  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Maintenance Manuals                  |                                   |  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Equipment Test Schedule              |                                   | 2.5.1  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  | 26 51 00  | SD-03 Product Data                   |                                   |  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Fluorescent lighting fixtures        |                                   | 2.1  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Fluorescent lamps                    |                                   | 2.1.4  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Lighting contactor                   |                                   | 2.4  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Time switch                          |                                   | 2.5  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Photocell switch                     |                                   | 2.6  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Exit signs                           |                                   | 2.7  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Emergency lighting equipment         |                                   | 2.8  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Occupancy sensors                    |                                   | 2.10   |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Electronic dimming ballast           |                                   | 2.1.2  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | Dimming ballast controls             |                                   | 2.1.3  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |
|  |   | SD-06 Test Reports                   |                                   |  |   |                               |                          |                      |                          |                                      |                      |   |  |              |                                  |                                  |                                      |

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CONTRACT NO.

| TITLE AND LOCATION             |          |                                 | CONTRACTOR                    |             |                                |                               |                          |                          |                      |                      |  |                                  | CONTRACT NO.                     |   |         |                      |     |
|--------------------------------|----------|---------------------------------|-------------------------------|-------------|--------------------------------|-------------------------------|--------------------------|--------------------------|----------------------|----------------------|--|----------------------------------|----------------------------------|---|---------|----------------------|-----|
| Repairs to BEQ 4200            |          |                                 |                               |             |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
| TRANSMITTER<br>ANTENNA<br>SITE |          |                                 | DESCRIPTION<br>ITEM SUBMITTED | PARAGRAPH # | GOVERNANCE /<br>CLASSIFICATION | CONTRACTOR:<br>SCHEDULE DATES |                          |                          | CONTRACTOR<br>ACTION | APPROVING AUTHORITY  |  |                                  |                                  | MAILED<br>TO CONTR/<br>DATE RCD<br>FRM APPR<br>AUTH | REMARKS |                      |     |
|                                |          |                                 |                               |             |                                | SUBMIT                        | APPROVAL<br>NEEDED<br>BY | MATERIAL<br>NEEDED<br>BY |                      | DATE<br>OF<br>ACTION | DATE FWD<br>TO APPR<br>AUTH/<br>DATE RCD<br>FROM CONTR | DATE FWD<br>TO OTHER<br>REVIEWER | DATE RCD<br>FROM OTH<br>REVIEWER |   |         | DATE<br>OF<br>ACTION |     |
| (a)                            | (b)      | (c)                             | (d)                           | (e)         | (f)                            | (g)                           | (h)                      | (i)                      | (j)                  | (k)                  | (l)  | (m)                              | (n)                              | (o)   | (p)     | (q)                  | (r) |
|                                | 26 51 00 | Operating test                  |                               | 3.2         |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                | 26 56 00 | SD-03 Product Data              |                               |             | G                              |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Fluorescent Luminaires          |                               | 2.2         |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Luminaire Light Sources         |                               | 2.2.2       |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Luminaire Ballasts              |                               | 2.2.3       |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | SD-06 Test Reports              |                               |             |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Operating test                  |                               | 3.2         |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | SD-10 Operation and Maintenance |                               |             |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Data                            |                               |             |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Electronic Ballast Warranty     |                               | 1.5.1       |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Operational Service             |                               | 1.6         |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                | 28 31 76 | SD-02 Shop Drawings             |                               |             |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Wiring Diagrams                 |                               | 3.2.1       |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | System Layout                   |                               | 1.2.1       |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | System Operation                |                               | 2.3         |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Notification Appliances         |                               | 2.12        |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | SD-03 Product Data              |                               |             |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Batteries                       |                               | 2.10.1      |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Battery chargers                |                               | 2.10.2      |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Annunciator                     |                               | 2.11        |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Notification appliances         |                               | 2.12        |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Addressable interface devices   |                               | 2.6         |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | SD-05 Design Data               |                               |             |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Battery power                   |                               | 2.10.1.2    |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | SD-06 Test Reports              |                               |             |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |
|                                |          | Field Quality Control           |                               | 3.5         |                                |                               |                          |                          |                      |                      |  |                                  |                                  |   |         |                      |     |

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CONTRACT NO.

| TITLE AND LOCATION  |                |                                     | CONTRACTOR  |                                |                            |                    |                    |                   |                     |                |  |                            | CONTRACT NO.                            |         |                            |             |                |
|---------------------|----------------|-------------------------------------|-------------|--------------------------------|----------------------------|--------------------|--------------------|-------------------|---------------------|----------------|--|----------------------------|---|---------|----------------------------|-------------|----------------|
| Repairs to BEQ 4200 |                |                                     |             |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
| TRANSMITTAL NO      | SPECIES        | DESCRIPTION<br>ITEM SUBMITTED       | PARAGRAPH # | GOVERNOR'S OFFICE / STATE WORK | CONTRACTOR: SCHEDULE DATES |                    |                    | CONTRACTOR ACTION | APPROVING AUTHORITY |                |  |                            | MAILED TO CONTR/ DATE RCD FRM APPR AUTH | REMARKS |                            |             |                |
|                     |                |                                     |             |                                | SUBMIT                     | APPROVAL NEEDED BY | MATERIAL NEEDED BY |                   | CONCURRENCE         | DATE OF ACTION | DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR | DATE FWD TO OTHER REVIEWER |   |         | DATE RCD FROM OTH REVIEWER | CONCURRENCE | DATE OF ACTION |
| (a)                 | (b)            | (c)                                 | (d)         | (e)                            | (f)                        | (g)                | (h)                | (i)               | (j)                 | (k)            | (l)  | (m)                        | (n)                                     | (o)     | (p)                        | (q)         | (r)            |
|                     | 28 31 76       | Testing Procedures                  | 3.5.1       |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Smoke sensor testing                | 2.8.1       |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | SD-07 Certificates                  |             |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Installer                           | 1.6.1.4     |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Formal Inspection and Tests         | 3.5.2.2     |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Final Testing                       | 3.5.2.3     |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | SD-09 Manufacturer's Field Reports  |             |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | System Operation                    | 2.3         |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Fire Alarm/Mass Notification System | 1.6.2.2     |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | SD-11 Closeout Submittals           |             |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | As-Built Drawings                   | 3.5.2.4     |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     | 31 11 00       | SD-03 Product Data                  |             |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Nonsaleable Materials               | 3.6.2       |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | SD-04 Samples                       |             |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Tree wound paint                    | 2.1         |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Herbicide                           | 2.2         |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     | 31 23 00.00 20 | SD-06 Test Reports                  |             |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Select material                     | 3.9.2.1     |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Density tests                       | 3.9.2.3     |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     | 32 17 23.00 20 | SD-03 Product Data                  |             |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Paints for roads and streets        | 2.1.1       |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Qualifications                      | 1.8         |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | SD-06 Test Reports                  |             |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |
|                     |                | Paints for roads and streets        | 2.1.1       |                                |                            |                    |                    |                   |                     |                |  |                            |   |         |                            |             |                |

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SUBMITTAL FORM, Jan 96

## SECTION 01 33 29

## SUSTAINABILITY REPORTING

02/17

## PART 1 GENERAL

## 1.1 REFERENCES

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

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

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

COUNCIL ON ENVIRONMENTAL QUALITY (CEQ) (WHITE HOUSE)

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

U.S. DEPARTMENT OF AGRICULTURE (USDA)

FSRIA 9002 Farm Security and Rural Investment Act  
Section 9002 (USDA BiopREFERRED Program)

U.S. DEPARTMENT OF ENERGY (DOE)

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

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

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

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

40 CFR 247 Comprehensive Procurement Guideline for  
Products Containing Recovered Materials

## 1.2 SUMMARY

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

## 1.3 SUBMITTALS

Submittals with an "S" are for inclusion in the Sustainability eNotebook,



in conformance to this section. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preliminary High Performance and Sustainable Building Checklist

Sustainability Action Plan

Preliminary Sustainability eNotebook

SD-11 Closeout Submittals

Final High Performance and Sustainable Building Checklist

Final Sustainability eNotebook

Amended Final Sustainability eNotebook

Amended Final High Performance and Sustainable Building Checklist

1.4 GUIDING PRINCIPLES VALIDATION (GPV)

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

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

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

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

compliance (including "S" submittals)

#### 1.4.1 Sustainability Action Plan

Include the following information in the Sustainability Action Plan:

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

#### 1.4.2 Costs

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

#### 1.4.3 Calculations

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

### 1.5 SUSTAINABILITY SUBMITTALS

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

#### 1.5.1 High Performance Sustainable Building (HPSB) Checklist

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

##### 1.5.1.1 HPSB Checklist Submittals

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

#### 1.5.2 "S" Submittals for Sustainability Documentation

Submit the GPV sustainability documentation required in this specification as "S" submittals in all affected UFGS Sections. Highlight GPV compliance data in "S" submittal.

### 1.5.3 Sustainability eNotebook

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

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

#### 1.5.3.1 Sustainability eNotebook Submittal Schedule

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

a. Preliminary Sustainability eNotebook

Submit preliminary Sustainability eNotebook for approval at the Pre-construction conference. Include Preliminary High Performance and Sustainable Building Checklist.

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

c. Final Sustainability eNotebook

Submit updated Sustainability eNotebook at the Beneficial Occupancy Date (BOD). Final progress payment retainage may be held by Contracting Officer until final sustainability documentation is complete. Submit three electronic copies of the Final Sustainability eNotebook on DVDs to the Government. Include Final High Performance and Sustainable Building Checklist.

d. Amended Final Sustainability eNotebook

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

### 1.6 DOCUMENTATION REQUIREMENTS

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

Contracting Officer approval.

- b. For each of the following paragraphs that require the use of products listed on Government-required websites, provide documentation of the process used to select products, or process used to determine why listed products do not meet project performance requirements.

#### 1.6.1 Commissioning

Submit approved Final Commissioning Report required by Section 01 91 00.15 TOTAL BUILDING COMMISSIONING as proof of this tracking requirement.

#### 1.6.2 Energy Efficient Products

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

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

#### 1.6.3 Indoor Water Use

Provide only water-consuming products that are EPA WaterSense labeled, or the most efficient water fixtures available that meet the requirements of ASHRAE 189.1 Section 6.3.2, when EPA WaterSense products are not available. Provide the following documentation:

For products available with EPA WaterSense labeling, proof that fixtures are labeled EPA WaterSense or Energy Star; for all other fixtures, proof they comply with the cited efficiency requirements.

#### 1.6.4 Reduce Volatile Organic Compounds (VOC) (Low Emitting Materials)

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

Provide certifications or labels that demonstrate compliance with cited requirements.

#### 1.6.5 Indoor Air Quality During Construction

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

For new construction and for renovation of unoccupied existing buildings, indoor air quality plan must meet the requirements of ASHRAE 189.1 Section 10.3.1.4. (Indoor Air Quality (IAQ) Construction Management), with maximum outdoor air consistent with achieving relative humidity no greater than 60 percent.

Provide documentation showing that after construction ends and prior to occupancy, HVAC filters were replaced and building air was flushed out in

accordance with the cited standard.

#### 1.6.6 Recycled Content

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

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

#### 1.6.7 Bio-Based Products

Provide products and material composed of the highest percentage of biobased materials (including rapidly renewable resources and certified sustainably harvested products), consistent with FSRIA 9002 USDA BioPreferred Program, to the maximum extent possible without jeopardizing the intended end use or detracting from the overall quality delivered to the end user. Use only supplies and materials of a type and quality that conform to applicable specifications and standards.

Comply with FSRIA 9002 USDA BioPreferred Program. Refer to <https://www.biopreferred.gov/BioPreferred/> for the product categories and BioPreferred Catalog. Selected products must comply with non-proprietary requirements of the Federal Acquisition Regulation, and must meet performance requirements. Provide the following documentation:

USDA BioPreferred label for each product; for bio-based products used on project but not listed with BioPreferred program, provide bio-based content and percentage.

#### 1.6.8 Ozone Depleting Substances

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

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

#### 1.6.9 Waste Material Management (Recycling - Construction)

Divert construction debris from landfill disposal where markets or on-site

recycling exists, and provide documentation in accordance with Section 01 74 19 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT.

## PART 2 PRODUCTS

Not used.

## PART 3 EXECUTION

### 3.1 SUSTAINABILITY COORDINATION

#### 3.1.1 Coordinating Sustainability Documentation Progress

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

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

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

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

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

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



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

| TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements   |  |  |                                      |                   |
|--|--|--|--------------------------------------|-------------------|
| UFGS 01 33 29, Para 1.6.5 Submittal Requirements (Interior Applications)   |  |  |                                      |                   |
| MATERIAL CATEGORY  | EMISSIONS REQUIREMENT  |  | MATERIALS WITH ADDED VOC REQUIREMENT | MATERIAL CATEGORY |
| <b>Composite Wood, Wood Structural Panel, and Agrifiber Products</b><br>particleboard<br>medium density fiberboard (MDF)<br>wheatboard<br>strawboard<br>panel substrates<br>door cores<br><b>no added urea-formaldehyde resins</b><br>including laminating adhesives for composite wood and agrifiber assemblies | Third-party certification (approved by CARB) of <b>California Air Resource Board's (CARB) regulation</b> Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products<br><br><b>CDPH/EHLB/Standard method V1.1 (California Section 01350)</b><br>(Use "office" or "classroom" space limits for all applications) (except: Structural panel components such as plywood, particle board, wafer board, and oriented strand board identified as "EXPOSURE 1," "EXTERIOR," or "HUD-APPROVED" are considered acceptable for interior use.) |  | none                                 | none              |

| TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements   |   |  |                                      |                   |
|--|---|--|--------------------------------------|-------------------|
| UFGS 01 33 29, Para 1.6.5 Submittal Requirements (Interior Applications)   |   |  |                                      |                   |
| MATERIAL CATEGORY  | EMISSIONS REQUIREMENT   |  | MATERIALS WITH ADDED VOC REQUIREMENT | MATERIAL CATEGORY |
| Office Furniture Systems and Seating installed prior to occupancy  | ANSI/BIFMA X7.1<br>ANSI/BIFMA X7.1:<br>(95 percent of installed office furniture system workstations and seating units)<br><br>Section 7.6.2 of ANSI/BIFMA e3<br>(50 percent of office furniture system workstations and seating units) |  | none                                 | none              |
| Ceiling and Wall Systems<br>ceiling and wall insulation<br>acoustical ceiling panels<br>tackable wall panels<br>gypsum wall board and panels<br>wall coverings | CDPH/EHLB/Standard method V1.1<br>(California Section 01350)<br>(Use "office" or "classroom" space limits for all applications)   |  | none                                 | none              |

-- End of Section --

## SECTION 01 35 26

## GOVERNMENTAL SAFETY REQUIREMENTS

11/15

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

|                   |  |
|-------------------|--|
| ASSE/SAFE A10.22  | (2007; R 2012) Safety Requirements for Rope-Guided and Non-Guided Workers' Hoists                          |
| ASSE/SAFE A10.34  | (2001; R 2012) Protection of the Public on or Adjacent to Construction Sites                               |
| ASSE/SAFE A10.44  | (2014) Control of Energy Sources (Lockout/Tagout) for Construction and Demolition Operations               |
| ASSE/SAFE Z244.1  | (2003; R 2014) Control of Hazardous Energy Lockout/Tagout and Alternative Methods                          |
| ASSE/SAFE Z359.0  | (2012) Definitions and Nomenclature Used for Fall Protection and Fall Arrest                               |
| ASSE/SAFE Z359.1  | (2007) Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components                     |
| ASSE/SAFE Z359.11 | (2014) Safety Requirements for Full Body Harnesses   |
| ASSE/SAFE Z359.12 | (2009) Connecting Components for Personal Fall Arrest Systems  |
| ASSE/SAFE Z359.13 | (2013) Personal Energy Absorbers and Energy Absorbing Lanyards   |
| ASSE/SAFE Z359.14 | (2014) Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems         |
| ASSE/SAFE Z359.15 | (2014) Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems |
| ASSE/SAFE Z359.2  | (2007) Minimum Requirements for a Comprehensive Managed Fall Protection Program                            |
| ASSE/SAFE Z359.3  | (2007) Safety Requirements for Positioning and Travel Restraint Systems                                    |

|                  |   |
|------------------|---|
| ASSE/SAFE Z359.4 | (2013) Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components |
| ASSE/SAFE Z359.6 | (2009) Specifications and Design Requirements for Active Fall Protection Systems                  |
| ASSE/SAFE Z359.7 | (2011) Qualification and Verification Testing of Fall Protection Products                         |

## ASME INTERNATIONAL (ASME)

|             |  |
|-------------|--|
| ASME B30.20 | (2013; INT Oct 2010 - May 2012) Below-the-Hook Lifting Devices   |
| ASME B30.22 | (2016) Articulating Boom Cranes  |
| ASME B30.23 | (2011) Personnel Lifting Systems Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings |
| ASME B30.26 | (2015; INT Jun 2010 - Jun 2014) Rigging Hardware   |
| ASME B30.3  | (2016) Tower Cranes  |
| ASME B30.5  | (2014) Mobile and Locomotive Cranes  |
| ASME B30.7  | (2011) Winches   |
| ASME B30.8  | (2015) Floating Cranes and Floating Derricks   |
| ASME B30.9  | (2014; INT Feb 2011 - Nov 2013) Slings   |

## ASTM INTERNATIONAL (ASTM)

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

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

|           |  |
|-----------|--|
| IEEE 1048 | (2003) Guide for Protective Grounding of Power Lines |
| IEEE C2   | (2017) National Electrical Safety Code               |

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

|             |  |
|-------------|--|
| NEMA Z535.2 | (2011) Environmental and Facility Safety Signs |
|-------------|--|

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

|         |                                   |
|---------|-----------------------------------|
| NFPA 10 | (2013) Standard for Portable Fire |
|---------|-----------------------------------|

## Extinguishers

|          |   |
|----------|---|
| NFPA 241 | (2013; Errata 2015) Standard for Safeguarding Construction, Alteration, and Demolition Operations |
| NFPA 51B | (2014) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work                   |
| NFPA 70  | (2017) National Electrical Code   |
| NFPA 70E | (2015; ERTA 1 2015) Standard for Electrical Safety in the Workplace                               |

## TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

|          |   |
|----------|---|
| TIA-1019 | (2012; R 2016) Standard for Installation, Alteration and Maintenance of Antenna Supporting Structures and Antennas                                      |
| TIA-222  | (2005G; Add 1 2007; Add 2 2009; Add 3 2014; Add 4 2014; R 2014; R 2016) Structural Standards for Steel Antenna Towers and Antenna Supporting Structures |

## U.S. ARMY CORPS OF ENGINEERS (USACE)

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

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

|                  |   |
|------------------|---|
| 29 CFR 1910      | Occupational Safety and Health Standards  |
| 29 CFR 1910.146  | Permit-required Confined Spaces   |
| 29 CFR 1910.147  | Control of Hazardous Energy (Lock Out/Tag Out)                                      |
| 29 CFR 1910.333  | Selection and Use of Work Practices   |
| 29 CFR 1915      | Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment |
| 29 CFR 1915.89   | Control of Hazardous Energy (Lockout/Tags-Plus)                                     |
| 29 CFR 1926      | Safety and Health Regulations for Construction                                      |
| 29 CFR 1926.1400 | Cranes and Derricks in Construction   |
| 29 CFR 1926.16   | Rules of Construction   |
| 29 CFR 1926.450  | Scaffolds   |
| 29 CFR 1926.500  | Fall Protection   |

|                 |   |
|-----------------|---|
| 29 CFR 1926.552 | Material Hoists, Personal Hoists, and Elevators   |
| 29 CFR 1926.553 | Base-Mounted Drum Hoists  |
| CPL 02-01-056   | (2014) Inspection Procedures for Accessing Communication Towers by Hoist                    |
| CPL 2.100       | (1995) Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146 |

## 1.2 DEFINITIONS

### 1.2.1 Competent Person (CP)

The CP is a person designated in writing, who, through training, knowledge and experience, is capable of identifying, evaluating, and addressing existing and predictable hazards in the working environment or working conditions that are dangerous to personnel, and who has authorization to take prompt corrective measures with regards to such hazards.

### 1.2.2 Competent Person, Confined Space

The CP, Confined Space, is a person meeting the competent person requirements as defined EM 385-1-1 Appendix Q, with thorough knowledge of OSHA's Confined Space Standard, 29 CFR 1910.146, and designated in writing to be responsible for the immediate supervision, implementation and monitoring of the confined space program, who through training, knowledge and experience in confined space entry is capable of identifying, evaluating and addressing existing and potential confined space hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

### 1.2.3 Competent Person, Cranes and Rigging

The CP, Cranes and Rigging, as defined in EM 385-1-1 Appendix Q, is a person meeting the competent person requirements, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the Crane and Rigging Program, who through training, knowledge and experience in crane and rigging is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

### 1.2.4 Competent Person, Excavation/Trenching

A CP, Excavation/Trenching, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and 29 CFR 1926, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the excavation/trenching program, who through training, knowledge and experience in excavation/trenching is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

### 1.2.5 Competent Person, Fall Protection

The CP, Fall Protection, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and in accordance with

ASSE/SAFE Z359.0, who has been designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the fall protection program, who through training, knowledge and experience in fall protection and rescue systems and equipment, is capable of identifying, evaluating and addressing existing and potential fall hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

#### 1.2.6 Competent Person, Scaffolding

The CP, Scaffolding is a person meeting the competent person requirements in EM 385-1-1 Appendix Q, and designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the scaffolding program. The CP for Scaffolding has enough training, knowledge and experience in scaffolding to correctly identify, evaluate and address existing and potential hazards and also has the authority to take prompt corrective measures with regard to these hazards. CP qualifications must be documented and include experience on the specific scaffolding systems/types being used, assessment of the base material that the scaffold will be erected upon, load calculations for materials and personnel, and erection and dismantling. The CP for scaffolding must have a documented, minimum of 8-hours of scaffold training to include training on the specific type of scaffold being used (e.g. mast-climbing, adjustable, tubular frame), in accordance with EM 385-1-1 Section 22.B.02.

#### 1.2.7 Competent Person (CP) Trainer

A competent person trainer as defined in EM 385-1-1 Appendix Q, who is qualified in the material presented, and who possesses a working knowledge of applicable technical regulations, standards, equipment and systems related to the subject matter on which they are training Competent Persons. A competent person trainer must be familiar with the typical hazards and the equipment used in the industry they are instructing. The training provided by the competent person trainer must be appropriate to that specific industry. The competent person trainer must evaluate the knowledge and skills of the competent persons as part of the training process.

#### 1.2.8 High Risk Activities

High Risk Activities are activities that involve work at heights, crane and rigging, excavations and trenching, scaffolding, electrical work, and confined space entry.

#### 1.2.9 High Visibility Accident

A High Visibility Accident is any mishap which may generate publicity or high visibility.

#### 1.2.10 Load Handling Equipment (LHE)

LHE is a term used to describe cranes, hoists and all other hoisting equipment (hoisting equipment means equipment, including crane, derricks, hoists and power operated equipment used with rigging to raise, lower or horizontally move a load).

#### 1.2.11 Medical Treatment

Medical Treatment is treatment administered by a physician or by registered



professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even though provided by a physician or registered personnel.

#### 1.2.12 Near Miss

A Near Miss is a mishap resulting in no personal injury and zero property damage, but given a shift in time or position, damage or injury may have occurred (e.g., a worker falls off a scaffold and is not injured; a crane swings around to move the load and narrowly misses a parked vehicle).

#### 1.2.13 Operating Envelope

The Operating Envelope is the area surrounding any crane or load handling equipment. Inside this "envelope" is the crane, the operator, riggers and crane walkers, other personnel involved in the operation, rigging gear between the hook, the load, the crane's supporting structure (i.e. ground or rail), the load's rigging path, the lift and rigging procedure.

#### 1.2.14 Qualified Person (QP)

The QP is a person designated in writing, who, by possession of a recognized degree, certificate, or professional standing, or extensive knowledge, training, and experience, has successfully demonstrated their ability to solve or resolve problems related to the subject matter, the work, or the project.

#### 1.2.15 Qualified Person, Fall Protection (QP for FP)

A QP for FP is a person meeting the requirements of EM 385-1-1 Appendix Q, and ASSE/SAFE Z359.0, with a recognized degree or professional certificate and with extensive knowledge, training and experience in the fall protection and rescue field who is capable of designing, analyzing, and evaluating and specifying fall protection and rescue systems.

#### 1.2.16 USACE Property and Equipment

Interpret "USACE" property and equipment specified in USACE EM 385-1-1 as Government property and equipment.

#### 1.2.17 Load Handling Equipment (LHE) Accident or Load Handling Equipment Mishap

A LHE accident occurs when any one or more of the eight elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; or collision, including unplanned contact between the load, crane, or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents, even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, or roll over). Document an LHE mishap or accident using the NAVFAC prescribed Navy Crane Center (NCC) accident form.

### 1.3 SUBMITTALS

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

#### SD-01 Preconstruction Submittals

Accident Prevention Plan (APP)

#### SD-06 Test Reports

Monthly Exposure Reports  
Notifications and Reports  
Accident Reports  
LHE Inspection Reports

#### SD-07 Certificates

Contractor Safety Self-Evaluation Checklist  
Crane Operators/Riggers  
Standard Lift Plan  
Critical Lift Plan  
Activity Hazard Analysis (AHA)  
Confined Space Entry Permit  
Hot Work Permit  
Certificate of Compliance

### 1.4 MONTHLY EXPOSURE REPORTS

Provide a Monthly Exposure Report and attach to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both Prime and subcontractor. Failure to submit the report may result in retention of up to 10 percent of the voucher.

### 1.5 CONTRACTOR SAFETY SELF-EVALUATION CHECKLIST

Contracting Officer will provide a "Contractor Safety Self-Evaluation checklist" to the Contractor at the pre-construction conference. Complete the checklist monthly and submit with each request for payment voucher. An acceptable score of 90 or greater is required. Failure to submit the completed safety self-evaluation checklist or achieve a score of at least 90 may result in retention of up to 10 percent of the voucher.

### 1.6 REGULATORY REQUIREMENTS

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

#### 1.6.1 Subcontractor Safety Requirements

For this contract, neither Contractor nor any subcontractor may enter into contract with any subcontractor that fails to meet the following

requirements. The term subcontractor in this and the following paragraphs means any entity holding a contract with the Contractor or with a subcontractor at any tier.

#### 1.6.1.1 Experience Modification Rate (EMR)

Subcontractors on this contract must have an effective EMR less than or equal to 1.10, as computed by the National Council on Compensation Insurance (NCCI) or if not available, as computed by the state agency's rating bureau in the state where the subcontractor is registered, when entering into a subcontract agreement with the Prime Contractor or a subcontractor at any tier. The Prime Contractor may submit a written request for additional consideration to the Contracting Officer where the specified acceptable EMR range cannot be achieved. Relaxation of the EMR range will only be considered for approval on a case-by-case basis for special conditions and must not be anticipated as tacit approval. Contractor's Site Safety and Health Officer (SSHO) must collect and maintain the certified EMR ratings for all subcontractors on the project and make them available to the Government at the Government's request.

#### 1.6.1.2 OSHA Days Away from Work, Restricted Duty, or Job Transfer (DART) Rate

Subcontractors on this contract must have a DART rate, calculated from the most recent, complete calendar year, less than or equal to 3.4 when entering into a subcontract agreement with the Prime Contractor or a subcontractor at any tier. The OSHA Dart Rate is calculated using the following formula:

$$(N/EH) \times 200,000$$

where:

N = number of injuries and illnesses with days away, restricted work, or job transfer

EH = total hours worked by all employees during most recent, complete calendar year

200,000 = base for 100 full-time equivalent workers (working 40 hours per week, 50 weeks per year)

The Prime Contractor may submit a written request for additional consideration to the Contracting Officer where the specified acceptable OSHA Dart rate range cannot be achieved for a particular subcontractor. Relaxation of the OSHA DART rate range will only be considered for approval on a case-by-case basis for special conditions and must not be anticipated as tacit approval. Contractor's SSHO must collect and maintain self-certified OSHA DART rates for all subcontractors on the project and make them available to the Government at the Government's request.

### 1.7 SITE QUALIFICATIONS, DUTIES, AND MEETINGS

#### 1.7.1 Personnel Qualifications

##### 1.7.1.1 Site Safety and Health Officer (SSHO)

Provide an SSHO that meets the requirements of EM 385-1-1 Section 1. The SSHO must ensure that the requirements of 29 CFR 1926.16 are met for the

project. Provide a Safety oversight team that includes a minimum of one (1) person at each project site to function as the SSHO. The SSHO or an equally-qualified Alternate SSHO must be at the work site at all times to implement and administer the Contractor's safety program and government-accepted Accident Prevention Plan (APP). The SSHO and Alternate SSHO must have the required training, experience, and qualifications in accordance with EM 385-1-1 Section 01.A.17, and all associated sub-paragraphs.

If the SSHO is off-site for a period longer than 24 hours, an equally-qualified alternate SSHO must be provided and must fulfill the same roles and responsibilities as the primary SSHO. When the SSHO is temporarily (up to 24 hours) off-site, a Designated Representative (DR), as identified in the AHA may be used in lieu of an Alternate SSHO, and must be on the project site at all times when work is being performed. Note that the DR is a collateral duty safety position, with safety duties in addition to their full time occupation.

#### 1.7.1.1.1 Additional Site Safety and Health Officer (SSHO) Requirements and Duties

The SSHO may also serve as the Quality Control Manager. The SSHO may not serve as the Superintendent.

#### 1.7.1.2 Competent Person Qualifications

Provide Competent Persons in accordance with EM 385-1-1, Appendix Q and herein. Competent Persons for high risk activities include confined space, cranes and rigging, excavation/trenching, fall protection, and electrical work. The CP for these activities must be designated in writing, and meet the requirements for the specific activity (i.e. competent person, fall protection).

The Competent Person identified in the Contractor's Safety and Health Program and accepted APP, must be on-site at all times when the work that presents the hazards associated with their professional expertise is being performed. Provide the credentials of the Competent Persons(s) to the the Contracting Officer for information in consultation with the Safety Office.

##### 1.7.1.2.1 Competent Person for Confined Space Entry

Provide a Confined Space (CP) Competent Person who meets the requirements of EM 385-1-1, Appendix Q, and herein. The CP for Confined Space Entry must supervise the entry into each confined space in accordance with EM 385-1-1, Section 34.

##### 1.7.1.2.2 Competent Person for Scaffolding

Provide a Competent Person for Scaffolding who meets the requirements of EM 385-1-1, Section 22.B.02 and herein.

##### 1.7.1.2.3 Competent Person for Fall Protection

Provide a Competent Person for Fall Protection who meets the requirements of EM 385-1-1, Section 21.C.04 and herein.

#### 1.7.1.3 Qualified Trainer Requirements

Individuals qualified to instruct the 40 hour contract safety awareness

course, or portions thereof, must meet the definition of a Competent Person Trainer, and, at a minimum, possess a working knowledge of the following subject areas: EM 385-1-1, Electrical Standards, Lockout/Tagout, Fall Protection, Confined Space Entry for Construction; Excavation, Trenching and Soil Mechanics, and Scaffolds in accordance with 29 CFR 1926.450, Subpart L.

Instructors are required to:

- a. Prepare class presentations that cover construction-related safety requirements.
- b. Ensure that all attendees attend all sessions by using a class roster signed daily by each attendee. Maintain copies of the roster for at least five (5) years. This is a certification class and must be attended 100 percent. In cases of emergency where an attendee cannot make it to a session, the attendee can make it up in another class session for the same subject.
- c. Update training course materials whenever an update of the EM 385-1-1 becomes available.
- d. Provide a written exam of at least 50 questions. Students are required to answer 80 percent correctly to pass.
- e. Request, review and incorporate student feedback into a continuous course improvement program.

#### 1.7.1.4 Crane Operators/Riggers

Provide Operators, Signal Persons, and Riggers meeting the requirements in EM 385-1-1, Section 15.B for Riggers and Section 16.B for Crane Operators and Signal Persons. Provide proof of current qualification.

#### 1.7.2 Personnel Duties

##### 1.7.2.1 Duties of the Site Safety and Health Officer (SSHO)

The SSHO must:

- a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily production report.
- b. Conduct mishap investigations and complete required accident reports. Report mishaps and near misses.
- c. Use and maintain OSHA's Form 300 to log work-related injuries and illnesses occurring on the project site for Prime Contractors and subcontractors, and make available to the Contracting Officer upon request. Post and maintain the Form 300A on the site Safety Bulletin Board.
- d. Maintain applicable safety reference material on the job site.
- e. Attend the pre-construction conference, pre-work meetings including preparatory meetings, and periodic in-progress meetings.

- f. Review the APP and AHAs for compliance with EM 385-1-1, and approve, sign, implement and enforce them.
- g. Establish a Safety and Occupational Health (SOH) Deficiency Tracking System that lists and monitors outstanding deficiencies until resolution.
- h. Ensure subcontractor compliance with safety and health requirements.
- i. Maintain a list of hazardous chemicals on site and their material Safety Data Sheets (SDS).
- j. Maintain a weekly list of high hazard activities involving energy, equipment, excavation, entry into confined space, and elevation, and be prepared to discuss details during QC Meetings.
- k. Provide and keep a record of site safety orientation and indoctrination for Contractor employees, subcontractor employees, and site visitors.

Superintendent, QC Manager, and SSHO are subject to dismissal if the above duties are not being effectively carried out. If Superintendent, QC Manager, or SSHO are dismissed, project work will be stopped and will not be allowed to resume until a suitable replacement is approved and the above duties are again being effectively carried out.

### 1.7.3 Meetings

#### 1.7.3.1 Preconstruction Conference

- a. Contractor representatives who have a responsibility or significant role in accident prevention on the project must attend the preconstruction conference. This includes the project superintendent, SSHO, QC manager, or any other assigned safety and health professionals who participated in the development of the APP (including the AHAs and special plans, program and procedures associated with it).
- b. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, and Government review of AHAs to preclude project delays.
- c. Deficiencies in the submitted APP, identified during the Contracting Officer's review, must be corrected, and the APP re-submitted for review prior to the start of construction. Work is not permitted to begin work until an APP is established that is acceptable to the Contracting Officer.

#### 1.7.3.2 Safety Meetings

Conduct safety meetings to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent SOH training and motivation. Conduct meetings at least once a month for all supervisors on the project location. The SSHO, supervisors,

or foremen must conduct meetings at least once a week for the trade workers. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting Officer on request. Notify the Contracting Officer of all scheduled meetings 7 calendar days in advance.

#### 1.8 ACCIDENT PREVENTION PLAN (APP)

A qualified person must prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of EM 385-1-1, Appendix A, and as supplemented herein. Cover all paragraph and subparagraph elements in EM 385-1-1, Appendix A. The APP must be job-specific and address any unusual or unique aspects of the project or activity for which it is written. The APP must interface with the Contractor's overall safety and health program referenced in the APP in the applicable APP element, and made site-specific. Describe the methods to evaluate past safety performance of potential subcontractors in the selection process. Also, describe innovative methods used to ensure and monitor safe work practices of subcontractors. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP must be signed by an officer of the firm (Prime Contractor senior person), the individual preparing the APP, the on-site superintendent, the designated SSHO, the Contractor QC Manager, and any designated Certified Safety Professional (CSP) or Certified Health Physicist (CIH). The SSHO must provide and maintain the APP and a log of signatures by each subcontractor foreman, attesting that they have read and understand the APP, and make the APP and log available on-site to the Contracting Officer. If English is not the foreman's primary language, the Prime Contractor must provide an interpreter.

Submit the APP to the Contracting Officer 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP. Once reviewed and accepted by the Contracting Officer, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP is cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified. Continuously review and amend the APP, as necessary, throughout the life of the contract. Changes to the accepted APP must be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and QC Manager. Incorporate unusual or high-hazard activities not identified in the original APP as they are discovered. Should any severe hazard exposure (i.e. imminent danger) become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate and remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSE/SAFE A10.34), and the environment.

The following guidelines are provided for compilation of the APP:

Accident Prevention Plans (APP)

Appendix A EM 385-1-1  
(15 SEPTEMBER 2008 edition)

FEAD offices with the new safety requirements of EM 385 dated 15 SEPTEMBER 2008 assist our Contractors in learning how to properly develop an Accident Prevention Plan which will meet the US Army Corps of Engineers Safety and Health Requirements Manual EM 385-1-1 15 September 2008 Appendix A requirements as a minimum plan. Many of the Accident Prevention Plans (APP) that have been submitted/accepted are not in the correct format or do not address all the requirements of Appendix A.

Special new note For LIMITED-SCOPE SERVICE, SUPPLY AND R&D CONTRACTS, for example, mowing (only), park attendant, rest room cleaning, the Contracting Officer and SOHO may allow an ABBREVIATED APP (customized APP requirements and waive the more stringent elements of this section). See 01.A.11 and Appendix A, paragraph 11.

An Accident Prevention Plan (APP) is a safety and health policy and program document. APP shall be job-specific and shall also address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the employer's overall safety and health program, and a copy shall be available on the work site. Any portions of the overall safety and health program that are referenced in the APP shall be included as appropriate. ANSI/ASSE A10.38 should be referenced for Programmatic Issues.

Most contracts awarded within NAVFAC are under the guidelines of the EM 385-1-1 concerning contract safety requirements. All NAVFAC FEAD/FSC contractors will adhere to the EM 385-1-1 requirements for Accident Prevention Plans. The APP shall be developed by qualified personnel and then signed in accordance with Appendix A, paragraph 1.

The Contractor shall be responsible for documenting the Qualified person's credentials. "Qualified person: one who, by possession of a recognized degree, certificate, or professional standing, or extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve or resolve problems related to the subject matter, the work, or the project."

The Contractor shall address each of the elements/sub-elements in the outline contained in Appendix A in the order that they are provided in the manual. If an item is not applicable because of the nature of the work to be performed, the Contractor shall state this exception and provide a justification. > See Appendix A

Accident Prevention Plans that are submitted shall follow the guidelines of Appendix A of the EM 385-1-1 or they will found not acceptable and sent back to the contractor for re-submittal. The contractor can not start work on a contract until the Accident Prevention Plan has been submitted and found acceptable. A copy shall be available on the work site. The APP shall be written in English by the Prime Contractor and shall articulate the specific work and hazards pertaining to the contract.

The APP shall contain appropriate appendices (for example, a SSHP for hazardous waste site cleanup operations, a Lead Compliance Plan when working with lead, or an Asbestos Hazard Abatement Plan when working with asbestos). The APP shall also implement in detail the pertinent requirements of this manual. Before initiation of work at the job site, an APP shall be reviewed and found acceptable by the GDA.



"Accepted/Acceptable: a term denoting when a written procedure, practice, method, program, engineering design, or employee qualification criteria submittal, which, after a cursory review by a GDA, is determined to generally conform to safety and health or contractual requirements. Acceptance or acceptability of such submittals in no way relieves the submitting entity from ensuring employees a safe and healthful work environment or complying with all contractual requirements and good engineering practices."

For contract operations, the Contractor's APP shall be job specific and should include work to be performed by subcontractors.

In addition, the APP should state measures to be taken by the Contractor to control hazards associated with materials, services, or equipment provided by suppliers.

Updates to the APP shall be reviewed and approved by the GDA.

"Approved: a method, equipment, procedure, practice, tool, etc., that is sanctioned, confirmed, as acceptable for a particular use or purpose by a person or organization authorized to render such approval or judgment."

Steps for putting the Accident Prevention Plan Together.

1. You will need a three ring binder that will contain your Accident Prevention Plan.
  2. You will need tab sheets numbered 1 through 10. The tab sheets will be used to separate the 10 sections shown in Appendix A.
  3. You will need to have an index page installed as the first page of your plan.
  4. Next insert tab sheet number one.
  5. Next comply with section #1 a. b. and c. When you have completed these items insert them into your tab # 1 section.
  6. Next insert tab sheet number two.
  7. Next comply with section #2 a. b. c. d. When you have completed these items insert them into your tab #2 section
  8. By now as you can see each tab section has sub statements within them that will be inserted into each section. Follow this procedure until all 10 sections are completed. Upon completion put together the correct number of Accident Prevention Plans required by your contract to be submitted to the and forward the copies to the Office in Charge of Construction.
- By complying with Appendix A of the EM 385-1-1 you will have an Accident Prevention Plan which will meet the requirements of your contract and the Accident Prevention Plan can be modified for reuse with other NAVFAC contracts which may be awarded to your company

#### 1.8.1 Names and Qualifications

Provide plans in accordance with the requirements outlined in Appendix A of EM 385-1-1, including the following:

- a. Names and qualifications (resumes including education, training, experience and certifications) of site safety and health personnel designated to perform work on this project to include the designated

SSHO and other competent and qualified personnel to be used. Specify the duties of each position.

- b. Qualifications of competent and of qualified persons. As a minimum, designate and submit qualifications of competent persons for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; and personal protective equipment and clothing to include selection, use and maintenance.

#### 1.8.2 Plans

Provide plans in the APP in accordance with the requirements outlined in Appendix A of EM 385-1-1, including the following:

##### 1.8.2.1 Confined Space Entry Plan

Develop a confined or enclosed space entry plan in accordance with EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, OSHA Directive CPL 2.100, and any other federal, state and local regulatory requirements identified in this contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none will be created.)

##### 1.8.2.2 Standard Lift Plan (SLP)

Plan lifts to avoid situations where the operator cannot maintain safe control of the lift. Prepare a written SLP in accordance with EM 385-1-1, Section 16.A.03, using Form 16-2 for every lift or series of lifts (if duty cycle or routine lifts are being performed). The SLP must be developed, reviewed and accepted by all personnel involved in the lift in conjunction with the associated AHA. Signature on the AHA constitutes acceptance of the plan. Maintain the SLP on the LHE for the current lift(s) being made. Maintain historical SLPs for a minimum of 3 months.

##### 1.8.2.3 Critical Lift Plan - Crane or Load Handling Equipment

Provide a Critical Lift Plan as required by EM 385-1-1, Section 16.H.01, using Form 16-3. In addition, Critical Lift Plans are required for the following:

- a. Lifts over 50 percent of the capacity of barge mounted mobile crane's hoist.
- b. When working around energized power lines where the work will get closer than the minimum clearance distance in EM 385-1-1 Table 16-1.
- c. For lifts with anticipated binding conditions.
- d. When erecting cranes.

##### 1.8.2.3.1 Critical Lift Plan Planning and Schedule

Critical lifts require detailed planning and additional or unusual safety

precautions. Develop and submit a critical lift plan to the Contracting Officer 30 calendar days prior to critical lift. Comply with load testing requirements in accordance with EM 385-1-1, Section 16.F.03.

#### 1.8.2.3.2 Lifts of Personnel

In addition to the requirements of EM 385-1-1, Section 16.H.02, for lifts of personnel, demonstrate compliance with the requirements of 29 CFR 1926.1400 and EM 385-1-1, Section 16.T.

#### 1.8.2.4 Multi-Purpose Machines, Material Handling Equipment, and Construction Equipment Lift Plan

Multi-purpose machines, material handling equipment, and construction equipment used to lift loads that are suspended by rigging gear, require proof of authorization from the machine OEM that the machine is capable of making lifts of loads suspended by rigging equipment. Written approval from a qualified registered professional engineer, after a safety analysis is performed, is allowed in lieu of the OEM's approval. Demonstrate that the operator is properly trained and that the equipment is properly configured to make such lifts and is equipped with a load chart.

#### 1.8.2.5 Fall Protection and Prevention (FP&P) Plan

The plan must comply with the requirements of EM 385-1-1, Section 21.D and ASSE/SAFE Z359.2, be site specific, and address all fall hazards in the work place and during different phases of construction. Address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 6 feet. A competent person or qualified person for fall protection must prepare and sign the plan documentation. Include FP&P systems, equipment and methods employed for every phase of work, roles and responsibilities, assisted rescue, self-rescue and evacuation procedures, training requirements, and monitoring methods. Review and revise, as necessary, the FP&P Plan documentation as conditions change, but at a minimum every six months, for lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. Keep and maintain the accepted FP&P Plan documentation at the job site for the duration of the project. Include the FP&P Plan documentation in the APP.

#### 1.8.2.6 Rescue and Evacuation Plan

Provide a Rescue and Evacuation Plan in accordance with EM 385-1-1 Section 21.N and ASSE/SAFE Z359.2, and include in the FP&P Plan and as part of the APP. 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.

#### 1.8.2.7 Hazardous Energy Control Program (HECP)

Develop a HECP in accordance with EM 385-1-1 Section 12, 29 CFR 1910.147, 29 CFR 1910.333, 29 CFR 1915.89, ASSE/SAFE Z244.1, and ASSE/SAFE A10.44. Submit this HECP as part of the APP. Conduct a preparatory meeting and inspection with all effected personnel to coordinate all HECP activities. Document this meeting and inspection in accordance with EM 385-1-1, Section 12.A.02. Ensure that each employee is familiar with and complies with these procedures.

#### 1.8.2.8 Excavation Plan

Identify the safety and health aspects of excavation, and provide and prepare the plan in accordance with EM 385-1-1, Section 25.A

#### 1.8.2.9 Occupant Protection Plan

Identify the safety and health aspects of lead-based paint removal, prepared in accordance with Section 02 82 33.13 20 REMOVAL/CONTROL AND DISPOSAL OF PAINT WITH LEAD.

#### 1.8.2.10 Lead Compliance Plan

Identify the safety and health aspects of lead work, and prepare in accordance with Section 02 83 13.00 20 LEAD IN CONSTRUCTION.

#### 1.8.2.11 Site Demolition Plan

Identify the safety and health aspects, and prepare in accordance with Section 02 41 00 DEMOLITION and referenced sources. Include engineering survey as applicable.

### 1.9 ACTIVITY HAZARD ANALYSIS (AHA)

Before beginning each activity, task or Definable Feature of Work (DFOW) involving a type of work presenting hazards not experienced in previous project operations, or where a new work crew or subcontractor is to perform the work, the Contractor(s) performing that work activity must prepare an AHA. AHAs must be developed by the Prime Contractor, subcontractor, or supplier performing the work, and provided for Prime Contractor review and approval before submitting to the Contracting Officer. AHAs must be signed by the SSHO, Superintendent, QC Manager and the subcontractor Foreman performing the work. Format the AHA in accordance with EM 385-1-1, Section 1 or as directed by the Contracting Officer. Submit the AHA for review at least 15 working days prior to the start of each activity task, or DFOW. The Government reserves the right to require the Contractor to revise and resubmit the AHA if it fails to effectively identify the work sequences, specific anticipated hazards, site conditions, equipment, materials, personnel and the control measures to be implemented.

AHAs must identify competent persons required for phases involving high risk activities, including confined entry, crane and rigging, excavations, trenching, electrical work, fall protection, and scaffolding.

#### 1.9.1 AHA Management

Review the AHA list periodically (at least monthly) at the Contractor supervisory safety meeting, and update as necessary when procedures, scheduling, or hazards change. Use the AHA during daily inspections by the SSHO to ensure the implementation and effectiveness of the required safety and health controls for that work activity.

#### 1.9.2 AHA Signature Log

Each employee performing work as part of an activity, task or DFOW must review the AHA for that work and sign a signature log specifically maintained for that AHA prior to starting work on that activity. The SSHO must maintain a signature log on site for every AHA. Provide employees whose primary language is other than English, with an interpreter to ensure

a clear understanding of the AHA and its contents.

#### 1.10 DISPLAY OF SAFETY INFORMATION

##### 1.10.1 Safety Bulletin Board

Within one calendar day after commencement of work, erect a safety bulletin board at the job site. Where size, duration, or logistics of project do not facilitate a bulletin board, an alternative method, acceptable to the Contracting Officer, that is accessible and includes all mandatory information for employee and visitor review, may be deemed as meeting the requirement for a bulletin board. Include and maintain information on safety bulletin board as required by EM 385-1-1, Section 01.A.07. Additional items required to be posted include:

- a. Confined space entry permit.
- b. Hot work permit.

##### 1.10.2 Safety and Occupational Health (SOH) Deficiency Tracking System

Establish a SOH deficiency tracking system that lists and monitors the status of SOH deficiencies in chronological order. Use the tracking system to evaluate the effectiveness of the APP. A monthly evaluation of the data must be discussed in the QC or SOH meeting with everyone on the project. The list must be posted on the project bulletin board and updated daily, and provide the following information:

- a. Date deficiency identified;
- b. Description of deficiency;
- c. Name of person responsible for correcting deficiency;
- d. Projected resolution date;
- e. Date actually resolved.

#### 1.11 SITE SAFETY REFERENCE MATERIALS

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

#### 1.12 EMERGENCY MEDICAL TREATMENT

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

#### 1.13 NOTIFICATIONS and REPORTS

##### 1.13.1 Mishap Notification

Notify the Contracting Officer as soon as practical, but no more than twenty-four hours, after any mishaps, including recordable accidents, incidents, and near misses, as defined in EM 385-1-1 Appendix Q, any report of injury, illness, or any property damage. For LHE or rigging mishaps, notify the Contracting Officer as soon as practical but not more than 4 hours after mishap. The Contractor is responsible for obtaining appropriate medical and emergency assistance and for notifying fire, law enforcement, and regulatory agencies. Immediate reporting is required for electrical mishaps, to include Arc Flash; shock; uncontrolled release of hazardous energy (includes electrical and non-electrical); load handling equipment or rigging; fall from height (any level other than same surface);

and underwater diving. These mishaps must be investigated in depth to identify all causes and to recommend hazard control measures.

Within notification include Contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (for example, type of construction equipment used and PPE used). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted. Assist and cooperate fully with the Government's investigation(s) of any mishap.

#### 1.13.2 Accident Reports

- a. Conduct an accident investigation for recordable injuries and illnesses, property damage, and near misses as defined in EM 385-1-1, to establish the root cause(s) of the accident. Complete the applicable NAVFAC Contractor Incident Reporting System (CIRS), and electronically submit via the NAVFAC Enterprise Safety Applications Management System (ESAMS). Complete and submit an accident investigation report in ESAMS within 5 days for mishaps defined in EM 385-1-1 01.D.03 and 10 days for accidents defined by EM 385-1-1 01.D.05. Complete an investigation report within 30 days for those mishaps defined by EM 385-1-1 01.D.04. Mishaps defined by EM 385-1-1 01.D.04 and 01.D.05 must include a written report submitted as an attachment in ESAMS using the following outline: (1) Mishap summary description to include process, findings and outcomes; (2) Root Cause; (3) Direct Factors; (4) Indirect and Contributing Factors; (5) Corrective Actions; and (6) Recommendations. The Contracting Officer will provide copies of any required or special forms.
- b. Near Misses: For Navy Projects, complete the applicable documentation in NAVFAC CIRS, and electronically submit via the NAVFAC ESAMS. Near miss reports are considered positive and proactive Contractor safety management actions.
- c. Conduct an accident investigation for any LHE accident (including rigging accidents) to establish the root cause(s) of the accident. Complete the LHE Accident Report (Crane and Rigging Accident Report) form and provide the report to the Contracting Officer within 30 calendar days of the accident. Do not proceed with crane operations until cause is determined and corrective actions have been implemented to the satisfaction of the Contracting Officer. The Contracting Officer will provide a blank copy of the accident report form.

#### 1.13.3 LHE Inspection Reports

Submit LHE inspection reports required in accordance with EM 385-1-1 and as specified herein with Daily Reports of Inspections.

#### 1.13.4 Certificate of Compliance and Pre-lift Plan/Checklist for LHE and Rigging

Provide a FORM 16-1 Certificate of Compliance for LHE entering an activity under this contract and in accordance with EM 385-1-1. Post certifications on the crane.

Develop a Standard Lift Plan (SLP) in accordance with EM 385-1-1, Section

16.H.03 using Form 16-2 Standard Pre-Lift Crane Plan/Checklist for each lift planned. Submit SLP to the Contracting Officer for approval within 15 calendar days in advance of planned lift.

#### 1.14 HOT WORK

##### 1.14.1 Permit and Personnel Requirements

Submit and obtain a written permit prior to performing "Hot Work" (i.e. welding or cutting) or operating other flame-producing/spark producing devices, from the MCAS Cherry Point Fire Department. A permit is required from the Explosives Safety Office for work in and around where explosives are processed, stored, or handled. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. Provide at least two 20 pound 4A:20 BC rated extinguishers for normal "Hot Work". The extinguishers must be current inspection tagged, and contain an 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 must be trained in accordance with NFPA 51B and remain on-site for a minimum of one hour after completion of the task or as specified on the hot work permit.

When starting work in the facility, require personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Fire Department phone number. REPORT ANY FIRE, NO MATTER HOW SMALL, TO THE MCAS CHERRY POINT FIRE DEPARTMENT IMMEDIATELY.

##### 1.14.2 Work Around Flammable Materials

Obtain permit approval from a NFPA Certified Marine Chemist for "HOT WORK" within or around flammable materials (such as fuel systems or welding/cutting on fuel pipes) or confined spaces (such as sewer wet wells, manholes, or vaults) that have the potential for flammable or explosive atmospheres.

Whenever these materials, except beryllium and chromium (VI), are encountered in indoor operations, local mechanical exhaust ventilation systems that are sufficient to reduce and maintain personal exposures to within acceptable limits must be used and maintained in accordance with manufacturer's instruction and supplemented by exceptions noted in EM 385-1-1, Section 06.H

#### 1.15 CONFINED SPACE ENTRY REQUIREMENTS

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

##### 1.15.1 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. Comply with EM 385-1-1, Section 34 for entry procedures. Hazards pertaining to the space must be reviewed with each employee during review of the AHA.

### 1.15.2 Forced Air Ventilation

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.

### 1.15.3 Sewer Wet Wells

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

### 1.15.4 Rescue Procedures and Coordination with Local Emergency Responders

Develop and implement an on-site rescue and recovery plan and procedures. The rescue plan must not rely on local emergency responders for rescue from a confined space.

## 1.16 SEVERE STORM PLAN

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

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

## PART 2 PRODUCTS

### 2.1 CONFINED SPACE SIGNAGE

Provide permanent signs integral to or securely attached to access covers for new permit-required confined spaces. Signs for confined spaces must comply with NEMA Z535.2. Signs wording: "DANGER--PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER" in bold letters a minimum of one inch in height and constructed to be clearly legible with all paint removed. The signal word "DANGER" must be red and readable from 5 feet.

## PART 3 EXECUTION

### 3.1 CONSTRUCTION AND OTHER WORK

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

PPE is governed in all areas by the nature of the work the employee is performing. Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks. Safety glasses must be worn or carried/available on each person. Mandatory PPE includes:

- a. Hard Hat
- b. Long Pants
- c. Appropriate Safety Shoes
- d. Appropriate Class Reflective Vests



### 3.1.1 Worksite Communication

Employees working alone in a remote location or away from other workers must be provided an effective means of emergency communications (i.e., cellular phone, two-way radios, land-line telephones or other acceptable means). The selected communication must be readily available (easily within the immediate reach) of the employee and must be tested prior to the start of work to verify that it effectively operates in the area/environment. An employee check-in/check-out communication procedure must be developed to ensure employee safety.

### 3.1.2 Hazardous Material Use

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

### 3.1.3 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 EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint, and hexavalent chromium, are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials. Low mercury lamps used within fluorescent lighting fixtures are allowed as an exception without further Contracting Officer approval. Notify the Radiation Safety Officer (RSO) prior to excepted items of radioactive material and devices being brought on base.

### 3.1.4 Unforeseen Hazardous Material

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

## 3.2 PRE-OUTAGE COORDINATION MEETING

Apply for utility outages at least 15 days in advance. As a minimum, the request must include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Once approved, and prior to beginning work on the utility system requiring shut down, attend a pre-outage coordination meeting with the Contracting Officer to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is

provided that no other means exist.

### 3.3 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

Provide and operate a Hazardous Energy Control Program (HECP) in accordance with EM 385-1-1 Section 12, 29 CFR 1910.333, 29 CFR 1915.89, and paragraph HAZARDOUS ENERGY CONTROL PROGRAM (HECP).

### 3.4 FALL PROTECTION PROGRAM

Establish a fall protection program, for the protection of all employees exposed to fall hazards. Within the program include company policy, identify roles and responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures in accordance with ASSE/SAFE Z359.2 and EM 385-1-1, Sections 21.A and 21.D.

#### 3.4.1 Training

Institute a fall protection training program. As part of the Fall Protection Program, provide training for each employee who might be exposed to fall hazards. Provide training by a competent person for fall protection in accordance with EM 385-1-1, Section 21.C. Document training and practical application of the competent person in accordance with EM 385-1-1, Section 21.C.04 and ASSE/SAFE Z359.2 in the AHA.

#### 3.4.2 Fall Protection Equipment and Systems

Enforce use of personal fall protection equipment and systems designated (to include fall arrest, restraint, and positioning) for each specific work activity in the Site Specific FP&P Plan and AHA at all times when an employee is exposed to a fall hazard. Protect employees from fall hazards as specified in EM 385-1-1, Section 21.

Provide personal fall protection equipment, systems, subsystems, and components that comply with EM 385-1-1 Section 21.I, 29 CFR 1926.500 Subpart M, ASSE/SAFE Z359.0, ASSE/SAFE Z359.1, ASSE/SAFE Z359.2, ASSE/SAFE Z359.3, ASSE/SAFE Z359.4, ASSE/SAFE Z359.6, ASSE/SAFE Z359.7, ASSE/SAFE Z359.11, ASSE/SAFE Z359.12, ASSE/SAFE Z359.13, ASSE/SAFE Z359.14, and ASSE/SAFE Z359.15.

##### 3.4.2.1 Additional Personal Fall Protection

In addition to the required fall protection systems, other protection such as safety skiffs, personal floatation devices, and life rings, are required when working above or next to water in accordance with EM 385-1-1, Sections 21.0 through 21.0.06. Personal fall protection systems and equipment are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall protection systems are required when operating other equipment such as scissor lifts. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, travel, or while performing work.

##### 3.4.2.2 Personal Fall Protection Harnesses

Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. The use

of body belts is not acceptable. Harnesses must 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. Snap hooks and carabiners must be self-closing and self-locking, capable of being opened only by at least two consecutive deliberate actions and have a minimum gate strength of 3,600 lbs in all directions. Use webbing, straps, and ropes made of synthetic fiber. The maximum free fall distance when using fall arrest equipment must not exceed 6 feet, unless the proper energy absorbing lanyard is used. Always take into consideration the total fall distance and any swinging of the worker (pendulum-like motion), that can occur during a fall, when attaching a person to a fall arrest system. All full body harnesses must be equipped with Suspension Trauma Preventers such as stirrups, relief steps, or similar in order to provide short-term relief from the effects of orthostatic intolerance in accordance with EM 385-1-1, Section 21.I.06.

#### 3.4.3 Fall Protection for Roofing Work

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

##### a. Low Sloped Roofs:

- (1) For work within 6 feet of an edge, on a roof having a slope less than or equal to 4:12 (vertical to horizontal), protect personnel from falling by use of personal fall arrest/restraint systems, guardrails, or safety nets. A safety monitoring system is not adequate fall protection and is not authorized. Provide in accordance with 29 CFR 1926.500.
- (2) For work greater than 6 feet from an edge, erect and install warning lines in accordance with 29 CFR 1926.500 and EM 385-1-1, Section L.

##### b. Steep-Sloped Roofs: Work on a roof having a slope greater than 4:12 (vertical to horizontal) requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also applies to residential or housing type construction.

#### 3.4.4 Horizontal Lifelines (HLL)

Provide HLL in accordance with EM 385-1-1, Section 21.I.08.d.2. Commercially manufactured horizontal lifelines (HLL) must 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). The competent person for fall protection may (if deemed appropriate by the qualified person) supervise the assembly, disassembly, use and inspection of the HLL system under the direction of the qualified person. Locally manufactured HLLs are not acceptable unless they are custom designed for limited or site specific applications by a Registered Professional Engineer who is qualified in designing HLL systems.

#### 3.4.5 Guardrails and Safety Nets

Design, install and use guardrails and safety nets in accordance with EM 385-1-1, Section 21.F.01 and 29 CFR 1926 Subpart M.

### 3.4.6 Rescue and Evacuation Plan and Procedures

When personal fall arrest systems are used, ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. Prepare a Rescue and Evacuation Plan and include a detailed discussion of the following: methods of rescue; methods of self-rescue or assisted-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and Evacuation Plan within the AHA for the phase of work, in the FP&P Plan, and the APP. The plan must comply with the requirements of EM 385-1-1, ASSE/SAFE Z359.2, and ASSE/SAFE Z359.4.

## 3.5 WORK PLATFORMS

### 3.5.1 Scaffolding

Provide employees with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Comply with the following requirements:

- a. Scaffold platforms greater than 20 feet in height must be accessed by use of a scaffold stair system.
- b. Ladders commonly provided by scaffold system manufacturers are prohibited for accessing scaffold platforms greater than 20 feet maximum in height.
- c. An adequate gate is required.
- d. Employees performing scaffold erection and dismantling must be qualified.
- e. Scaffold must be capable of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted FP&P plan.
- f. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward.
- g. Special care must be given to ensure scaffold systems are not overloaded.
- h. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material are prohibited. The first tie-in must be at the height equal to 4 times the width of the smallest dimension of the scaffold base.
- i. Scaffolding other than suspended types must bear on base plates upon wood mudsills (2 in x 10 in x 8 in minimum) or other adequate firm foundation.
- j. Scaffold or work platform erectors must have fall protection during the erection and dismantling of scaffolding or work platforms that are more than 6 feet.
- k. Delineate fall protection requirements when working above 6 feet or above dangerous operations in the FP&P Plan and AHA for the phase of

work.

### 3.5.2 Elevated Aerial Work Platforms (AWPs)

Workers must be anchored to the basket or bucket in accordance with manufacturer's specifications and instructions (anchoring to the boom may only be used when allowed by the manufacturer and permitted by the CP). Lanyards used must be sufficiently short to prohibit worker from climbing out of basket. The climbing of rails is prohibited. Lanyards with built-in shock absorbers are acceptable. Self-retracting devices are not acceptable. Tying off to an adjacent pole or structure is not permitted unless a safe device for 100 percent tie-off is used for the transfer.

Use of AWPs must be operated, inspected, and maintained as specified in the operating manual for the equipment and delineated in the AHA. Operators of AWPs must be designated as qualified operators by the Prime Contractor. Maintain proof of qualifications on site for review and include in the AHA.

## 3.6 EQUIPMENT

### 3.6.1 Material Handling Equipment (MHE)

- a. MHE such as forklifts must not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions. MHE fitted with personnel work platform attachments are prohibited from traveling or positioning while personnel are working on the platform.
- b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions. MHE Operators must be trained in accordance with OSHA 29 CFR 1910, Subpart N.
- c. Operators of forklifts or power industrial trucks must be licensed in accordance with OSHA.

### 3.6.2 Load Handling Equipment (LHE)

The following requirements apply. In exception, these requirements do not apply to commercial truck mounted and articulating boom cranes used solely to deliver material and supplies (not prefabricated components, structural steel, or components of a systems-engineered metal building) where the lift consists of moving materials and supplies from a truck or trailer to the ground; to cranes installed on mechanics trucks that are used solely in the repair of shore-based equipment; to cranes that enter the activity but are not used for lifting; nor to other machines not used to lift loads suspended by rigging equipment. However, LHE accidents occurring during such operations must be reported.

- a. Equip cranes and derricks as specified in EM 385-1-1, Section 16.
- b. Notify the Contracting Officer 15 working days in advance of any LHE entering the activity, in accordance with EM 385-1-1, Section 16.A.02, so that necessary quality assurance spot checks can be coordinated. Prior to cranes entering federal activities, a Crane Access Permit must be obtained from the Contracting Officer. A copy of the permitting process will be provided at the Preconstruction Conference. Contractor's operator must remain with the crane during the spot check. Rigging gear must comply with OSHA and ASME B30.9.

- c. Comply with the LHE manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person (as defined in ASME B30.5). Perform all testing in accordance with the manufacturer's recommended procedures.
- d. Comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, ASME B30.8 for floating cranes and floating derricks, ASME B30.9 for slings, ASME B30.20 for below the hook lifting devices and ASME B30.26 for rigging hardware.
- e. When operating in the vicinity of overhead transmission lines, operators and riggers must be alert to this special hazard and follow the requirements of EM 385-1-1 Section 11, and ASME B30.5 or ASME B30.22 as applicable.
- f. Do not use crane suspended personnel work platforms (baskets) unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Do not lift personnel with a line hoist or friction crane. Additionally, submit a specific AHA for this work to the Contracting Officer. Ensure the activity and AHA are thoroughly reviewed by all involved personnel.
- g. Inspect, maintain, and recharge portable fire extinguishers as specified in NFPA 10, Standard for Portable Fire Extinguishers.
- h. All employees must keep clear of loads about to be lifted and of suspended loads, except for employees required to handle the load.
- i. Use cribbing when performing lifts on outriggers.
- j. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.
- k. A physical barricade must be positioned to prevent personnel access where accessible areas of the LHE's rotating superstructure poses a risk of striking, pinching or crushing personnel.
- l. Maintain inspection records in accordance by EM 385-1-1, Section 16.D, including shift, monthly, and annual inspections, the signature of the person performing the inspection, and the serial number or other identifier of the LHE that was inspected. Records must be available for review by the Contracting Officer.
- m. Maintain written reports of operational and load testing in accordance with EM 385-1-1, Section 16.F, listing the load test procedures used along with any repairs or alterations performed on the LHE. Reports must be available for review by the Contracting Officer.
- n. Certify that all LHE operators have been trained in proper use of all safety devices (e.g. anti-two block devices).
- o. Take steps to ensure that wind speed does not contribute to loss of control of the load during lifting operations. At wind speeds greater than 20 mph, the operator, rigger and lift supervisor must cease all crane operations, evaluate conditions and determine if the lift may proceed. Base the determination to proceed or not on wind calculations per the manufacturer and a reduction in LHE rated capacity if

applicable. Include this maximum wind speed determination as part of the activity hazard analysis plan for that operation.

- p. On mobile cranes, lifts where the load weight is greater than 90 percent of the equipment's capacity are prohibited.

### 3.6.3 Machinery and Mechanized Equipment

- a. Proof of qualifications for operator must be kept on the project site for review.
- b. Manufacture specifications or owner's manual for the equipment must be on-site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Incorporate such additional safety precautions or requirements into the AHAs.

### 3.6.4 Base Mounted Drum Hoists

- a. Operation of base mounted drum hoists must comply with EM 385-1-1 and ASSE/SAFE A10.22.
- b. Rigging gear must comply with applicable ASME/OSHA standards
- c. When used on telecommunication towers, base mounted drum hoists must comply with TIA-1019, TIA-222, ASME B30.7, 29 CFR 1926.552, and 29 CFR 1926.553.
- d. When used to hoist personnel, the AHA must include a written standard operating procedure. Operators must have a physical examination in accordance with EM 385-1-1 Section 16.B.05 and trained, at a minimum, in accordance with EM 385-1-1 Section 16.U and 16.T. The base mounted drum hoist must also comply with OSHA Instruction CPL 02-01-056 and ASME B30.23.
- e. Material and personnel must not be hoisted simultaneously.
- f. Personnel cage must be marked with the capacity (in number of persons) and load limit in pounds.
- g. Construction equipment must not be used for hoisting material or personnel or with trolley/tag lines. Construction equipment may be used for towing and assisting with anchoring guy lines.

### 3.6.5 Use of Explosives

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

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

### 3.7 EXCAVATIONS

Soil classification must be performed by a competent person in accordance

with 29 CFR 1926 and EM 385-1-1.

### 3.7.1 Utility Locations

Provide a third party, independent, private utility locating company to positively identify underground utilities in the work area in addition to any station locating service and coordinated with the station utility department.

### 3.7.2 Utility Location Verification

Physically verify underground utility locations, including utility depth, by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within 3 feet of the underground system.

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

Utilities located within and under concrete slabs or pier structures, bridges, parking areas, and the like, are extremely difficult to identify. Whenever contract work involves chipping, saw cutting, or core drilling through concrete, bituminous asphalt or other impervious surfaces, the existing utility location must be coordinated with station utility departments in addition to location and depth verification by a third party, independent, private locating company. The third party, independent, private locating company must 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.

## 3.8 ELECTRICAL

Perform electrical work in accordance with EM 385-1-1, Appendix A, Sections 11 and 12.

### 3.8.1 Conduct of Electrical Work

As delineated in EM 385-1-1, electrical work is to be conducted in a de-energized state unless there is no alternative method for accomplishing the work. In those cases obtain an energized work permit from the Contracting Officer. The energized work permit application must be accompanied by the AHA and a summary of why the equipment/circuit needs to be worked energized. Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Attach temporary grounds in accordance with ASTM F855 and IEEE 1048. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator is 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 are permitted to enter. When work requires work near energized circuits as defined by NFPA 70, high voltage personnel must use personal protective



equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves and electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA. Ensure that each employee is familiar with and complies with these procedures and 29 CFR 1910.147.

### 3.8.2 Qualifications

Electrical work must be performed by QP personnel with verifiable credentials who are familiar with applicable code requirements. Verifiable credentials consist of State, National and Local Certifications or Licenses that a Master or Journeyman Electrician may hold, depending on work being performed, and must be identified in the appropriate AHA. Journeyman/Apprentice ratio must be in accordance with State and Local requirements applicable to where work is being performed.

### 3.8.3 Arc Flash

Conduct a hazard analysis/arc flash hazard analysis whenever work on or near energized parts greater than 50 volts is necessary, in accordance with NFPA 70E.

All personnel entering the identified arc flash protection boundary must be QPs and properly trained in NFPA 70E requirements and procedures. Unless permitted by NFPA 70E, no Unqualified Person is permitted to approach nearer than the Limited Approach Boundary of energized conductors and circuit parts. Training must be administered by an electrically qualified source and documented.

### 3.8.4 Grounding

Ground electrical circuits, equipment and enclosures in accordance with NFPA 70 and IEEE C2 to provide a permanent, continuous and effective path to ground unless otherwise noted by EM 385-1-1.

Check grounding circuits to ensure that the circuit between the ground and a grounded power conductor has a resistance low enough to permit sufficient current flow to allow the fuse or circuit breaker to interrupt the current.

### 3.8.5 Testing

Temporary electrical distribution systems and devices must be inspected, tested and found acceptable for Ground-Fault Circuit Interrupter (GFCI) protection, polarity, ground continuity, and ground resistance before initial use, before use after modification and at least monthly. Monthly inspections and tests must be maintained for each temporary electrical distribution system, and signed by the electrical CP or QP.

-- End of Section --

## SECTION 01 42 00

## SOURCES FOR REFERENCE PUBLICATIONS

11/14

## 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](mailto: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](mailto: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](mailto:info@aluminum.org)  
Internet: <http://www.aluminum.org>

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](mailto: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@ashto.org](mailto:info@ashto.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 BEARING MANUFACTURERS ASSOCIATION (ABMA)  
2025 M Street, NW, Suite 800  
Washington, DC 20036  
Ph: 202-367-1155  
E-mail: [info@americanbearings.org](mailto:info@americanbearings.org)  
Internet: <http://www.americanbearings.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](mailto: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](mailto:mail@acgih.org)  
Internet: <http://www.acgih.org>

AMERICAN HARDBOARD ASSOCIATION (AHA)  
1210 West Northwest Highway  
Palatine, IL 60067  
Ph: 847-934-8800  
Fax: 847-934-8803  
E-mail: [aha@hardboard.org](mailto:aha@hardboard.org)  
Internet: <http://domensino.com/AHA/>

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](mailto: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  
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Fax: 708-479-6139  
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Internet: <http://www.asse-plumbing.org>

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Internet: <http://www.awwa.org>

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Internet: <http://www.ejma.org>

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Johnston, RI 02919-4923  
Ph: 877-364-6726  
Fax: 401-275-3029  
E-mail: [servicedesk.myrisk@fmglobal.com](mailto: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](mailto:fccchr@usc.edu)  
Internet: <http://www.usc.edu/dept/fccchr>

GLASS ASSOCIATION OF NORTH AMERICA (GANA)  
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CH-1211 Geneva 20, Switzerland

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Internet: <http://www.iec.ch>

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Fax: 41-22-733-34-30

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Washington, DC 20026-3268  
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Fax: 202-708-9981  
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UNI-BELL PVC PIPE ASSOCIATION (UBPPA)  
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WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMPMA)  
507 First Street  
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Fax: 530-661-9586  
E-mail: [info@wmmpa.com](mailto:info@wmmpa.com)  
Internet: <http://www.wmmpa.com>

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

-- End of Section --

## SECTION 01 45 00.00 20

## QUALITY CONTROL

11/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

## 1.2 SUBMITTALS

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

SD-01 Preconstruction Submittals

Construction Quality Control (QC) Plan

Submit a Construction QC Plan within 20 days after receipt of Notice of Award. The QC Plan shall include a preliminary submittal of the list of definable features of work that shall cover the first 90 days of construction.

Contract Document Review

SD-07 Certificates

CA Resume

## 1.3 INFORMATION FOR THE CONTRACTING OFFICER

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

Deliver the following to the Contracting Officer during Construction:

- a. CQC Report: Submit the report by 10:00 AM the next working day after each day that work is performed and for every seven consecutive calendar days of no-work.
- b. Contractor Production Report: Submit the report by 10:00 AM the next working day after each day that work is performed and for every seven consecutive calendar days of no-work, attached to the CQC Report.



- c. Preparatory Phase Checklist: Submit the report in the same manner as the CQC Report for each Preparatory Phase held.
- d. Initial Phase Checklist: Submit the report in the same manner as the CQC Report for each Initial Phase held.
- e. QC Specialist Reports: Submit the report by 10:00 AM the next working day after each day that work is performed.
- f. Field Test Reports: Within two working days after the test is performed, submit the report as an attachment to the CQC Report.
- g. Monthly Summary Report of Tests: Submit the report as an attachment to the CQC Report at the end of each month.
- h. Testing Plan and Log: Submit the report as an attachment to the CQC Report, at the end of each month. Provide a copy of the final Testing Plan and Log to the OMSI preparer for inclusion into the OMSI documentation.
- i. Rework Items List: Submit lists containing new entries daily, in the same manner as the CQC Report.
- j. CQC Meeting Minutes: Within two working days after the meeting is held, submit the report as an attachment to the CQC Report.
- k. QC Certifications: As required by the paragraph entitled "QC Certifications."

#### 1.4 QC PROGRAM REQUIREMENTS

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

##### 1.4.1 Commissioning

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

- a. Verify and document that the applicable equipment and systems are installed in accordance with the design intent as expressed through the Contract and according to the manufacturer's recommendations and industry accepted minimum standards.

- b. Verify and document that equipment and systems receive complete operational checkout by the installing contractors.
- c. Verify and document proper performance of equipment and systems.
- d. Verify that Operation and Maintenance (O&M) documentation is complete.
- e. Verify the Training Plan and training materials are accurate and provide correct instruction and documentation on the critical elements of the products, materials, and systems in the constructed facility. Verify that all identified Government operating personnel are trained.
- f. Verify and document that all contract requirements for LEED fundamental commissioning are met.

#### 1.4.2 Acceptance of the Construction Quality Control (QC) Plan

Acceptance of the QC Plan is required prior to the start of construction. The Contracting Officer reserves the right to require changes in the QC Plan and operations as necessary, including removal of personnel, to ensure the specified quality of work. The Contracting Officer reserves the right to interview any member of the QC organization at any time in order to verify the submitted qualifications. All QC organization personnel are subject to acceptance by the Contracting Officer. The Contracting Officer may require the removal of any individual for non-compliance with quality requirements specified in the Contract.

#### 1.4.3 Preliminary Construction Work Authorized Prior to Acceptance

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

#### 1.4.4 Notification of Changes

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

### 1.5 QC ORGANIZATION

#### 1.5.1 QC Manager

##### 1.5.1.1 Duties

Provide a QC Manager at the work site to implement and manage the QC program. The only duties and responsibilities of the QC Manager are to manage and implement the QC program on this Contract. The QC Manager is required to attend the partnering meetings, QC Plan Meetings, Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control, perform submittal review and certification, ensure testing is performed and provide QC certifications and documentation required in this Contract. The QC Manager is responsible for managing and coordinating the three phases of control and documentation performed by testing laboratory personnel and any other inspection and testing personnel required by this Contract. The QC Manager is the manager of all QC activities.

#### 1.5.1.2 Qualifications

An individual with a minimum of 10 years combined experience in the following positions: Project Superintendent, QC Manager, Project Manager, Project Engineer or Construction Manager on similar size and type construction contracts which included the major trades that are part of this Contract. The individual must have at least two years experience as a QC Manager. The individual must be familiar with the requirements of EM 385-1-1, and have experience in the areas of hazard identification, safety compliance, and sustainability.

A graduate of a four year accredited college or university program in one of the following disciplines: Engineering, Architecture, Construction Management, Engineering Technology, Building Construction, or Building Science, with a minimum of 10 years experience as a Project Superintendent, QC Manager, Project Manager, Project Engineer or Construction Manager on similar size and type construction contracts which included the major trades that are part of this Contract. The individual must have at least two years experience as a QC Manager. The individual must be familiar with the requirements of EM 385-1-1, and have experience in the areas of hazard identification, safety compliance, and sustainability.

#### 1.5.2 Commissioning Authority

##### 1.5.2.1 Duties

Provide a Commissioning Authority (CA) as key person for the Cx and documentation thereof, who is subordinate to the QC Manager. The CA directs and coordinates Cx activities and submits Cx reports to the Contracting Officer to meet the submittal and reporting requirements of Commissioning and develops the commissioning plan. The CA coordinates the actions of the QC Specialists, Testing Laboratory personnel, eOMSI Preparer, and other inspection and testing personnel required by this Contract for building Cx.

##### 1.5.2.2 Qualifications

The CA must be certified as a commissioning professional by the Associated Air Balance Council (AABC) Commissioning Group (ACG), the Association of Energy Engineers (AEE), the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), the Commissioning Process Management Professional (CPMP), the Building Commissioning Association (BCA), the National Environmental Balancing Bureau (NEBB), or the University of Wisconsin - Madison (UWM). CA resume is required, providing education, experience and management capabilities on at least two similar size and type contracts. The CA may not have been involved with the project design, construction management, or supervision, and must be with a third-party firm that is not on the design team.

#### 1.5.3 Construction Quality Management Training

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

#### 1.5.4 Alternate QC Manager Duties and Qualifications

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

#### 1.5.5 Registered Fire Protection Engineer

The U.S. Registered Fire Protection Engineer (FPE) must be an independent third party hired directly by the Prime Contractor as an integral part of the Prime Contractor's Quality Control Organization. This FPE must have no business relationships (owner, partner, operating officer, distributor, salesman, or technical representative) with any subcontractors involved with this project, or with any fire protection equipment device manufacturers, suppliers or installers for any such equipment provided as part of this project. This FPE is responsible for review, approval, and coordination of all fire protection system material submittals, calculations, shop drawings, etc.

### 1.6 QUALITY CONTROL (QC) PLAN

#### 1.6.1 Construction Quality Control (QC) Plan

##### 1.6.1.1 Requirements

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

- a. QC ORGANIZATION: A chart showing the QC organizational structure.
- b. NAMES AND QUALIFICATIONS: Names and qualifications, in resume format, for each person in the QC organization. Include the CQM for Contractors course certifications for the QC Manager and Alternate QC Manager as required by the paragraphs entitled "Construction Quality Management Training" and "Alternate QC Manager Duties and Qualifications".
- c. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL: Duties, responsibilities, and authorities of each person in the QC organization.
- d. OUTSIDE ORGANIZATIONS: A listing of outside organizations, such as architectural and consulting engineering firms, that will be employed by the Contractor and a description of the services these firms will provide.
- e. APPOINTMENT LETTERS: Letters signed by an officer of the firm appointing the QC Manager and Alternate QC Manager and stating that they are responsible for implementing and managing the QC program as described in this Contract. Include in this letter the responsibility of the QC Manager and Alternate QC Manager to implement and manage the three phases of control, and their authority to stop work which is not in compliance with the Contract. Letters of direction are to be issued

by the QC Manager to all other QC Specialists outlining their duties, authorities, and responsibilities. Include copies of the letters in the QC Plan.

- f. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER: Procedures for reviewing, certifying, and managing submittals. Provide the name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to submitting for approval. Provide the initial submittal of the Submittal Register as specified in Section 01 33 00 SUBMITTAL PROCEDURES.
- g. TESTING LABORATORY INFORMATION: Testing laboratory information required by the paragraphs entitled "Accreditation Requirements", as applicable.
- h. TESTING PLAN AND LOG: A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test. Use Government forms to log and track tests.
- i. PROCEDURES TO COMPLETE REWORK ITEMS: Procedures to identify, record, track, and complete rework items. Use Government forms to record and track rework items.
- j. DOCUMENTATION PROCEDURES: Use Government form.
- k. LIST OF DEFINABLE FEATURES: A Definable Feature of Work (DFOW) is a task that is separate and distinct from other tasks and has control requirements and work crews unique to that task. A DFOW is identified by different trades or disciplines and is an item or activity on the construction schedule. Include in the list of DFOWs, but not be limited to, all critical path activities on the construction schedule. Include all activities for which this specification requires QC Specialists or specialty inspection personnel. Provide separate DFOWs in the construction schedule for each design development stage and submittal package.
- l. PROCEDURES FOR PERFORMING THE THREE PHASES OF CONTROL: Identify procedures used to ensure the three phases of control to manage the quality on this project. For each DFOW, a Preparatory and Initial phase checklist will be filled out during the Preparatory and Initial phase meetings. Conduct the Preparatory and Initial Phases and meetings with a view towards obtaining quality construction by planning ahead and identifying potential problems for each DFOW.
- m. PERSONNEL MATRIX: A personnel matrix showing for each section of the specification who will review and certify submittals, who will perform and document the three phases of control, and who will perform and document the testing.
- n. PROCEDURES FOR COMPLETION INSPECTION: Procedures for identifying and documenting the completion inspection process. Include in these procedures the responsible party for punch out inspection, pre-final inspection, and final acceptance inspection.
- o. TRAINING PROCEDURES AND TRAINING LOG: Procedures for coordinating and documenting the training of personnel required by the Contract.
- p. ORGANIZATION AND PERSONNEL CERTIFICATIONS LOG: Procedures for

coordinating, tracking and documenting all certifications on subcontractors, testing laboratories, suppliers, personnel, etc. QC Manager will ensure that certifications are current, appropriate for the work being performed, and will not lapse during any period of the contract that the work is being performed.

#### 1.7 COORDINATION AND MUTUAL UNDERSTANDING MEETING

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

##### 1.7.1 Purpose

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

- a. Waste Management Plan.
- b. IAQ Management Plan.
- c. Procedures for noise and acoustics management.
- d. Environmental Protection Plan.
- e. Environmental regulatory requirements.
- f. Cx Plan.

##### 1.7.2 Coordination of Activities

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

##### 1.7.3 Attendees

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

## 1.8 QC MEETINGS

After the start of construction, conduct weekly QC meetings once every two weeks by the QC Manager at the work site with the Project Superintendent, the CA, and the foremen who are performing the work of the DFOWs. The QC Manager is to prepare the minutes of the meeting and provide a copy to the Contracting Officer within two working days after the meeting. The Contracting Officer may attend these meetings. As a minimum, accomplish the following at each meeting:

- a. Review the minutes of the previous meeting.
- b. Review the schedule and the status of work and rework.
- c. Review the status of submittals.
- d. Review the work to be accomplished in the next two weeks and documentation required.
- e. Resolve QC and production problems (RFI, etc.).
- f. Address items that may require revising the QC Plan.
- g. Review Accident Prevention Plan (APP).
- h. Review environmental requirements and procedures.
- i. Review Waste Management Plan.
- j. Review IAQ Management Plan.
- k. Review Environmental Management Plan.
- l. Review the status of training completion.
- m. Review Cx Plan and progress.

## 1.9 DESIGN REVIEW AND DOCUMENTATION

### 1.9.1 Basis of Design and Design Intent

The CA must review the basis of design received from the Contracting Officer and the design intent. The Basis of Design is not part of the contract documents, but will be provided by the Contracting Officer upon request. Document the Basis of Design review in the Design Review report required below.

### 1.9.2 Design Review

The CA must review design documents to verify that each commissioned system meets the design intent relative to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. Fully document design review in written report.

### 1.9.3 Contract Document Review

The CA must review the Contract documents to verify that Cx is adequately specified, and that each commissioned system is likely to meet the design

intent relative to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. Fully document contract document review in written report.

#### 1.10 THREE PHASES OF CONTROL

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

##### 1.10.1 Preparatory Phase

Notify the Contracting Officer at least two work days in advance of each preparatory phase meeting. The meeting will be conducted by the QC Manager and attended by the Project Superintendent, the CA, and the foreman responsible for the DFOW. When the DFOW will be accomplished by a subcontractor, that subcontractor's foreman must attend the preparatory phase meeting. Document the results of the preparatory phase actions in the daily CQC Report and in the Preparatory Phase Checklist. Perform the following prior to beginning work on each DFOW:

- a. Review each paragraph of the applicable specification sections.
- b. Review the Contract drawings.
- c. Verify that field measurements are as indicated on construction and/or shop drawings before confirming product orders, in order to minimize waste due to excessive materials.
- d. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required.
- e. Review the testing plan and ensure that provisions have been made to provide the required QC testing.
- f. Examine the work area to ensure that the required preliminary work has been completed.
- g. Coordinate the schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- h. Arrange for the return of shipping/packaging materials, such as wood pallets, where economically feasible.
- i. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data and are properly stored.
- j. Discuss specific controls used and construction methods, construction tolerances, workmanship standards, and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DFOW.
- k. Review the APP and appropriate AHA to ensure that applicable safety requirements are met, and that required material Safety Data Sheets (SDS) are submitted.



1. Review the Cx Plan and ensure all preliminary work items have been completed and documented.

#### 1.10.2 Initial Phase

Notify the Contracting Officer at least two work days in advance of each initial phase. When construction crews are ready to start work on a DFOW, conduct the initial phase with the Project Superintendent, and the foreman responsible for that DFOW. Observe the initial segment of the DFOW to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily CQC Report and in the Initial Phase Checklist. Repeat the initial phase for each new crew to work on-site, or when acceptable levels of specified quality are not being met. Perform the following for each DFOW:

- a. Establish level of workmanship and verify that it meets the minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- b. Resolve any workmanship issues.
- c. Ensure that testing is performed by the approved laboratory.
- d. Check work procedures for compliance with the APP and the appropriate AHA to ensure that applicable safety requirements are met.
- e. Review project specific work plans (i.e. Cx, HAZMAT Abatement, Stormwater Management) to ensure all preparatory work items have been completed and documented.

#### 1.10.3 Follow-Up Phase

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

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

#### 1.10.4 Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same DFOW if the quality of on-going work is unacceptable, if there are changes in the applicable QC organization, if there are changes in the on-site production supervision or work crew, if work on a DFOW is resumed after substantial period of inactivity, or if other problems develop.

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

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

#### 1.11 SUBMITTAL REVIEW AND CERTIFICATION

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

#### 1.12 TESTING

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

##### 1.12.1 Accreditation Requirements

Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (E 329, C 1077, D 3666, D 3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing must meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the Corporate Office.

##### 1.12.2 Laboratory Accreditation Authorities

Laboratory Accreditation Authorities include the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology at <http://ts.nist.gov/ts/htdocs/210/214/214.htm>, the American Association of State Highway and Transportation Officials (AASHTO) program at <http://www.amrl.net/amrlsitefinity/default/aap.aspx>, International Accreditation Services, Inc. (IAS) at <http://www.iasonline.org>, U. S. Army Corps of Engineers Materials Testing Center (MTC) at <http://gsl.erdc.usace.army.mil/SL/MTC/>, and the American Association for Laboratory Accreditation (A2LA) program at <http://www.a2la.org/>.

##### 1.12.3 Capability Check

The Contracting Officer retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract.

##### 1.12.4 Test Results

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

tests at the end of each month, in accordance with paragraph INFORMATION FOR THE CONTRACTING OFFICER.

#### 1.12.5 Test Reports and Monthly Summary Report of Tests

Furnish the signed reports, certifications, and a summary report of field tests at the end of each month to the Contracting Officer. Attach a copy of the summary report to the last daily CQC Report of each month. Provide a copy of the signed test reports and certifications to the OMSI preparer for inclusion into the OMSI documentation.

#### 1.13 QC CERTIFICATIONS

##### 1.13.1 CQC Report Certification

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

##### 1.13.2 Invoice Certification

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

##### 1.13.3 Completion Certification

Upon completion of work under this Contract, the QC Manager must furnish a certificate to the Contracting Officer attesting that "the work has been completed, inspected, tested and is in compliance with the Contract." Provide a copy of this final QC Certification for completion to the OMSI preparer for inclusion into the OMSI documentation.

#### 1.14 COMPLETION INSPECTIONS

##### 1.14.1 Punch-Out Inspection

Near the completion of all work or any increment thereof, established by a completion time stated in the Contract Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the QC Manager and the CA must conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings, specifications and Contract. Include in the punch list any remaining items on the "Rework Items List", which were not corrected prior to the Punch-Out Inspection. Include within the punch list the estimated date by which the deficiencies will be corrected. Provide a copy of the punch list to the Contracting Officer. The QC Manager, or staff, must make follow-on inspections to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government "Pre-Final Inspection".

##### 1.14.2 Pre-Final Inspection

The Government and QCM will perform this inspection to verify that the facility is complete and ready to be occupied. A Government "Pre-Final Punch List" will be documented by the QCM as a result of this inspection.

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

#### 1.14.3 Final Acceptance Inspection

Notify the Contracting Officer at least 14 calendar days prior to the date a final acceptance inspection can be held. State within the notice that all items previously identified on the pre-final punch list will be corrected and acceptable, along with any other unfinished Contract work, by the date of the final acceptance inspection. The Contractor must be represented by the QC Manager, the Project Superintendent, the CA, and others deemed necessary. Attendees for the Government will include the Contracting Officer, other FEAD personnel, and personnel representing the Client. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the Contract Clause entitled "Inspection of Construction."

#### 1.15 DOCUMENTATION

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

##### 1.15.1 Construction Documentation

Reports are required for each day that work is performed and must be attached to the CQC Report prepared for the same day. Maintain current and complete records of on-site and off-site QC program operations and activities. The forms identified under the paragraph "INFORMATION FOR THE CONTRACTING OFFICER" will be used. Reports are required for each day work is performed. Account for each calendar day throughout the life of the Contract. Every space on the forms must be filled in. Use N/A if nothing can be reported in one of the spaces. The Project Superintendent and the QC Manager must prepare and sign the Contractor Production and CQC Reports, respectively. The reporting of work must be identified by terminology consistent with the construction schedule. In the "remarks" sections of the reports, enter pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site, QC problem areas, deviations from the QC Plan, construction deficiencies encountered, meetings held. For each entry in the report(s), identify the Schedule Activity No. that is associated with the entered remark.

##### 1.15.2 Quality Control Validation

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

- a. All completed Preparatory and Initial Phase Checklists, arranged by specification section.
- b. All milestone inspections, arranged by Activity Number.

- c. An up-to-date copy of the Testing Plan and Log with supporting field test reports, arranged by specification section.
- d. Copies of all contract modifications, arranged in numerical order. Also include documentation that modified work was accomplished.
- e. An up-to-date copy of the Rework Items List.
- f. Maintain up-to-date copies of all punch lists issued by the QC staff to the Contractor and Sub-Contractors and all punch lists issued by the Government.
- g. Commissioning documentation including Cx checklists, schedules, tests, and reports.

#### 1.15.3 Testing Plan and Log

As tests are performed, the CA and the QC Manager will record on the "Testing Plan and Log" the date the test was performed and the date the test results were forwarded to the Contracting Officer. Attach a copy of the updated "Testing Plan and Log" to the last daily CQC Report of each month, per the paragraph "INFORMATION FOR THE CONTRACTING OFFICER". Provide a copy of the final "Testing Plan and Log" to the OMSI preparer for inclusion into the OMSI documentation.

#### 1.15.4 Rework Items List

The QC Manager must maintain a list of work that does not comply with the Contract, identifying what items need to be reworked, the date the item was originally discovered, the date the item will be corrected by, and the date the item was corrected. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the "Rework Items List" to the last daily CQC Report of each month. The Contractor is responsible for including those items identified by the Contracting Officer.

#### 1.15.5 As-Built Drawings

The QC Manager is required to ensure the as-built drawings, required by Section 01 78 00 CLOSEOUT SUBMITTALS are kept current on a daily basis and marked to show deviations which have been made from the Contract drawings. Ensure each deviation has been identified with the appropriate modifying documentation (e.g. PC No., Modification No., Request for Information No., etc.). The QC Manager must initial each revision. Upon completion of work, the QC Manager will furnish a certificate attesting to the accuracy of the as-built drawings prior to submission to the Contracting Officer.

#### 1.16 NOTIFICATION ON NON-COMPLIANCE

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

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

## 3.1 PREPARATION

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

-- End of Section --

## SECTION 01 50 00

## TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS

08/09

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511 (2007) Standard for Reduced-Pressure  
Principle Backflow Prevention Assembly

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH  
(FCCCHR)

FCCCHR List (continuously updated) List of Approved  
Backflow Prevention Assemblies

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

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

NFPA 70 (2017) National Electrical Code

## U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1 (2015; Rev L) Obstruction Marking and  
Lighting

## U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD (2009) Manual on Uniform Traffic Control  
Devices

## 1.2 SUBMITTALS

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

## SD-01 Preconstruction Submittals

Construction Site Plan  
Traffic Control Plan

## SD-07 Certificates

Backflow Tester Certification  
Backflow Preventers Certificate of Full Approval

### 1.3 CONSTRUCTION SITE PLAN

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

### 1.4 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.

#### 1.4.1 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.

#### 1.4.2 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.

### 1.5 HURRICANE CONDITION OF READINESS

Unless directed otherwise, comply with:

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



- c. Condition TWO (Sustained winds of 50 knots or greater expected within 24 hours): Curtail or cease routine activities until securing operation is complete. Reinforce or remove form work and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact Contracting Officer for weather and Condition of Readiness (COR) updates and completion of required actions.
- d. Condition ONE. (Sustained winds of 50 knots or greater expected within 12 hours): Secure the jobsite, and leave Government premises.

## PART 2 PRODUCTS

### 2.1 TEMPORARY SIGNAGE

#### 2.1.1 Bulletin Board

Immediately upon beginning of work, provide a weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer.

### 2.2 TEMPORARY TRAFFIC CONTROL

#### 2.2.1 Haul Roads

Construct access and haul roads necessary for proper prosecution of the work under this contract. Construct with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic are to be avoided. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, must be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads are subject to approval by the Contracting Officer. Lighting must be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations.

#### 2.2.2 Barricades

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

#### 2.2.3 Fencing

Provide fencing along the construction site at all open excavations and tunnels to control access by unauthorized people.

- a. The safety fencing must be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 48 inches high and maximum mesh size of 2 inches, supported and tightly secured to steel posts located on maximum 10 foot centers, constructed at the approved location. Install fencing to be able to restrain a force of

at least 250 pounds against it.

### 2.3 TEMPORARY WIRING

Provide temporary wiring in accordance with NFPA 241 and NFPA 70. Include frequent inspection of all equipment and apparatus.

### 2.4 BACKFLOW PREVENTERS

Reduced pressure principle type conforming to the applicable requirements AWWA C511. Provide backflow preventers complete with flanged , mounted gate valve. The particular make, model/design, and size of backflow preventers to be installed must be included in the latest edition of the List of Approved Backflow Prevention Assemblies issued by the FCCCHR List and be accompanied by a Certificate of Full Approval from FCCCHR List.

## PART 3 EXECUTION

### 3.1 EMPLOYEE PARKING

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

### 3.2 TEMPORARY BULLETIN BOARD

Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer.

### 3.3 AVAILABILITY AND USE OF UTILITY SERVICES

#### 3.3.1 Temporary Utilities

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

#### 3.3.2 Sanitation

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

#### 3.3.3 Telephone

Make arrangements and pay all costs for telephone facilities desired.

### 3.3.4 Obstruction Lighting of Cranes

Provide a minimum of 2 aviation red or high intensity white obstruction lights on temporary structures (including cranes) over 100 feet above ground level. Light construction and installation must comply with FAA AC 70/7460-1. Lights must be operational during periods of reduced visibility, darkness, and as directed by the Contracting Officer.

### 3.3.5 Fire Protection

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

## 3.4 TRAFFIC PROVISIONS

### 3.4.1 Maintenance of Traffic

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

### 3.4.2 Protection of Traffic

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

### 3.4.3 Rush Hour Restrictions

Do not interfere with the peak traffic flows preceding and during normal operations without notification to and approval by the Contracting Officer.

#### 3.4.4 Dust Control

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

### 3.5 CONTRACTOR'S TEMPORARY FACILITIES

#### 3.5.1 Safety

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

#### 3.5.2 Storage Area

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

#### 3.5.3 Supplemental Storage Area

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

#### 3.5.4 Appearance of Trailers

- a. Trailers utilized by the Contractor for administrative or material storage purposes must present a clean and neat exterior appearance and be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on installation property.

#### 3.5.5 Maintenance of Storage Area

- a. Keep fencing in a state of good repair and proper alignment. Grassed or unpaved areas, which are not established roadways, will be covered

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

#### 3.5.6 Security Provisions

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

#### 3.5.7 Weather Protection of Temporary Facilities and Stored Materials

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

##### 3.5.7.1 Building and Site Storm Protection

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

#### 3.6 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, furnish and erect temporary project safety fencing at the work site. Maintain the safety fencing during the life of the contract and, upon completion and acceptance of the work, will become the property of the Contractor and be removed from the work site.

#### 3.7 CLEANUP

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

#### 3.8 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and any other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence that will become the property of the Contractor.

Restore areas used by the Contractor for the storage of equipment or material, or other use to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary.

-- End of Section --

## SECTION 01 57 19

## TEMPORARY ENVIRONMENTAL CONTROLS

11/15

## PART 1 GENERAL

## 1.1 REFERENCES

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

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

|                 |  |
|-----------------|--|
| 29 CFR 1910.120 | Hazardous Waste Operations and Emergency Response  |
| 40 CFR 112      | Oil Pollution Prevention   |
| 40 CFR 241      | Guidelines for Disposal of Solid Waste   |
| 40 CFR 243      | Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste              |
| 40 CFR 258      | Subtitle D Landfill Requirements   |
| 40 CFR 260      | Hazardous Waste Management System: General   |
| 40 CFR 261      | Identification and Listing of Hazardous Waste  |
| 40 CFR 261.7    | Residues of Hazardous Waste in Empty Containers  |
| 40 CFR 262      | Standards Applicable to Generators of Hazardous Waste  |
| 40 CFR 262.31   | Standards Applicable to Generators of Hazardous Waste-Labeling   |
| 40 CFR 262.34   | Standards Applicable to Generators of Hazardous Waste-Accumulation Time  |
| 40 CFR 263      | Standards Applicable to Transporters of Hazardous Waste  |
| 40 CFR 264      | Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities                |
| 40 CFR 265      | Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities |
| 40 CFR 266      | Standards for the Management of Specific Hazardous Wastes and Specific Types of                                  |

|                |  |
|----------------|--|
|                | Hazardous Waste Management Facilities  |
| 40 CFR 268     | Land Disposal Restrictions   |
| 40 CFR 273     | Standards For Universal Waste Management   |
| 40 CFR 273.2   | Standards for Universal Waste Management - Batteries   |
| 40 CFR 273.4   | Standards for Universal Waste Management - Mercury Containing Equipment  |
| 40 CFR 273.5   | Standards for Universal Waste Management - Lamps   |
| 40 CFR 279     | Standards for the Management of Used Oil   |
| 40 CFR 300     | National Oil and Hazardous Substances Pollution Contingency Plan   |
| 40 CFR 300.125 | National Oil and Hazardous Substances Pollution Contingency Plan - Notification and Communications   |
| 40 CFR 355     | Emergency Planning and Notification  |
| 40 CFR 50      | National Primary and Secondary Ambient Air Quality Standards   |
| 40 CFR 60      | Standards of Performance for New Stationary Sources  |
| 40 CFR 63      | National Emission Standards for Hazardous Air Pollutants for Source Categories   |
| 40 CFR 64      | Compliance Assurance Monitoring  |
| 40 CFR 745     | Lead-Based Paint Poisoning Prevention in Certain Residential Structures  |
| 49 CFR 171     | General Information, Regulations, and Definitions  |
| 49 CFR 172     | Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements |
| 49 CFR 173     | Shippers - General Requirements for Shipments and Packagings   |
| 49 CFR 178     | Specifications for Packagings  |

## 1.2 DEFINITIONS

### 1.2.1 Class I and II Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act. A list of Class I ODS can be found on the EPA website at the following weblink.



<http://www.epa.gov/ozone/science/ods/classone.html>.

Class II ODS is defined in Section 602(s) of The Clean Air Act. A list of Class II ODS can be found on the EPA website at the following weblink.

<http://www.epa.gov/ozone/science/ods/classtwo.html>.

#### 1.2.2 Contractor Generated Hazardous Waste

Contractor generated hazardous waste is materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene), waste thinners, excess paints, excess solvents, waste solvents, excess pesticides, and contaminated pesticide equipment rinse water.

#### 1.2.3 Electronics Waste

Electronics waste is discarded electronic devices intended for salvage, recycling, or disposal.

#### 1.2.4 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally or historically.

#### 1.2.5 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

#### 1.2.6 Hazardous Debris

As defined in paragraph SOLID WASTE, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore structure) in accordance with 40 CFR 261. Hazardous debris also includes debris that exhibits a characteristic of hazardous waste in accordance with 40 CFR 261.

#### 1.2.7 Hazardous Materials

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

Hazardous material is any material that: Is regulated as a hazardous material in accordance with 49 CFR 173; or requires a Safety Data Sheet (SDS) in accordance with 29 CFR 1910.120; or during end use, treatment, handling, packaging, storage, transportation, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by 40 CFR 261 Subparts A, B, C, or D. Designation of a material by this definition, when separately regulated or

controlled by other sections or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this section for "control" purposes. Such material includes ammunition, weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, medical waste and infectious materials, bulk fuels, radioactive materials, and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs).

#### 1.2.8 Hazardous Waste

Hazardous Waste is any material that meets the definition of a solid waste and exhibit a hazardous characteristic (ignitability, corrosivity, reactivity, or toxicity) as specified in 40 CFR 261, Subpart C, or contains a listed hazardous waste as identified in 40 CFR 261, Subpart D.

#### 1.2.9 Land Application

Land Application means spreading or spraying discharge water at a rate that allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" must occur. Comply with federal, state, and local laws and regulations.

#### 1.2.10 Municipal Separate Storm Sewer System (MS4) Permit

MS4 permits are those held by installations to obtain NPDES permit coverage for their stormwater discharges.

#### 1.2.11 National Pollutant Discharge Elimination System (NPDES)

The NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

#### 1.2.12 Oily Waste

Oily waste are those materials that are, or were, mixed with Petroleum, Oils, and Lubricants (POLs) and have become separated from that POLs. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, POLs and may be appropriately tested and discarded in a manner which is in compliance with other state and local requirements.

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land filled provided that: It is not prohibited in other state regulations or local ordinances; the amount generated is "de minimus" (a small amount); it is the result of minor leaks or spills resulting from normal process operations; and free-flowing oil has been removed to the practicable extent possible. Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, perform a hazardous waste determination prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

### 1.2.13 Regulated Waste

Regulated waste are solid wastes that have specific additional federal, state, or local controls for handling, storage, or disposal.

### 1.2.14 Sediment

Sediment is soil and other debris that have eroded and have been transported by runoff water or wind.

### 1.2.15 Solid Waste

Solid waste is a solid, liquid, semi-solid or contained gaseous waste. A solid waste can be a hazardous waste, non-hazardous waste, or non-Resource Conservation and Recovery Act (RCRA) regulated waste. Types of solid waste typically generated at construction sites may include:

#### 1.2.15.1 Debris

Debris is non-hazardous solid material generated during the construction, demolition, or renovation of a structure that exceeds 2.5-inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (for example, cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.

#### 1.2.15.2 Green Waste

Green waste is the vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.

#### 1.2.15.3 Material not regulated as solid waste

Material not regulated as solid waste is nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

#### 1.2.15.4 Non-Hazardous Waste

Non-hazardous waste is waste that is excluded from, or does not meet, hazardous waste criteria in accordance with 40 CFR 263.

#### 1.2.15.5 Recyclables

Recyclables are materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable, wiring, insulated/non-insulated copper wire cable, wire rope, and structural components. It also includes commercial-grade refrigeration equipment with Freon removed, household

appliances where the basic material content is metal, clean polyethylene terephthalate bottles, cooking oil, used fuel oil, textiles, high-grade paper products and corrugated cardboard, stackable pallets in good condition, clean crating material, and clean rubber/vehicle tires. Metal meeting the definition of lead contaminated or lead based paint contaminated may be included as recyclable if sold to a scrap metal company. Paint cans that meet the definition of empty containers in accordance with 40 CFR 261.7 may be included as recyclable if sold to a scrap metal company.

#### 1.2.15.6 Surplus Soil

Surplus soil is existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars, and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included and must be managed in accordance with paragraph HAZARDOUS MATERIAL MANAGEMENT.

#### 1.2.15.7 Scrap Metal

This includes scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe, and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

#### 1.2.15.8 Wood

Wood is dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included. Treated wood includes, but is not limited to, lumber, utility poles, crossties, and other wood products with chemical treatment.

#### 1.2.16 Surface Discharge

Surface discharge means discharge of water into drainage ditches, storm sewers, creeks or "waters of the United States". Surface discharges are discrete, identifiable sources and require a permit from the governing agency. Comply with federal, state, and local laws and regulations.

#### 1.2.17 Wastewater

Wastewater is the used water and solids from a community that flow to a treatment plant.

##### 1.2.17.1 Stormwater

Stormwater is any precipitation in an urban or suburban area that does not evaporate or soak into the ground, but instead collects and flows into storm drains, rivers, and streams.

#### 1.2.18 Waters of the United States

Waters of the United States means Federally jurisdictional waters, including wetlands, that are subject to regulation under Section 404 of the Clean Water Act or navigable waters, as defined under the Rivers and Harbors Act.

### 1.2.19 Wetlands

Wetlands are those 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.

### 1.2.20 Universal Waste

The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (for example, thermostats), and lamps (for example, fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal. These regulations can be found at 40 CFR 273.

## 1.3 SUBMITTALS

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

### SD-01 Preconstruction Submittals

- Preconstruction Survey
- Solid Waste Management Permit
- Regulatory Notifications
- Environmental Protection Plan
- Dirt and Dust Control Plan
- Employee Training Records
- Environmental Manager Qualifications

### SD-06 Test Reports

- Solid Waste Management Report

### SD-07 Certificates

- Employee Training Records
- ECATTS Certificate Of Completion

### SD-11 Closeout Submittals

- Waste Determination Documentation
- Disposal Documentation for Hazardous and Regulated Waste
- Assembled Employee Training Records
- Solid Waste Management Permit
- Solid Waste Management Report
- Contractor Hazardous Material Inventory Log
- Hazardous Waste/Debris Management
- Regulatory Notifications
- Sales Documentation
- Contractor Certification

## 1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during 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. Protect the environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire duration of this Contract. Comply with federal, state, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

Tests and procedures assessing whether construction operations comply with Applicable Environmental Laws may be required. Analytical work must be performed by qualified laboratories; and where required by law, the laboratories must be certified.

#### 1.4.1 Training in Environmental Compliance Assessment Training and Tracking System (ECATTS)

##### 1.4.1.1 Personnel Requirements

The Environmental Manager is responsible for environmental compliance on projects. The Environmental Manager must complete applicable ECATTS training modules (installation specific or general) prior to starting respective portions of on-site work under this Contract. If personnel changes occur for any of these positions after starting work, replacement personnel must complete applicable ECATTS training within 14 days of assignment to the project.

##### 1.4.1.2 Certification

Submit an ECATTS certificate of completion for personnel who have completed the required ECATTS training. This training is web-based and can be accessed from any computer with Internet access using the following instructions.

Register for NAVFAC Environmental Compliance Training and Tracking System, by logging on to <https://environmentaltraining.ecatts.com/>. Obtain the password for registration from the Contracting Officer.

##### 1.4.1.3 Refresher Training

This training has been structured to allow contractor personnel to receive credit under this contract and to carry forward credit to future contracts. Ensure the Environmental Manager review their training plans for new modules or updated training requirements prior to beginning work. Some training modules are tailored for specific state regulatory requirements; therefore, Contractors working in multiple states will be required to retake modules tailored to the state where the contract work is being performed.

#### 1.4.2 Conformance with the Environmental Management System

Perform work under this contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). Perform work in a manner that conforms to objectives and targets of the environmental programs and operational controls identified by the EMS. Support Government personnel when environmental compliance and EMS audits are conducted by escorting auditors at the Project site, answering questions, and providing proof of records being maintained. Provide monitoring and measurement information as necessary to address

environmental performance relative to environmental, energy, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, take corrective and preventative actions. In addition, employees must be aware of their roles and responsibilities under the installation EMS and of how these EMS roles and responsibilities affect work performed under the contract.

Coordinate with the installation's EMS coordinator to identify training needs associated with environmental aspects and the EMS, and arrange training or take other action to meet these needs. Provide training documentation to the Contracting Officer. The Installation Environmental Office will retain associated environmental compliance records. Make EMS Awareness training completion certificates available to Government auditors during EMS audits and include the certificates in the Employee Training Records. See paragraph EMPLOYEE TRAINING RECORDS.

## 1.5 QUALITY ASSURANCE

### 1.5.1 Preconstruction Survey and Protection of Features

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, perform a Preconstruction Survey of the project site with the Contracting Officer, and take photographs showing existing environmental conditions in and adjacent to the site. Submit a report for the record. Include in the report a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. The Contractor and the Contracting Officer will sign this survey report upon mutual agreement regarding its accuracy and completeness. Protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference that their preservation may cause to the work under the Contract.

### 1.5.2 Regulatory Notifications

Provide regulatory notification requirements in accordance with federal, state and local regulations. In cases where the Government will also provide public notification (such as stormwater permitting), coordinate with the Contracting Officer. Submit copies of regulatory notifications to the Contracting Officer at least 15 days prior to commencement of work activities. Typically, regulatory notifications must be provided for the following (this listing is not all-inclusive): demolition, renovation, NPDES defined site work, construction, removal or use of a permitted air emissions source, and remediation of controlled substances (asbestos, hazardous waste, lead paint).

### 1.5.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting. Provide the following information: types, quantities, and use of hazardous materials that will be brought onto the installation; and types and quantities of wastes/wastewater that may be generated during the Contract. Discuss the results of the Preconstruction Survey at this time.

Prior to initiating any work on site, meet with the Contracting Officer and installation Environmental Office to discuss the proposed Environmental Protection Plan (EPP). Develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural and cultural resources, required reports, required permits, permit requirements (such as mitigation measures), and other measures to be taken.

#### 1.5.4 Environmental Manager

Appoint in writing an Environmental Manager for the project site. The Environmental Manager is directly responsible for coordinating contractor compliance with federal, state, local, and installation requirements. The Environmental Manager must ensure compliance with Hazardous Waste Program requirements (including hazardous waste handling, storage, manifesting, and disposal); implement the EPP; ensure environmental permits are obtained, maintained, and closed out; ensure compliance with Stormwater Program requirements; ensure compliance with Hazardous Materials (storage, handling, and reporting) requirements; and coordinate any remediation of regulated substances (lead, asbestos, PCB transformers). This can be a collateral position; however, the person in this position must be trained to adequately accomplish the following duties: ensure waste segregation and storage compatibility requirements are met; inspect and manage Satellite Accumulation areas; ensure only authorized personnel add wastes to containers; ensure Contractor personnel are trained in 40 CFR requirements in accordance with their position requirements; coordinate removal of waste containers; and maintain the Environmental Records binder and required documentation, including environmental permits compliance and close-out. Submit Environmental Manager Qualifications to the Contracting Officer.

#### 1.5.5 Employee Training Records

Prepare and maintain Employee Training Records throughout the term of the contract meeting applicable 40 CFR requirements. Provide Employee Training Records in the Environmental Records Binder. Submit these Assembled Employee Training Records to the Contracting Officer at the conclusion of the project, unless otherwise directed.

Train personnel to meet EPA and state requirements. Conduct environmental protection/pollution control meetings for personnel prior to commencing construction activities. Conduct additional meetings for new personnel and when site conditions change. Include in the training and meeting agenda: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, waters of the United States, and endangered species and their habitat that are known to be in the area.

#### 1.5.6 Non-Compliance Notifications

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with federal, state or local environmental laws or regulations, permits, and other elements of the Contractor's EPP. After receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time



extensions will be granted or equitable adjustments allowed for any such suspensions. This is in addition to any other actions the Contracting Officer may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

#### 1.6 ENVIRONMENTAL PROTECTION PLAN

The purpose of the EPP is to present an overview of known or potential environmental issues that must be considered and addressed during construction. Incorporate construction related objectives and targets from the installation's EMS into the EPP. Include in the EPP measures for protecting natural and cultural resources, required reports, and other measures to be taken. Meet with the Contracting Officer or Contracting Officer Representative to discuss the EPP and develop a mutual understanding relative to the details for environmental protection including measures for protecting natural resources, required reports, and other measures to be taken. Submit the EPP within 15 days after notice to proceed and not less than 10 days before the preconstruction meeting. Revise the EPP throughout the project to include any reporting requirements, changes in site conditions, or contract modifications that change the project scope of work in a way that could have an environmental impact. No requirement in this section will relieve the Contractor of any applicable federal, state, and local environmental protection laws and regulations. During Construction, identify, implement, and submit for approval any additional requirements to be included in the EPP. Maintain the current version onsite.

The EPP includes, but is not limited to, the following elements:

##### 1.6.1 General Overview and Purpose

###### 1.6.1.1 Descriptions

A brief description of each specific plan required by environmental permit or elsewhere in this Contract such as traffic control plan Hazardous, Toxic and Radioactive Waste (HTRW) Plan.

###### 1.6.1.2 Duties

The duties and level of authority assigned to the person(s) on the job site who oversee environmental compliance, such as who is responsible for adherence to the EPP, who is responsible for spill cleanup and training personnel on spill response procedures, who is responsible for manifesting hazardous waste to be removed from the site (if applicable), and who is responsible for training the Contractor's environmental protection personnel.

###### 1.6.1.3 Procedures

A copy of any standard or project-specific operating procedures that will be used to effectively manage and protect the environment on the project site.

###### 1.6.1.4 Communications

Communication and training procedures that will be used to convey environmental management requirements to Contractor employees and subcontractors.

#### 1.6.1.5 Contact Information

Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

#### 1.6.2 General Site Information

##### 1.6.2.1 Drawings

Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, jurisdictional wetlands, material storage areas, structures, sanitary facilities, storm drains and conveyances, and stockpiles of excess soil.

##### 1.6.2.2 Work Area

Work area plan showing the proposed activity in each portion of the area and identify the areas of limited use or nonuse. Include measures for marking the limits of use areas, including methods for protection of features to be preserved within authorized work areas and methods to control runoff and to contain materials on site, and a traffic control plan.

##### 1.6.2.3 Documentation

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

#### 1.6.3 Management of Natural Resources

- a. Land resources
- b. Tree protection
- c. Replacement of damaged landscape features
- d. Temporary construction
- e. Stream crossings
- f. Fish and wildlife resources
- g. Wetland areas

#### 1.6.4 Protection of Historical and Archaeological Resources

- a. Objectives
- b. Methods

#### 1.6.5 Stormwater Management and Control

- a. Ground cover
- b. Erodible soils
- c. Temporary measures
  - (1) Structural Practices
  - (2) Temporary and permanent stabilization
- d. Effective selection, implementation and maintenance of Best Management Practices (BMPs).

#### 1.6.6 Protection of the Environment from Waste Derived from Contractor Operations

Control and disposal of solid and sanitary waste. Control and disposal of

hazardous waste.

This item consist of the management procedures for hazardous waste to be generated. The elements of those procedures will coincide with the Installation Hazardous Waste Management Plan. The Contracting Officer will provide a copy of the Installation Hazardous Waste Management Plan. As a minimum, include the following:

- a. List of the types of hazardous wastes expected to be generated
- b. Procedures to ensure a written waste determination is made for appropriate wastes that are to be generated
- c. Sampling/analysis plan, including laboratory method(s) that will be used for waste determinations and copies of relevant laboratory certifications
- d. Methods and proposed locations for hazardous waste accumulation/storage (that is, in tanks or containers)
- e. Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted)
- f. Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268)
- g. Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and similar
- h. Used oil management procedures in accordance with 40 CFR 279; Hazardous waste minimization procedures
- i. Plans for the disposal of hazardous waste by permitted facilities; and Procedures to be employed to ensure required employee training records are maintained.

#### 1.6.7 Prevention of Releases to the Environment

Procedures to prevent releases to the environment

Notifications in the event of a release to the environment

#### 1.6.8 Regulatory Notification and Permits

List what notifications and permit applications must be made. Some permits require up to 180 days to obtain. Demonstrate that those permits have been obtained or applied for by including copies of applicable environmental permits. The EPP will not be approved until the permits have been obtained.

#### 1.6.9 Clean Air Act Compliance

##### 1.6.9.1 Haul Route

Submit truck and material haul routes along with a Dirt and Dust Control Plan for controlling dirt, debris, and dust on Installation roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

#### 1.6.9.2 Pollution Generating Equipment

Identify air pollution generating equipment or processes that may require federal, state, or local permits under the Clean Air Act. Determine requirements based on any current installation permits and the impacts of the project. Provide a list of all fixed or mobile equipment, machinery or operations that could generate air emissions during the project to the Installation Environmental Office (Air Program Manager).

#### 1.6.9.3 Stationary Internal Combustion Engines

Identify portable and stationary internal combustion engines that will be supplied, used or serviced. Comply with 40 CFR 60 Subpart IIII, 40 CFR 60 Subpart JJJJ, 40 CFR 63 Subpart ZZZZ, and local regulations as applicable. At minimum, include the make, model, serial number, manufacture date, size (engine brake horsepower), and EPA emission certification status of each engine. Maintain applicable records and log hours of operation and fuel use. Logs must include reasons for operation and delineate between emergency and non-emergency operation.

#### 1.6.9.4 Refrigerants

Identify management practices to ensure that heating, ventilation, and air conditioning (HVAC) work involving refrigerants complies with 40 CFR 82 requirements. Technicians must be certified, maintain copies of certification on site, use certified equipment and log work that requires the addition or removal of refrigerant. Any refrigerant reclaimed is the property of the Government, coordinate with the Installation Environmental Office to determine the appropriate turn in location.

#### 1.6.9.5 Air Pollution-engineering Processes

Identify planned air pollution-generating processes and management control measures (including, but not limited to, spray painting, abrasive blasting, demolition, material handling, fugitive dust, and fugitive emissions). Log hours of operations and track quantities of materials used.

#### 1.6.9.6 Compliant Materials

Provide the Government a list of and SDSs for all hazardous materials proposed for use on site. Materials must be compliant with all Clean Air Act regulations for emissions including solvent and volatile organic compound contents, and applicable National Emission Standards for Hazardous Air Pollutants requirements. The Government may alter or limit use of specific materials as needed to meet installation permit requirements for emissions.

### 1.7 LICENSES AND PERMITS

Obtain licenses and permits required for the construction of the project and in accordance with FAR 52.236-7. Notify the Government of all general use permitted equipment the Contractor plans to use on site. This paragraph supplements the Contractor's responsibility under FAR 52.236-7.

### 1.8 ENVIRONMENTAL RECORDS BINDER

Maintain on-site a separate three-ring Environmental Records Binder and submit at the completion of the project. Make separate parts within the

binder that correspond to each submittal listed under paragraph CLOSEOUT SUBMITTALS in this section.

#### 1.9 SOLID WASTE MANAGEMENT PERMIT

Provide the Contracting Officer with written notification of the quantity of anticipated solid waste or debris that is anticipated or estimated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance from the receiving location or as applicable; submit one copy of the receiving location state and local Solid Waste Management Permit or license showing such agency's approval of the disposal plan before transporting wastes off Government property.

##### 1.9.1 Solid Waste Management Report

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the definitions provided in this section), amount, location, and name of the business receiving the solid waste.

#### 1.10 FACILITY HAZARDOUS WASTE GENERATOR STATUS

Marine Corps Air Station Cherry Point is designated as a Large Quantity Generator. Meet the regulatory requirements of this generator designation for any work conducted within the boundaries of this Installation. Comply with provisions of federal, state, and local regulatory requirements applicable to this generator status regarding training and storage, handling, and disposal of construction derived wastes.

#### PART 2 PRODUCTS

Not Used

#### PART 3 EXECUTION

##### 3.1 PROTECTION OF NATURAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants, including their habitats. Prior to the commencement of activities, consult with the Installation Environmental Office, regarding rare species or sensitive habitats that need to be protected. The protection of rare, threatened, and endangered animal and plant species identified, including their habitats, is the Contractor's responsibility.

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work that is consistent with the requirements of the Installation Environmental Office or as otherwise specified. Confine construction activities to within the limits of the work indicated or specified.

##### 3.1.1 Flow Ways

Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as specified and permitted.

### 3.1.2 Vegetation

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officer's permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use of attached ropes, cables, or guys is authorized, the Contractor is responsible for any resultant damage.

Protect existing trees that are to remain to ensure they are not injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. Coordinate with the Contracting Officer and Installation Environmental Office to determine appropriate action for trees and other landscape features scarred or damaged by equipment operations.

### 3.1.3 Streams

Stream crossings must allow movement of materials or equipment without violating water pollution control standards of the federal, state, and local governments. Construction of stream crossing structures must be in compliance with any required permits including, but not limited to, Clean Water Act Section 404, and Section 401 Water Quality.

The Contracting Officer's approval and appropriate permits are required before any equipment will be permitted to ford live streams. In areas where frequent crossings are required, install temporary culverts or bridges. Obtain Contracting Officer's approval prior to installation. Remove temporary culverts or bridges upon completion of work, and repair the area to its original condition unless otherwise required by the Contracting Officer.

## 3.2 STORMWATER

Do not discharge stormwater from construction sites to the sanitary sewer. If the water is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization in advance from the Installation Environmental Office for any release of contaminated water.

### 3.2.1 Erosion and Sediment Control Measures

Provide erosion and sediment control measures in accordance with state and local laws and regulations. Preserve vegetation to the maximum extent practicable.

Erosion control inspection reports may be compiled as part of a stormwater pollution prevention plan inspection reports.

### 3.2.2 Work Area Limits

Mark the areas that need not be disturbed under this Contract prior to commencing construction activities. Mark or fence isolated areas within the general work area that are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, any markers must be visible in the dark. Personnel must be knowledgeable of the purpose for marking and protecting particular objects.

### 3.2.3 Contractor Facilities and Work Areas

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Contracting Officer. Move or relocate the Contractor facilities only when approved by the Government. Provide erosion and sediment controls for onsite borrow and spoil areas to prevent sediment from entering nearby waters. Control temporary excavation and embankments for plant or work areas to protect adjacent areas.

### 3.2.4 Municipal Separate Storm Sewer System (MS4) Management

Comply with the Installation's MS4 permit requirements.

## 3.3 SURFACE AND GROUNDWATER

### 3.3.1 Cofferdams, Diversions, and Dewatering

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure must be constantly controlled to maintain compliance with existing state water quality standards and designated uses of the surface water body. Comply with the State of North Carolina water quality standards and anti-degradation provisions. Do not discharge excavation ground water to the sanitary sewer, storm drains, or to surface waters without prior specific authorization in writing from the Installation Environmental Office. Discharge of hazardous substances will not be permitted under any circumstances. Use sediment control BMPs to prevent construction site runoff from directly entering any storm drain or surface waters.

If the construction dewatering is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization for any contaminated groundwater release in advance from the Installation Environmental Officer and the federal or state authority, as applicable. Discharge of hazardous substances will not be permitted under any circumstances.

### 3.3.2 Waters of the United States

Do not enter, disturb, destroy, or allow discharge of contaminants into waters of the United States.

## 3.4 AIR RESOURCES

Equipment operation, activities, or processes will be in accordance with 40 CFR 64 and state air emission and performance laws and standards.

### 3.4.1 Burning

Burning is prohibited on the Government premises.

### 3.4.2 EPA Certification Requirements

Heating and air conditioning technicians must be certified through an EPA-approved program. Maintain copies of certifications at the employees' places of business; technicians must carry certification wallet cards, as provided by environmental law.

### 3.4.3 Dust Control

Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster.

#### 3.4.3.1 Particulates

Dust particles, aerosols and gaseous by-products from construction activities, and processing and preparation of materials (such as from asphaltic batch plants) must be controlled at all times, including weekends, holidays, and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates that would exceed 40 CFR 50, state, and local air pollution standards or that would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators, or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp. Provide sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a particulate nuisance or hazard occurs. Comply with state and local visibility regulations.

#### 3.4.3.2 Abrasive Blasting

Blasting operations cannot be performed without prior approval of the Installation Air Program Manager. The use of silica sand is prohibited in sandblasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive agent, paint chips, and other debris.

#### 3.4.4 Odors

Control odors from construction activities. The odors must be in compliance with state regulations and local ordinances and may not constitute a health hazard.

### 3.5 WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of waste. Include procedures for pollution prevention/ hazardous waste minimization in the Hazardous Waste Management Section of the EPP. Obtain a copy of the installation's Pollution Prevention/Hazardous Waste Minimization Plan for reference material when preparing this part of the EPP. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the anticipated types of the hazardous materials to be used in the construction when requesting information.



### 3.5.1 Salvage, Reuse and Recycle

Identify anticipated materials and waste for salvage, reuse, and recycling. Describe actions to promote material reuse, resale or recycling. To the extent practicable, all scrap metal must be sent for reuse or recycling and will not be disposed of in a landfill.

Include the name, physical address, and telephone number of the hauler, if transported by a franchised solid waste hauler. Include the destination and, unless exempted, provide a copy of the state or local permit (cover) or license for recycling.

### 3.5.2 Nonhazardous Solid Waste Diversion Report

Maintain an inventory of nonhazardous solid waste diversion and disposal of construction and demolition debris. Submit a report to the Contracting Officer on the first working day after each fiscal year quarter, starting the first quarter that nonhazardous solid waste has been generated. Include the following in the report:

|  |  |
|--|--|
| Construction and Demolition (C&D) Debris Disposed  | (____) cubic yards or tons, as appropriate |
| C&D Debris Recycled  | (____) cubic yards or tons, as appropriate |
| Total C&D Debris Generated   | (____) cubic yards or tons, as appropriate |
| Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount) | (____) cubic yards or tons, as appropriate |

## 3.6 WASTE MANAGEMENT AND DISPOSAL

### 3.6.1 Waste Determination Documentation

Complete a Waste Determination form (provided at the pre-construction conference) for Contractor-derived wastes to be generated. All potentially hazardous solid waste streams that are not subject to a specific exclusion or exemption from the hazardous waste regulations (e.g. scrap metal, domestic sewage) or subject to special rules, (lead-acid batteries and precious metals) must be characterized in accordance with the requirements of 40 CFR 261 or corresponding applicable state or local regulations. Base waste determination on user knowledge of the processes and materials used, and analytical data when necessary. Consult with the Installation environmental staff for guidance on specific requirements. Attach support documentation to the Waste Determination form. As a minimum, provide a Waste Determination form for the following waste (this listing is not inclusive): oil- and latex -based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and containers of the original materials.

### 3.6.2 Solid Waste Management

#### 3.6.2.1 Solid Waste Management Report

Provide copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, a statement indicating the disposal location for the solid waste that is signed by an employee authorized to legally obligate or bind the firm may be submitted. The Contractor certification must include the receiver's tax identification number and business, EPA or state registration number, along with the receiver's delivery and business addresses and telephone numbers. For each solid waste retained for the Contractor's own use, submit the information previously described in this paragraph on the solid waste disposal report. Prices paid or received do not have to be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

#### 3.6.2.2 Control and Management of Solid Wastes

Pick up solid wastes, and place in covered containers that 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. Employ segregation measures so that no hazardous or toxic waste will become co-mingled with non-hazardous solid waste. Transport solid waste off Government property and dispose of it in compliance with 40 CFR 260, state, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill is the minimum acceptable offsite solid waste disposal option. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. Solid waste disposal offsite must comply with most stringent local, state, and federal requirements, including 40 CFR 241, 40 CFR 243, and 40 CFR 258.

Manage hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, in accordance with 49 CFR 173.

#### 3.6.3 Control and Management of Hazardous Waste

Do not dispose of hazardous waste on Government property. Do not discharge any waste to a sanitary sewer, storm drain, or to surface waters or conduct waste treatment or disposal on Government property without written approval of the Contracting Officer.

##### 3.6.3.1 Hazardous Waste/Debris Management

Identify construction activities that will generate hazardous waste or debris. Provide a documented waste determination for resultant waste streams. Identify, label, handle, store, and dispose of hazardous waste or debris in accordance with federal, state, and local regulations, including 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, and 40 CFR 268.

Manage hazardous waste in accordance with the approved Hazardous Waste Management Section of the EPP. Store hazardous wastes in approved containers in accordance with 49 CFR 173 and 49 CFR 178. Hazardous waste generated within the confines of Government facilities is identified as being generated by the Government. Prior to removal of any hazardous waste from Government property, hazardous waste manifests must be signed by

personnel from the Installation Environmental Office. Do not bring hazardous waste onto Government property. Provide the Contracting Officer with a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in 40 CFR 372-SUBPART D.

### 3.6.3.2 Waste Storage/Satellite Accumulation/90 Day Storage Areas

Accumulate hazardous waste at satellite accumulation points and in compliance with 40 CFR 262.34 and applicable state or local regulations. Individual waste streams will be limited to 55 gallons of accumulation (or 1 quart for acutely hazardous wastes). If the Contractor expects to generate hazardous waste at a rate and quantity that makes satellite accumulation impractical, the Contractor may request a temporary 90 day accumulation point be established. Submit a request in writing to the Contracting Officer and provide the following information (Attach Site Plan to the Request):

|                                  |         |
|----------------------------------|---------|
| Contract Number                  | (_____) |
| Contractor                       | (_____) |
| Haz/Waste or Regulated Waste POC | (_____) |
| Phone Number                     | (_____) |
| Type of Waste                    | (_____) |
| Source of Waste                  | (_____) |
| Emergency POC                    | (_____) |
| Phone Number                     | (_____) |
| Location of the Site             | (_____) |

Attach a Waste Determination form for the expected waste streams. Allow 10 working days for processing this request. Additional compliance requirements (e.g. training and contingency planning) that may be required are the responsibility of the Contractor. Barricade the designated area where waste is being stored and post a sign identifying as follows:

"DANGER - UNAUTHORIZED PERSONNEL KEEP OUT"

### 3.6.3.3 Hazardous Waste Disposal

#### 3.6.3.3.1 Responsibilities for Contractor's Disposal

Provide hazardous waste manifest to the Installations Environmental Office for review, approval, and signature prior to shipping waste off Government property.

#### 3.6.3.3.1.1 Services

Provide service necessary for the final treatment or disposal of the hazardous material or waste in accordance with 40 CFR 260, local, and state, laws and regulations, and the terms and conditions of the Contract within 60 days after the materials have been generated. These services include necessary personnel, labor, transportation, packaging, detailed analysis (if required for disposal or transportation, include manifesting

or complete waste profile sheets, equipment, and compile documentation).

#### 3.6.3.3.1.2 Samples

Obtain a representative sample of the material generated for each job done to provide waste stream determination.

#### 3.6.3.3.1.3 Analysis

Analyze each sample taken and provide analytical results to the Contracting Officer. See paragraph WASTE DETERMINATION DOCUMENTATION.

#### 3.6.3.3.1.4 Labeling

Determine the Department of Transportation's (DOT's) proper shipping names for waste (each container requiring disposal) and demonstrate to the Contracting Officer how this determination is developed and supported by the sampling and analysis requirements contained herein. Label all containers of hazardous waste with the words "Hazardous Waste" or other words to describe the contents of the container in accordance with 40 CFR 262.31 and applicable state or local regulations.

#### 3.6.3.4 Universal Waste Management

Manage the following categories of universal waste in accordance with federal, state, and local requirements and installation instructions:

- a. Batteries as described in 40 CFR 273.2
- b. Lamps as described in 40 CFR 273.5
- c. Mercury-containing equipment as described in 40 CFR 273.4

Mercury is prohibited in the construction of this facility, unless specified otherwise, and with the exception of mercury vapor lamps and fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, in rubbish containers is prohibited. Remove without breaking, pack to prevent breakage, and transport out of the activity in an unbroken condition for disposal as directed.

#### 3.6.3.5 Electronics End-of-Life Management

Recycle or dispose of electronics waste, including, but not limited to, used electronic devices such computers, monitors, hard-copy devices, televisions, mobile devices, in accordance with 40 CFR 260-262, state, and local requirements, and installation instructions.

#### 3.6.3.6 Disposal Documentation for Hazardous and Regulated Waste

Contact the Contracting Officer for the facility RCRA identification number that is to be used on each manifest.

Submit a copy of the applicable EPA and or state permit(s), manifest(s), or license(s) for transportation, treatment, storage, and disposal of hazardous and regulated waste by permitted facilities. Hazardous or toxic waste manifests must be reviewed, signed, and approved by the Contracting Officer before the Contractor may ship waste. To obtain specific disposal instructions, coordinate with the Installation Environmental Office.

### 3.6.4 Releases/Spills of Oil and Hazardous Substances

#### 3.6.4.1 Response and Notifications

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated in accordance with 40 CFR 300. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the Installation Fire Department, the Installation Command Duty Officer, the Installation Environmental Office, the Contracting Officer and the state or local authority.

Submit verbal and written notifications as required by the federal (40 CFR 300.125 and 40 CFR 355), state, local regulations and instructions. Provide copies of the written notification and documentation that a verbal notification was made within 20 days. Spill response must be in accordance with 40 CFR 300 and applicable state and local regulations. Contain and clean up these spills without cost to the Government.

#### 3.6.4.2 Clean Up

Clean up hazardous and non-hazardous waste spills. Reimburse the Government for costs incurred including sample analysis materials, clothing, equipment, and labor if the Government will initiate its own spill cleanup procedures, for Contractor- responsible spills, when: Spill cleanup procedures have not begun within one hour of spill discovery/occurrence; or, in the Government's judgment, spill cleanup is inadequate and the spill remains a threat to human health or the environment.

### 3.6.5 Mercury Materials

Immediately report to the Environmental Office and the Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction of the Contracting Officer.

Do not recycle a mercury spill cleanup; manage it as a hazardous waste for disposal.

### 3.7 HAZARDOUS MATERIAL MANAGEMENT

Include hazardous material control procedures in the Safety Plan, in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Do not bring hazardous material onto Government property that does not directly relate to requirements for the performance of this contract. Submit an SDS and estimated quantities to be used for each hazardous material to the Contracting Officer prior to bringing the material on the installation. Typical materials requiring SDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. Use hazardous materials in a manner that minimizes the amount of hazardous waste generated. Containers of hazardous materials must have National Fire Protection Association labels or their equivalent. Certify that hazardous materials removed from the site are hazardous materials and

do not meet the definition of hazardous waste, in accordance with 40 CFR 261.

### 3.7.1 Contractor Hazardous Material Inventory Log

Submit the "Contractor Hazardous Material Inventory Log" (found at: <https://www.wbdg.org/FFC/NAVGRAPH/graphdoc.pdf>), which provides information required by (EPCRA Sections 312 and 313) along with corresponding SDS, to the Contracting Officer at the start and at the end of construction (30 days from final acceptance), and update no later than January 31 of each calendar year during the life of the contract. Keep copies of the SDSs for hazardous materials onsite. At the end of the project, provide the Contracting Officer with copies of the SDSs, and the maximum quantity of each material that was present at the site at any one time, the dates the material was present, the amount of each material that was used during the project, and how the material was used.

The Contracting Officer may request documentation for any spills or releases, environmental reports, or off-site transfers.

### 3.8 PREVIOUSLY USED EQUIPMENT

Clean previously used construction equipment prior to bringing it onto the project site. Equipment must be free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. Consult with the U.S. Department of Agriculture jurisdictional office for additional cleaning requirements.

### 3.9 CONTROL AND MANAGEMENT OF LEAD-BASED PAINT (LBP)

Manage and dispose of lead-contaminated waste in accordance with 40 CFR 745 and Section 02 82 33.13 20 REMOVAL/CONTROL AND DISPOSAL OF PAINT WITH LEAD; Section 02 83 13.00 20 LEAD IN CONSTRUCTION;. Manifest any lead-contaminated waste and provide the manifest to the Contracting Officer.

### 3.10 MILITARY MUNITIONS

In the event military munitions, as defined in 40 CFR 260, are discovered or uncovered, immediately stop work in that area and immediately inform the Contracting Officer.

### 3.11 PETROLEUM, OIL, LUBRICANT (POL) STORAGE AND FUELING

POL products include flammable or combustible liquids, such as gasoline, diesel, lubricating oil, used engine oil, hydraulic oil, mineral oil, and cooking oil. Store POL products and fuel equipment and motor vehicles in a manner that affords the maximum protection against spills into the environment. Manage and store POL products in accordance with EPA 40 CFR 112, and other federal, state, regional, and local laws and regulations. Use secondary containments, dikes, curbs, and other barriers, to prevent POL products from spilling and entering the ground, storm or sewer drains, stormwater ditches or canals, or navigable waters of the United States. Describe in the EPP (see paragraph ENVIRONMENTAL PROTECTION PLAN) how POL tanks and containers must be stored, managed, and inspected and what protections must be provided. Storage of oil, including fuel, on the project site is not allowed. Fuel must be brought to the project site each day that work is performed.

### 3.11.1 Used Oil Management

Manage used oil generated on site in accordance with 40 CFR 279. Determine if any used oil generated while onsite exhibits a characteristic of hazardous waste. Used oil containing 1,000 parts per million of solvents is considered a hazardous waste and disposed of at the Contractor's expense. Used oil mixed with a hazardous waste is also considered a hazardous waste. Dispose in accordance with paragraph HAZARDOUS WASTE DISPOSAL.

### 3.12 INADVERTENT DISCOVERY OF PETROLEUM-CONTAMINATED SOIL OR HAZARDOUS WASTES

If petroleum-contaminated soil, or suspected hazardous waste is found during construction that was not identified in the Contract documents, immediately notify the Contracting Officer. Do not disturb this material until authorized by the Contracting Officer.

### 3.13 CHLORDANE

Evaluate excess soils and concrete foundation debris generated during the demolition of housing units or other wooden structures for the presence of chlordane or other pesticides prior to reuse or final disposal.

### 3.14 SOUND INTRUSION

Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives are not permitted without written permission from the Contracting Officer, and then only during the designated times.

Keep construction activities under surveillance and control to minimize environment damage by noise. Comply with the provisions of the State of North Carolina rules.

### 3.15 POST CONSTRUCTION CLEANUP

Clean up areas used for construction in accordance with Contract Clause: "Cleaning Up". Unless otherwise instructed in writing by the Contracting Officer, remove traces of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. Grade parking area and similar temporarily used areas to conform with surrounding contours.

-- End of Section --

## SECTION 01 78 00

## CLOSEOUT SUBMITTALS

08/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM E1971 (2005; R 2011) Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings

## GREEN SEAL (GS)

GS-37 (2012) Cleaning Products for Industrial and Institutional Use

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

FC 1-300-09N (2014; with Change 2) Navy and Marine Corps Design Procedures

UFC 1-300-08 (2009, with Change 2) Criteria for Transfer and Acceptance of DoD Real Property

## 1.2 DEFINITIONS

## 1.2.1 As-Built Drawings

As-built drawings are developed and maintained by the Contractor and depict actual conditions, including deviations from the Contract Documents. These deviations and additions may result from coordination required by, but not limited to: contract modifications; official responses to Contractor submitted Requests for Information; direction from the Contracting Officer; designs which are the responsibility of the Contractor, and differing site conditions. Maintain the as-builts throughout construction as red-lined hard copies on site. As-built drawings are further defined in NFAS 5252.236-9310. These files serve as the basis for the creation of the record drawings.

## 1.2.2 Record Drawings

The record drawings are the final compilation of actual conditions reflected in the as-built drawings.

## 1.3 SUBMITTALS

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



## SD-03 Product Data

- Warranty Management Plan
- Warranty Tags
- Final Cleaning
- Spare Parts Data

## SD-08 Manufacturer's Instructions

- Posted Instructions

## SD-10 Operation and Maintenance Data

- Operation and Maintenance Manuals

## SD-11 Closeout Submittals

- As-Built Drawings
- Certification of EPA Designated Items
- Interim DD FORM 1354
- Checklist for DD FORM 1354
- NAVFAC Sustainable & Energy Data Record Card

## 1.4 SPARE PARTS DATA

Submit three copies of the Spare Parts Data list.

- a. Indicate manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair. List those items that may be standard to the normal maintenance of the system.

## 1.5 WARRANTY MANAGEMENT

## 1.5.1 Warranty Management Plan

Develop a warranty management plan. At least 30 days before the planned pre-warranty conference, submit three sets of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase must be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period will begin on the date of project acceptance and continue for the full product warranty period. A joint 4 month and 9 month warranty inspection will be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Include within the warranty management plan , but not limited to, the following:

- a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.

- b. Furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.
- c. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.
- d. A list for each warranted equipment, item, feature of construction or system indicating:
  - (1) Name of item.
  - (2) Model and serial numbers.
  - (3) Location where installed.
  - (4) Name and phone numbers of manufacturers or suppliers.
  - (5) Names, addresses and telephone numbers of sources of spare parts.
  - (6) Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have extended warranties must be indicated with separate warranty expiration dates.
  - (7) Cross-reference to warranty certificates as applicable.
  - (8) Starting point and duration of warranty period.
  - (9) Summary of maintenance procedures required to continue the warranty in force.
  - (10) Cross-reference to specific pertinent Operation and Maintenance manuals.
  - (11) Organization, names and phone numbers of persons to call for warranty service.
  - (12) Typical response time and repair time expected for various warranted equipment.
- e. The plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.
- f. Procedure and status of tagging of all equipment covered by extended warranties.
- g. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

#### 1.5.2 Performance Bond

The Performance Bond must remain effective throughout the construction period.

- a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.
- b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

- c. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure to respond will be cause for the Contracting Officer to proceed against the Contractor.

#### 1.5.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty will be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, be continuously available, and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

#### 1.5.4 Warranty Tags

At the time of installation, tag each warranted item with a durable, oil and water resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also, submit three record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

|                          |  |
|--------------------------|--|
| Type of product/material |  |
| Model number             |  |
| Serial number            |  |
| Contract number          |  |
| Warranty period from/to  |  |
| Inspector's signature    |  |
| Construction Contractor  |  |
| Address                  |  |
| Telephone number         |  |

|  |  |
|--|--|
| Warranty contact   |  |
| Address  |  |
| Telephone number   |  |
| Warranty response time<br>priority code  |  |
| WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE<br>DURING THE WARRANTY PERIOD. |  |

## PART 2 PRODUCTS

### 2.1 CERTIFICATION OF EPA DESIGNATED ITEMS

Submit the Certification of EPA Designated Items as required by FAR 52.223-9, "Certification and Estimate of Percentage of Recovered Material Content for EPA Designated Items". Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification will read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content. The following exemptions may apply to the non-procurement of recycled/recovered content materials:

- 1) The product does not meet appropriate performance standards;
- 2) The product is not available within a reasonable time frame;
- 3) The product is not available competitively (from two or more sources);
- 4) The product is only available at an unreasonable price (compared with a comparable non-recycled content product)."

Record each product used in the project that has a requirement or option of containing recycled or biobased content, noting total price, total value of post-industrial recycled content, total value of post-consumer recycled content, total value of biobased content, exemptions (1, 2, 3, or 4, as indicated), and comments. Recycled and biobased content values may be determined by weight or volume percent, but must be consistent throughout.

## PART 3 EXECUTION

### 3.1 AS-BUILT DRAWINGS

Provide and maintain As-Built Drawings in accordance with NFAS 5252.236-9310. Submit As-Built Drawings 30 days prior to Beneficial Occupancy Date (BOD).

#### 3.1.1 Markup Guidelines

Make comments and markup the drawings complete without reference to letters, memos, or materials that are not part of the As-Built drawing. Show what was changed, how it was changed, where item(s) were relocated and change related details. These working as-built markup prints must be neat, legible and accurate as follows:

- a. Use base colors of red, green, and blue. Color code for changes as follows:
  - (1) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes.
  - (2) Deletions (Red) - Over-strike deleted graphic items (lines), lettering in notes and leaders.
  - (3) Additions (Green) - Added items, lettering in notes and leaders.
- b. Provide a legend if colors other than the "base" colors of red, green, and blue are used.
- c. Add and denote any additional equipment or material facilities, service lines, incorporated under As-Built Revisions if not already shown in legend.
- d. Use frequent written explanations on markup drawings to describe changes. Do not totally rely on graphic means to convey the revision.
- e. Use legible lettering and precise and clear digital values when marking prints. Clarify ambiguities concerning the nature and application of change involved.
- f. Wherever a revision is made, also make changes to related section views, details, legend, profiles, plans and elevation views, schedules, notes and call out designations, and mark accordingly to avoid conflicting data on all other sheets.
- g. For deletions, cross out all features, data and captions that relate to that revision.
- h. For changes on small-scale drawings and in restricted areas, provide large-scale inserts, with leaders to the applicable location.
- i. Indicate one of the following when attaching a print or sketch to a markup print:
  - 1) Add an entire drawing to contract drawings
  - 2) Change the contract drawing to show
  - 3) Provided for reference only to further detail the initial design.
- j. Incorporate all shop and fabrication drawings into the markup drawings.

### 3.1.2 As-Built Drawings Content

Show on the as-built drawings, but not limited to, the following information:

- a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and

similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.

- b. The location and dimensions of any changes within the building structure.
- c. Layout and schematic drawings of electrical circuits and piping.
- d. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.
- e. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to shop drawings, fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.
- f. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.
- g. Changes or Revisions which result from the final inspection.
- h. Where contract drawings or specifications present options, show only the option selected for construction on the working as-built markup drawings.
- i. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.
- j. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.
- k. Changes in location of equipment and architectural features.
- j. Modifications (include within change order price the cost to change working as-built markup drawings to reflect modifications) and compliance with FC 1-300-09N procedures.
- l. Actual location of anchors, construction and control joints, etc., in concrete.
- m. Unusual or uncharted obstructions that are encountered in the contract work area during construction.
- n. Location, extent, thickness, and size of stone protection particularly where it will be normally submerged by water.

### 3.2 OPERATION AND MAINTENANCE MANUALS

Provide project operation and maintenance manuals as specified in Section 01 78 23 OPERATION AND MAINTENANCE MANUALS DATA. Provide three electronic copies of the Operation and Maintenance Manual files. Submit to the Contracting Officer for approval within 60 calendar days of the Beneficial Occupancy Date (BOD). Update and resubmit files for final approval at BOD.

### 3.3 CLEANUP

Provide final cleaning in accordance with ASTM E1971 and submit two copies of the listing of completed final clean-up items. Leave premises "broom clean." Comply with GS-37 for general purpose cleaning and bathroom cleaning. Use only nonhazardous cleaning materials, including natural cleaning materials, in the final cleanup. Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Replace filters of operating equipment and comply with the Indoor Air Quality (IAQ) Management Plan. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site. Recycle, salvage, and return construction and demolition waste from project in accordance with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

### 3.4 REAL PROPERTY RECORD

Near the completion of Project, but a minimum of 60 days prior to final acceptance of the work, complete and submit an accounting of all installed property with Interim DD FORM 1354. Include any additional assets, improvements, and alterations from the Draft DD FORM 1354. Contact the Contracting Officer for any project specific information necessary to complete the DD FORM 1354. Refer to UFC 1-300-08 for instruction on completing the DD FORM 1354. For information purposes, a blank fillable PDF DD FORM 1354 may be obtained at the following:  
<http://www.dtic.mil/whs/directives/forms/eforms/dd1354.pdf>

Submit the completed Checklist for DD FORM 1354 of Installed Building Equipment items. Attach this list to the updated DD FORM 1354.

### 3.5 NAVFAC SUSTAINABLE & ENERGY DATA RECORD CARD

Within 60 days of the completion of Project, complete an electronic copy of the NAVFAC Sustainable & Energy Data Record Card, and submit to the Contracting Officer. Instructions and a blank DD Form (fill-able) in ADOBE (PDF) may be obtained at the Whole Building Design Guide web site by navigating: Home > Participating Agencies > Department of Defense (DoD) > NAVFAC Sustainable Development Program > Contract Documents > NAVFAC Sustainable & Energy Data Record Card; or directly at  
[http://www.wbdg.org/pdfs/navfac\\_sustainable\\_energy\\_data\\_record\\_card.pdf](http://www.wbdg.org/pdfs/navfac_sustainable_energy_data_record_card.pdf).

-- End of Section --

## SECTION 01 78 23

## OPERATION AND MAINTENANCE DATA

08/15

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

|            |  |
|------------|--|
| ASTM E1971 | (2005; R 2011) Standard Guide for<br>Stewardship for the Cleaning of Commercial<br>and Institutional Buildings |
|------------|--|

## 1.2 SUBMITTALS

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

## SD-10 Operation and Maintenance Data

- O&M Database
- Training Plan
- Training Outline
- Training Content

## SD-11 Closeout Submittals

- Validation of Training Completion

## 1.3 OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data for the provided equipment, product, or system, defining the importance of system interactions, troubleshooting, and long-term preventive operation and maintenance. Compile, prepare, and aggregate O&M data to include 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.

## 1.3.1 Package Quality

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

## 1.3.2 Package Content

Provide data package content in accordance with paragraph 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. Use Data Package 5 for commissioned items without a specified data package requirement in the individual technical sections. Provide a Data Package 5 instead of Data Package 1 or 2, as specified in the individual technical section, for items that are commissioned.

#### 1.3.3 Changes to Submittals

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

#### 1.3.4 Commissioning Authority Review and Approval

Submit the commissioned systems and equipment submittals to the Commissioning Authority (CxA) to review for completeness and applicability. Obtain validation from the CxA that the systems and equipment provided meet the requirements of the Contract documents and design intent, particularly as they relate to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. The CxA communicates deficiencies to the Contracting Officer. Submit the O&M manuals to the Contracting Officer upon a successful review of the corrections, and with the CxA recommendation for approval and acceptance of these O&M manuals. This work is in addition to the normal review procedures for O&M data.

#### 1.4 O&M DATABASE

Develop an editable, electronic spreadsheet based on the equipment in the Operation and Maintenance Manuals that contains the information required to start a preventive maintenance program. As a minimum, provide list of system equipment, location installed, warranty expiration date, manufacturer, model, and serial number.

#### 1.5 OPERATION AND MAINTENANCE MANUAL FILE FORMAT

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

##### 1.5.1 Organization

Bookmark Product and Drawing Information documents using the current version of CSI Masterformat numbering system, and arrange submittals using the specification sections as a structure. Use CSI Masterformat and UFGS numbers along with descriptive bookmarked titles that explain the content of the information that is being bookmarked.

### 1.5.2 CD or DVD Label and Disk Holder or Case

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

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

### 1.6 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

The following are a detailed description of the data package items listed in paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES.

#### 1.6.1 Operating Instructions

Provide specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

##### 1.6.1.1 Safety Precautions and Hazards

List personnel hazards and equipment or product safety precautions for operating conditions. List all residual hazards identified in the AHA provided under Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Provide recommended safeguards for each identified hazard.

##### 1.6.1.2 Operator Prestart

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

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

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

##### 1.6.1.4 Normal Operations

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

##### 1.6.1.5 Emergency Operations

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

#### 1.6.1.6 Operator Service Requirements

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

#### 1.6.1.7 Environmental Conditions

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

#### 1.6.1.8 Operating Log

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

#### 1.6.1.9 Additional Requirements for HVAC Control Systems

Provide Data Package 5 and the following for control systems:

- a. Narrative description on how to perform and apply functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.
- b. Full as-built sequence of operations.
- c. Copies of checkout tests and calibrations performed by the Contractor (not Cx tests).
- d. Full points list. Provide a listing of rooms with the following information for each room:
  - (1) Floor
  - (2) Room number
  - (3) Room name
  - (4) Air handler unit ID
  - (5) Reference drawing number
  - (6) Air terminal unit tag ID
  - (7) Heating or cooling valve tag ID
  - (8) Minimum cfm
  - (9) Maximum cfm
- e. Full print out of all schedules and set points after testing and acceptance of the system.
- f. Full as-built print out of software program.
- g. Marking of system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

#### 1.6.2 Preventive Maintenance

Provide the following information for preventive and scheduled maintenance to minimize repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

#### 1.6.2.1 Lubrication Data

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

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

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

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

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

#### 1.6.2.3 Cleaning Recommendations

Provide environmentally preferable cleaning recommendations in accordance with ASTM E1971.

#### 1.6.3 Repair

Provide manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

##### 1.6.3.1 Troubleshooting Guides and Diagnostic Techniques

Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what

conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

#### 1.6.3.2 Wiring Diagrams and Control Diagrams

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

#### 1.6.3.3 Repair Procedures

Provide instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

#### 1.6.3.4 Removal and Replacement Instructions

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

#### 1.6.3.5 Spare Parts and Supply Lists

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

#### 1.6.3.6 Repair Work-Hours

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

### 1.6.4 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:

#### 1.6.4.1 Product Submittal Data

Provide a copy of SD-03 Product Data submittals documented with the required approval.

#### 1.6.4.2 Manufacturer's Instructions

Provide a copy of SD-08 Manufacturer's Instructions submittals documented with the required approval.

#### 1.6.4.3 O&M Submittal Data

Provide a copy of SD-10 Operation and Maintenance Data submittals documented with the required approval.

#### 1.6.4.4 Parts Identification

Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing must show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Group the parts shown in the listings by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog.

#### 1.6.4.5 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 of the system. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

#### 1.6.4.6 Extended Warranty Information

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

#### 1.6.4.7 Personnel Training Requirements

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

#### 1.6.4.8 Testing Equipment and Special Tool Information

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

#### 1.6.4.9 Testing and Performance Data

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

#### 1.6.4.10 Field Test Reports

Provide a copy of Field Test Reports (SD-06) submittals documented with the required approval.

#### 1.6.4.11 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.

#### 1.7 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Provide the O&M data packages specified in individual technical sections. The information required in each type of data package follows:

##### 1.7.1 Data Package 1

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

##### 1.7.2 Data Package 2

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

##### 1.7.3 Data Package 3

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

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

#### 1.7.4 Data Package 4

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

#### 1.7.5 Data Package 5

- a. Safety precautions and hazards
- b. Operator prestart
- c. Start-up, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Environmental conditions
- f. Preventive maintenance plan, schedule, and procedures
- g. Troubleshooting guides and diagnostic techniques
- h. Wiring and control diagrams
- i. Maintenance and repair procedures
- j. Removal and replacement instructions
- k. Spare parts and supply list
- l. Product submittal data
- m. Manufacturer's instructions
- n. O&M submittal data
- o. Parts identification
- p. Testing equipment and special tool information
- q. Warranty information



- r. Extended warranty information
- s. Testing and performance data
- t. Contractor information
- u. Field test reports
- v. Additional requirements for HVAC control systems

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

### 3.1 TRAINING

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

#### 3.1.1 Training Plan

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

- a. Equipment included in training
- b. Intended audience
- c. Location of training
- d. Dates of training
- e. Objectives
- f. Outline of the information to be presented and subjects covered including description
- g. Start and finish times and duration of training on each subject
- h. Methods (e.g. classroom lecture, video, site walk-through, actual operational demonstrations, written handouts)
- i. Instructor names and instructor qualifications for each subject
- j. List of texts and other materials to be furnished by the Contractor that are required to support training

### 3.1.2 Training Content

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

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

### 3.1.3 Training Outline

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

### 3.1.4 Unresolved Questions from Attendees

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

### 3.1.5 Validation of Training Completion

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

### 3.1.6 Quality Control Coordination

Coordinate this training with the QC Manager and or CxA in accordance with  
Section 01 45 00.00 20 QUALITY CONTROL.

-- End of Section --

## SECTION 01 80 00

## REPORTS

04/15

## PART 1 GENERAL

## 1.1 REPORTS INCLUDED

## 1.1.1 Asbestos and Lead Paint Inspection Report

Asbestos and Lead Based Paint Inspection Report: January 2014

## 1.2 USE OF INFORMATION

## 1.2.1 Warranty

The information disclosed in the referenced reports is based on data obtained in specific locations and is assumed to be representative of conditions throughout the site. This information is furnished without warranty and is only for general information to be used by the contractor in the preparation of his bid and work schedule. It is not intended as a replacement for personal investigation and judgment, or interpretation of the information furnished, as required of the contractor in the performance of this contract.

## 1.2.2 Site Visit

Bidders should visit the site and acquaint themselves with all existing conditions prior to preparing their bid. This will include a review of the conditions contained in the enclosed report as they relate to the site. The contractor is responsible for including in his bid and work schedule, procedures for handling existing site conditions delineated in the included reports in accord with applicable laws and regulations as those conditions may affect the work.

## 1.2.3 Application of Information

Recommendations contained in the reports are to be used by the contractor only to the extent that these recommendations comply with applicable laws, regulations, and other sections of the these specifications.

## PART 2 PRODUCTS

Not used.

## PART 3 EXECUTION

## 3.1 VARYING CONDITIONS

If during the course of the work, conditions are encountered which are not covered in the included reports or are different from conditions that would be reasonably anticipated from the included reports, the contractor shall immediately notify the Contracting Officer. If such conditions are hazardous or the continuation of work would cause a hazardous condition to develop, he shall stop work and proceed as directed by the Contracting Officer as directed by provisions contained in other sections of this specification. This may include modifications to, or the development of a

new, Health and Safety Plan for this project, and alternate or additional appropriate abatement procedures.

### 3.2 CHANGES TO THE CONTRACT

Any changes to the contract made as a result of site conditions which differ from those delineated in the report may result in an adjustment of the contract amount. The adjustment will be an increase or decrease depending on the scope and nature of the change and will be in accord with other provisions of these specifications.

-- End of Section --



January 12, 2015

Mr. Bill Faulkenberry  
MBF Architects, PA  
317-C Pollock Street  
New Bern, NC 28560

Reference: Report of Limited Asbestos and Lead Based Paint Survey  
MCAS Cherry Point – Building 4200  
Havelock, Craven County, North Carolina  
ECS Project No. 22-21996

Dear Mr. Griffith:

In accordance with ECS Carolinas, LLP (ECS) proposal number 22-19151 dated November 11, 2014 and authorized on December 4, 2014, ECS is pleased to submit this report of our asbestos and lead paint survey at the referenced site. This report includes a description of our understanding of the project background information, a description of the scope of work performed, including our findings, conclusions and comments.

### **PROJECT INFORMATION**

The subject site is Building 4200 at the Marine Corps Air Station (MCAS) Cherry Point located in Havelock, Craven County, North Carolina. Building 4200 is a three-story story Bachelor Enlisted Quarters (BEQ) building consisting of approximately 43,080 square feet. The building was reportedly constructed in 1990 and is slated for renovations. ECS was requested to conduct an asbestos and lead-based paint survey of the interior and exterior portions of the building. The project understanding is based on correspondence between Mr. Bill Faulkenberry with MBF Architects, PA and Mr. Braxton Dawson with ECS.

### **PROCEDURE/METHODOLOGY**

On December 15, 2014, ECS representative Mr. Braxton Dawson, (NC Accredited Asbestos Inspector No. 12830 and NC Accredited Lead Inspector/Risk Assessor No. 120251) visited the site to conduct the asbestos and lead paint survey. The weather conditions at the time of the site visits were approximately 55 degrees Fahrenheit and sunny.

#### ***Limited Asbestos Survey***

ECS was requested to perform an asbestos survey of the subject property to identify (asbestos containing materials) ACMs which could be disturbed during demolition or renovation activities. The EPA defines an ACM as a material containing greater than one percent (>1%) asbestos. The National Emission Standard for Hazardous Air Pollutants (NESHAP) requires the identification of both friable materials (materials which can be pulverized or reduced to a powder by hand pressure when dry) and non-friable materials (materials which pose a hazard when sawn, sanded, drilled or pulverized) likely to become friable during demolition and/or renovation activities. NESHAP requires that the identified ACM be removed prior to initiating activities likely to disturb the ACM.

The survey consisted of observing the accessible areas of the site for the presence of suspect materials which may contain asbestos. Homogeneous materials (materials that were observed to be similar based on material type, color, texture, etc.) were identified in various functional spaces during the survey. ECS was able to access one room from each floor to verify that the materials were homogeneous. ECS was not able to access the attic space or the roof due to a locked access hatch.

In order to determine if the suspect materials observed during the visual survey contained asbestos, representative bulk samples were collected and placed in sealed plastic bags. EPA regulations require that multiple samples of each homogeneous area be collected for laboratory analysis. The samples were submitted to EMSL Analytical Inc. (EMSL) in Morrisville, North Carolina for analysis using the EPA recommended method of Polarized Light Microscopy (PLM) coupled with dispersion staining (Method No. EPA 600/M4-020-82, Dec. 1982). EMSL participates in the National Voluntary Laboratory Accreditation Program (NVLAP). Their NVLAP accreditation number is 200671-0.

### ***Limited Lead-Based Paint Survey***

The purpose of the lead inspection is to identify the general location of lead-based paint surfaces. This process consists of screening various painted surfaces based on color, substrate, phase of construction, etc. for the presence of lead-based paint. The role of the lead inspector is to determine and then report the presence of lead-based paint surfaces.

The lead-based paint inspection methodology follows general guidelines published by the EPA and OSHA. This process consists of screening painted surfaces (i.e. walls, ceilings, windows, window frames, doors, etc.) for lead-based paint. The lead-based paint inspection includes obtaining readings using a calibrated RMD LPA-1 XRF Lead-Based Paint Analyzer assigned to ECS. A reading was taken at each test location as listed in Attachment A. The State of North Carolina (State) defines lead-based paint as having “a lead content of 1.0 mg/cm<sup>2</sup> of painted surface or greater than 0.5% lead.”

## **RESULTS**

### ***Limited Asbestos Survey***

Some of the samples collected are considered multi-layered. These samples were comprised of more than one material, and each one is analyzed separately as per NESHAP requirements. If a sample of a material from a homogeneous area is found to be positive, then that material is considered positive, regardless of the results of the other samples of that material, within that area. The data summary table (Attachment A) and asbestos figures (Attachment B) summarize the samples collected during ECS’ site visit. Site photographs are included in Attachment C. The bulk laboratory analysis results and chain of custody are included in Attachment D. Asbestos was not identified in the materials sampled.

### ***Limited Lead-Based Paint Survey***

The data summary table (Attachment A) and lead figures (Attachment B) summarize the surfaces analyzed during ECS’ site visit. Site photographs are included in Attachment C. Concentrations of lead in excess of or equal to EPA and State levels (1.0 mg/cm<sup>2</sup>) were detected on the following components:

- The ceramic glazing on the janitorial sinks in the laundry rooms on each floor contains lead-based paint. ECS observed two sinks in each laundry room.
- The ceramic glazing on sinks in the common areas bathrooms on each floor contains lead-based paint. ECS observed one sink in each common area bathroom.
- The ceramic glazing on vanity sinks in each individual unit contains lead-based paint. ECS observed one vanity sink per unit.
- The orange and brown metal access ladders located in the first floor mechanical corridors and the third floor mechanical room contains lead-based paint. ECS observed three ladders in the building.

### **CONCLUSIONS AND RECOMMENDATIONS**

Based on the results of analytical testing, asbestos was not detected in the samples obtained by ECS. In general, concentrations of lead in excess of or equal to EPA and State levels were detected on ceramic glazed sinks located in the common area bathrooms and laundry rooms on each floor.

ECS recommends the following in regards to the building components containing lead-based paint being affected by the renovations:

1. Renovations to the materials should be done so that as little dust as possible is released.
2. Remove and replace if possible lead-containing components as identified by this report. Additionally, the components may be covered with another substrate (wallboard, for example) to enclose the lead-based paint and reduce hazards.
3. Only qualified lead-based paint abatement contractors should perform lead-based paint abatement activities.
4. The following traditional methods of paint removal are unsafe if applied to old paint containing lead because these methods are known to poison children, occupants, and workers:
  - Open-flame burning or torching.
  - Machine sanding or grinding without a HEPA vacuum exhaust tool.
  - Uncontained hydro-blasting or high pressure washing.
  - Abrasive blasting or sand blasting.
  - Heat guns operating above 1,100 °F

If the lead-based paint containing materials are removed, they should be removed intact and shall be disposed of in the appropriate landfill, provided landfill waste profile requirements are complied with. Disposal must comply with the land disposal restriction notification requirements of 40 CFR 258.

This report summarizes our evaluation of the conditions observed at the site. The findings



prepared by ECS are based upon testing performed in the buildings. ACM and lead-based paint may exist (undetected) in other areas due to their inaccessibility or due to the limited nature of our testing. Our recommendations are based on the guidelines presented in EPA, North Carolina, and OSHA asbestos and lead regulations. Please note that this document is not a specification for asbestos or lead removal. It does not contain means and methods for abatement. If you are planning an asbestos or lead abatement project, please contact ECS to discuss the requirements. Use of this document without the express written consent of ECS is at the sole risk of the user and or/abatement contractor.

ECS appreciates the opportunity to provide our asbestos and lead paint services for this project. If you have questions or need additional information, please contact us at (910) 686-9114.

Respectfully,

**ECS CAROLINAS, LLP**



Braxton B. Dawson  
Environmental Staff Scientist



Amy Conchas, REM  
Environmental Principal

- Attachments:
- A. Summary Tables
  - B. Figures
  - C. Photographs
  - D. Laboratory Bulk Asbestos Analysis & Chain of Custody

**TABLE 1**  
**Summary of Asbestos Data**  
**Limited Asbestos and Lead-Based Paint Survey**  
**MCAS Cherry Point - Building 4200**  
**Havelock, Craven County, North Carolina**

| Sample No. | Material Description                 | Sample Location         | Friable / Non-Friable | Results |
|------------|--------------------------------------|-------------------------|-----------------------|---------|
| HA1-1      | Grey Cove Base                       | 1st & 2nd Floor Lounges | Non-Friable           | ND      |
| HA1-2      | Grey Cove Base                       | 1st & 2nd Floor Lounges | Non-Friable           | ND      |
| HA2-1      | Cove Base Mastic                     | 1st & 2nd Floor Lounges | Non-Friable           | ND      |
| HA2-2      | Cove Base Mastic                     | 1st & 2nd Floor Lounges | Non-Friable           | ND      |
| HA3-1A     | Brown Cove Base                      | Common Areas            | Non-Friable           | ND      |
| HA3-2A     | Brown Cove Base                      | Common Areas            | Non-Friable           | ND      |
| HA3-1B     | Cove Base Mastic                     | Common Areas            | Non-Friable           | ND      |
| HA3-2B     | Cove Base Mastic                     | Common Areas            | Non-Friable           | ND      |
| HA4-1A     | Grey Floor Tile                      | 1st & 2nd Floor Lounges | Non-Friable           | ND      |
| HA4-2A     | Grey Floor Tile                      | 1st & 2nd Floor Lounges | Non-Friable           | ND      |
| HA4-1B     | Floor Tile Mastic                    | 1st & 2nd Floor Lounges | Non-Friable           | ND      |
| HA4-2B     | Floor Tile Mastic                    | 1st & 2nd Floor Lounges | Non-Friable           | ND      |
| HA5-1A     | White Floor Tile                     | Common Hallway          | Non-Friable           | ND      |
| HA5-2A     | White Floor Tile                     | Common Bathroom         | Non-Friable           | ND      |
| HA5-1B     | Floor Tile Mastic                    | Common Hallway          | Non-Friable           | ND      |
| HA5-2B     | Floor Tile Mastic                    | Common Bathroom         | Non-Friable           | ND      |
| HA6-1      | HVAC Mastic                          | Rooms                   | Non-Friable           | ND      |
| HA6-2      | HVAC Mastic                          | Rooms                   | Non-Friable           | ND      |
| HA7-1A     | Tan Floor Tile                       | 3rd Floor Lounge        | Non-Friable           | ND      |
| HA7-2A     | Tan Floor Tile                       | 3rd Floor Lounge        | Non-Friable           | ND      |
| HA7-1B     | Floor Tile Mastic                    | 3rd Floor Lounge        | Non-Friable           | ND      |
| HA7-2B     | Floor Tile Mastic                    | 3rd Floor Lounge        | Non-Friable           | ND      |
| HA8-1      | Drywall & Joint Compound (composite) | Common Hallway          | Non-Friable           | ND      |
| HA8-2      | Drywall & Joint Compound (composite) | Common Bathroom         | Non-Friable           | ND      |
| HA8-3      | Drywall & Joint Compound (composite) | Private Bath Ceiling    | Non-Friable           | ND      |
| HA9-1      | Ceiling Texture                      | Common Hallway          | Non-Friable           | ND      |
| HA9-2      | Ceiling Texture                      | Common Bathroom         | Non-Friable           | ND      |
| HA9-3      | Ceiling Texture                      | Common Hallway          | Non-Friable           | ND      |
| HA9-4      | Ceiling Texture                      | Common Bathroom         | Non-Friable           | ND      |
| HA9-5      | Ceiling Texture                      | Common Hallway          | Non-Friable           | ND      |
| HA9-6      | Ceiling Texture                      | Common Bathroom         | Non-Friable           | ND      |
| HA9-7      | Ceiling Texture                      | Laundry Room            | Non-Friable           | ND      |
| HA10-1     | Thermal Systems Insulation (TSI)     | Mechanical Rooms        | Friable               | ND      |
| HA10-2     | Thermal Systems Insulation (TSI)     | Mechanical Rooms        | Friable               | ND      |
| HA10-3     | Thermal Systems Insulation (TSI)     | Mechanical Rooms        | Friable               | ND      |
| HA11-1     | Window Caulk                         | Exterior Windows        | Non-Friable           | ND      |
| HA11-2     | Window Caulk                         | Exterior Windows        | Non-Friable           | ND      |

ND = Not Detected

Positive Stop = Not Analyzed

**Bold = Asbestos-Containing Material**

**TABLE 2**  
**Summary of XRF Lead Data**  
**Limited Asbestos and Lead-Based Paint Survey**  
**MCAS Cherry Point - Building 4200**  
**Havelock, Craven County, North Carolina**

| Number | Location                      | Component           | Substrate | Color  | Result (mg/cm2) |
|--------|-------------------------------|---------------------|-----------|--------|-----------------|
| 1      | Calibration                   | N/A                 | N/A       | N/A    | 1.0             |
| 2      | Calibration                   | N/A                 | N/A       | N/A    | 1.0             |
| 3      | Calibration                   | N/A                 | N/A       | N/A    | 1.0             |
| 4      | Calibration                   | N/A                 | N/A       | N/A    | -0.2            |
| 5      | Calibration                   | N/A                 | N/A       | N/A    | -0.1            |
| 6      | Calibration                   | N/A                 | N/A       | N/A    | 0.0             |
| 7      | 1st Floor Common Area         | Door Frame          | Metal     | Brown  | -0.1            |
| 8      | 1st Floor Common Area         | Door                | Metal     | Brown  | 0.0             |
| 9      | 1st Floor Common Area         | Door                | Metal     | Brown  | -0.1            |
| 10     | 1st Floor Common Area         | Door Frame          | Metal     | Brown  | -0.3            |
| 11     | 1st Floor Common Area         | Ceiling             | Concrete  | White  | -0.2            |
| 12     | 1st Floor Common Area         | Ceiling             | Drywall   | White  | -0.2            |
| 13     | 1st Floor Common Area         | Ceiling             | Concrete  | White  | 0.0             |
| 14     | 1st Floor Laundry Room        | Door Frame          | Metal     | Brown  | -0.2            |
| 15     | 1st Floor Laundry Room        | Door                | Metal     | Brown  | -0.1            |
| 16     | 1st Floor Laundry Room        | Wall                | Concrete  | White  | 0.0             |
| 17     | 1st Floor Laundry Room        | Janitorial Sink     | Ceramic   | White  | >9.9            |
| 18     | 1st Floor Laundry Room        | Counter Sink        | Ceramic   | White  | >9.9            |
| 19     | 1st Floor Laundry Room        | Cabinet             | Wood      | White  | -0.3            |
| 20     | 1st Floor Laundry Room        | Shelf               | Wood      | White  | -0.2            |
| 21     | 1st Floor Laundry Room        | Ceiling             | Concrete  | White  | 0.0             |
| 22     | 1st Floor Lounge              | Ceiling             | Concrete  | White  | 0.0             |
| 23     | 1st Floor Lounge              | Ceiling             | Drywall   | White  | -0.2            |
| 24     | 1st Floor Lounge              | Wall                | Concrete  | White  | -0.2            |
| 25     | 1st Floor Lounge              | Door                | Metal     | Brown  | -0.2            |
| 26     | 1st Floor Lounge              | Door Frame          | Metal     | Brown  | -0.3            |
| 27     | 1st Floor Lounge              | Window Frame        | Metal     | Brown  | -0.2            |
| 28     | 1st Floor Bathroom            | Wall                | Concrete  | White  | -0.4            |
| 29     | 1st Floor Bathroom            | Door                | Metal     | Brown  | -0.1            |
| 30     | 1st Floor Bathroom            | Door Frame          | Metal     | Brown  | -0.4            |
| 31     | 1st Floor Bathroom            | Sink                | Ceramic   | White  | >9.9            |
| 32     | 1st Floor Bathroom            | Toilet              | Porcelain | White  | -0.2            |
| 33     | 1st Floor Bathroom            | Ceiling             | Concrete  | White  | -0.1            |
| 34     | 1st Floor Mechanical Corridor | Door                | Metal     | Brown  | -0.2            |
| 35     | 1st Floor Mechanical Corridor | Door Frame          | Metal     | Brown  | -0.2            |
| 36     | 1st Floor Mechanical Corridor | Access Ladder       | Metal     | Brown  | 2.4             |
| 37     | 1st Floor Mechanical Room     | Door                | Metal     | Brown  | -0.1            |
| 38     | 1st Floor Mechanical Room     | Door Frame          | Metal     | Brown  | 0.0             |
| 39     | 1st Floor Mechanical Room     | Access Ladder       | Metal     | Orange | >9.9            |
| 40     | 1st Floor Office              | Wall                | Concrete  | White  | -0.1            |
| 41     | 1st Floor Office              | Window Frame        | Metal     | Brown  | -0.2            |
| 42     | 1st Floor Office              | Door                | Metal     | Brown  | 0.2             |
| 43     | 1st Floor Office              | Door Frame          | Metal     | Brown  | -0.2            |
| 44     | 1st Floor Office              | Ceiling             | Concrete  | White  | 0.3             |
| 45     | 1st Floor Units               | Wall                | Metal     | White  | -0.2            |
| 46     | 1st Floor Units               | Ceiling             | Concrete  | White  | -0.2            |
| 47     | 1st Floor Units               | Door Frame          | Metal     | Brown  | -0.1            |
| 48     | 1st Floor Units               | Door                | Metal     | Brown  | -0.1            |
| 49     | 1st Floor Units               | Vanity Sink         | Ceramic   | White  | >9.9            |
| 50     | 1st Floor Units               | Bathroom Door       | Metal     | Brown  | 0.0             |
| 51     | 1st Floor Units               | Bathroom Door Frame | Metal     | Brown  | -0.2            |
| 52     | 1st Floor Units               | Bathroom Ceiling    | Drywall   | White  | 0.1             |
| 53     | 1st Floor Units               | Floor Tile          | Ceramic   | Beige  | -0.6            |
| 54     | 1st Floor Units               | Wall Tile           | Ceramic   | White  | -0.2            |
| 55     | 1st Floor Units               | Wall                | Concrete  | White  | 0.3             |
| 56     | 2nd Floor Units               | Wall                | Metal     | White  | -0.1            |
| 57     | 2nd Floor Units               | Ceiling             | Concrete  | White  | -0.4            |
| 58     | 2nd Floor Units               | Door                | Metal     | Brown  | -0.1            |
| 59     | 2nd Floor Units               | Door Frame          | Metal     | Brown  | -0.1            |
| 60     | 2nd Floor Units               | Vanity Sink         | Ceramic   | White  | >9.9            |

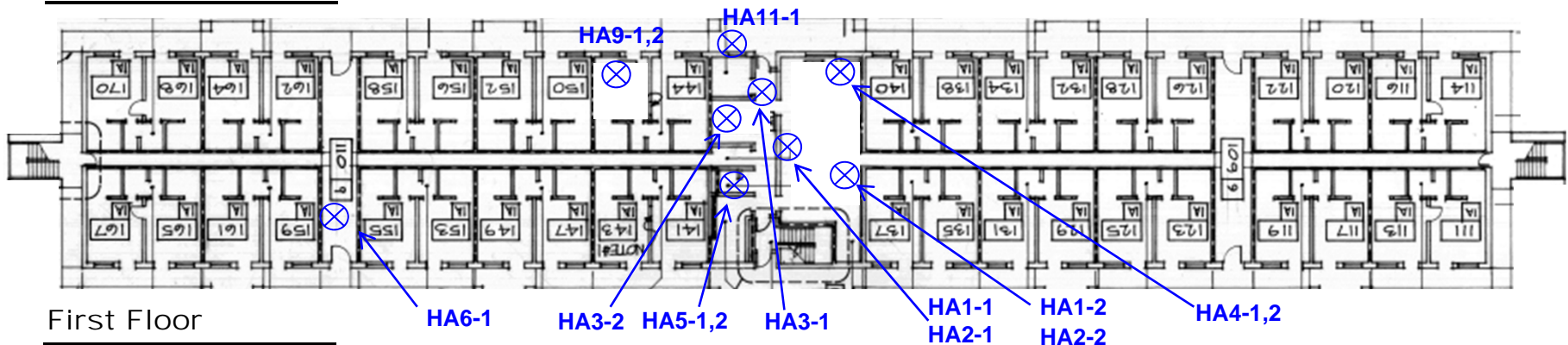
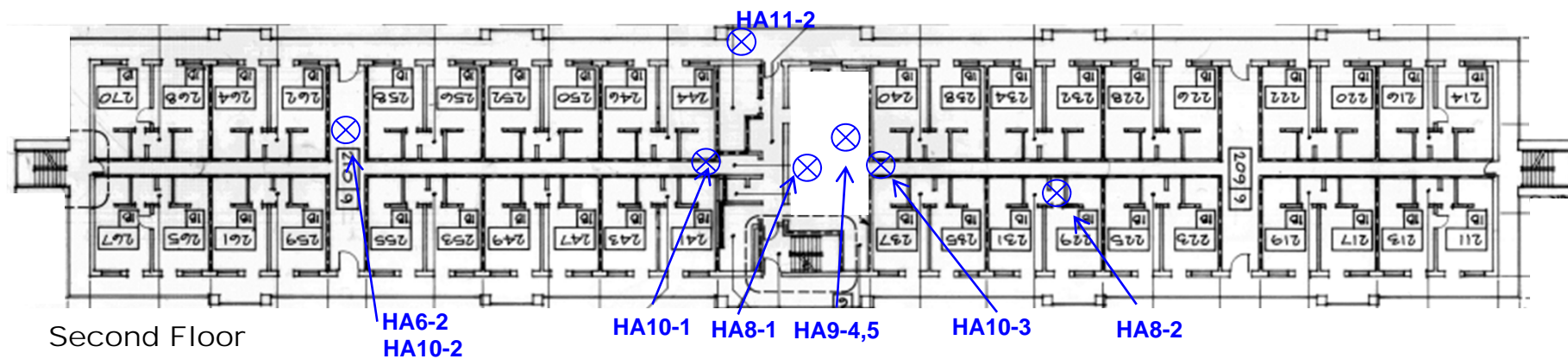
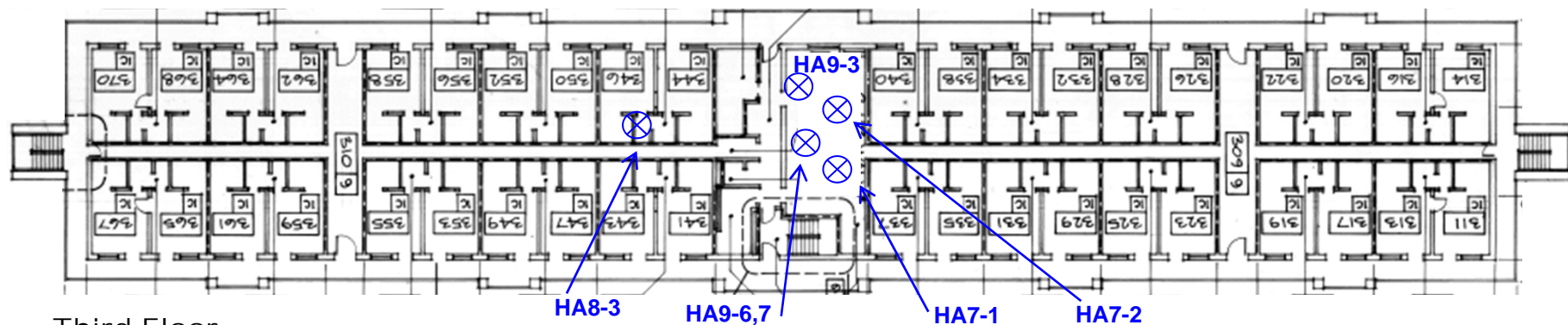
**TABLE 2**  
**Summary of XRF Lead Data**  
**Limited Asbestos and Lead-Based Paint Survey**  
**MCAS Cherry Point - Building 4200**  
**Havelock, Craven County, North Carolina**

| Number | Location                      | Component              | Substrate      | Color        | Result (mg/cm2) |
|--------|-------------------------------|------------------------|----------------|--------------|-----------------|
| 61     | 2nd Floor Units               | Bathroom Door          | Metal          | Brown        | 0.0             |
| 62     | 2nd Floor Units               | Bathroom Door Frame    | Metal          | Brown        | -0.2            |
| 63     | 2nd Floor Units               | Bathroom Ceiling       | Drywall        | White        | 0.1             |
| 64     | 2nd Floor Units               | Wall Tile              | Ceramic        | White        | -0.4            |
| 65     | 2nd Floor Units               | Floor Tile             | Ceramic        | Beige        | -0.1            |
| 66     | 2nd Floor Units               | Bathroom Wall          | Concrete       | White        | -0.1            |
| 67     | 3rd Floor Units               | Wall                   | Metal          | White        | 0.0             |
| 68     | 3rd Floor Units               | Ceiling                | Concrete       | White        | 0.0             |
| 69     | 3rd Floor Units               | Door                   | Metal          | Brown        | -0.4            |
| 70     | 3rd Floor Units               | Door Frame             | Metal          | Brown        | -0.1            |
| 71     | <b>3rd Floor Units</b>        | <b>Vanity Sink</b>     | <b>Ceramic</b> | <b>White</b> | <b>&gt;9.9</b>  |
| 72     | 3rd Floor Units               | Bathroom Door          | Metal          | Brown        | 0.0             |
| 73     | 3rd Floor Units               | Bathroom Door Frame    | Metal          | Brown        | -0.2            |
| 74     | 3rd Floor Units               | Bathroom Ceiling       | Drywall        | White        | 0.1             |
| 75     | 3rd Floor Units               | Wall Tile              | Ceramic        | White        | 0.3             |
| 76     | 3rd Floor Units               | Floor Tile             | Ceramic        | Beige        | -0.4            |
| 77     | 3rd Floor Units               | Bathroom Wall          | Concrete       | White        | -0.2            |
| 78     | 2nd Floor Common Area         | Door Frame             | Metal          | Brown        | -0.2            |
| 79     | 2nd Floor Common Area         | Door                   | Metal          | Brown        | -0.3            |
| 80     | 2nd Floor Common Area         | Door                   | Metal          | Brown        | -0.2            |
| 81     | 2nd Floor Common Area         | Door Frame             | Metal          | Brown        | 0.0             |
| 82     | 2nd Floor Common Area         | Ceiling                | Concrete       | White        | -0.2            |
| 83     | 2nd Floor Common Area         | Wall                   | Concrete       | White        | -0.1            |
| 84     | 2nd Floor Lounge              | Ceiling                | Concrete       | White        | -0.1            |
| 85     | 2nd Floor Lounge              | Ceiling                | Drywall        | White        | 0.0             |
| 86     | 2nd Floor Lounge              | Wall                   | Concrete       | White        | -0.1            |
| 87     | 2nd Floor Lounge              | Door                   | Metal          | Brown        | -0.2            |
| 88     | 2nd Floor Lounge              | Door Frame             | Metal          | Brown        | 0.0             |
| 89     | 2nd Floor Lounge              | Window Frame           | Metal          | Brown        | -0.2            |
| 90     | 2nd Floor Lounge              | Mini Blinds            | Aluminum       | White        | -0.2            |
| 91     | 2nd Floor Lounge              | Wall                   | Concrete       | White        | -0.1            |
| 92     | 2nd Floor Laundry Room        | Wall                   | Concrete       | White        | -0.2            |
| 93     | <b>2nd Floor Laundry Room</b> | <b>Janitorial Sink</b> | <b>Ceramic</b> | <b>White</b> | <b>&gt;9.9</b>  |
| 94     | <b>2nd Floor Laundry Room</b> | <b>Counter Sink</b>    | <b>Ceramic</b> | <b>White</b> | <b>&gt;9.9</b>  |
| 95     | 2nd Floor Laundry Room        | Wall                   | Concrete       | White        | -0.2            |
| 96     | 2nd Floor Laundry Room        | Cabinet                | Wood           | White        | -0.3            |
| 97     | 2nd Floor Laundry Room        | Shelf                  | Wood           | White        | 0.0             |
| 98     | 2nd Floor Laundry Room        | Ceiling                | Concrete       | White        | -0.1            |
| 99     | 2nd Floor Mechanical Corridor | Door                   | Metal          | Brown        | 0.1             |
| 100    | 2nd Floor Mechanical Corridor | Door Frame             | Metal          | Brown        | -0.2            |
| 101    | 2nd Floor Mechanical Room     | Door                   | Metal          | Brown        | -0.2            |
| 102    | 2nd Floor Mechanical Room     | Door Frame             | Metal          | Brown        | 0.0             |
| 103    | 2nd Floor Bathroom            | Wall                   | Concrete       | White        | -0.2            |
| 104    | 2nd Floor Bathroom            | Door                   | Metal          | Brown        | -0.1            |
| 105    | 2nd Floor Bathroom            | Door Frame             | Metal          | Brown        | -0.1            |
| 106    | <b>2nd Floor Bathroom</b>     | <b>Sink</b>            | <b>Ceramic</b> | <b>White</b> | <b>&gt;9.9</b>  |
| 107    | 2nd Floor Bathroom            | Toilet                 | Porcelain      | White        | -0.2            |
| 108    | 2nd Floor Bathroom            | Ceiling                | Concrete       | White        | -0.1            |
| 109    | 3rd Floor Common Area         | Door Frame             | Metal          | Brown        | -0.2            |
| 110    | 3rd Floor Common Area         | Door                   | Metal          | Brown        | -0.3            |
| 111    | 3rd Floor Common Area         | Door                   | Metal          | Brown        | -0.2            |
| 112    | 3rd Floor Common Area         | Door Frame             | Metal          | Brown        | 0.0             |
| 113    | 3rd Floor Common Area         | Ceiling                | Concrete       | White        | -0.2            |
| 114    | 3rd Floor Common Area         | Wall                   | Concrete       | White        | 0.0             |
| 115    | 3rd Floor Laundry Room        | Wall                   | Concrete       | White        | -0.2            |
| 116    | <b>3rd Floor Laundry Room</b> | <b>Janitorial Sink</b> | <b>Ceramic</b> | <b>White</b> | <b>&gt;9.9</b>  |
| 117    | <b>3rd Floor Laundry Room</b> | <b>Counter Sink</b>    | <b>Ceramic</b> | <b>White</b> | <b>&gt;9.9</b>  |
| 118    | 3rd Floor Laundry Room        | Wall                   | Concrete       | White        | -0.2            |
| 119    | 3rd Floor Laundry Room        | Cabinet                | Wood           | White        | -0.3            |
| 120    | 3rd Floor Laundry Room        | Shelf                  | Wood           | White        | -0.1            |
| 121    | 3rd Floor Laundry Room        | Ceiling                | Concrete       | White        | 0.3             |

**TABLE 2**  
**Summary of XRF Lead Data**  
**Limited Asbestos and Lead-Based Paint Survey**  
**MCAS Cherry Point - Building 4200**  
**Havelock, Craven County, North Carolina**

| Number     | Location                         | Component                  | Substrate      | Color        | Result (mg/cm2) |
|------------|----------------------------------|----------------------------|----------------|--------------|-----------------|
| 122        | 3rd Floor Lounge                 | Ceiling                    | Concrete       | White        | -0.1            |
| 123        | 3rd Floor Lounge                 | Ceiling                    | Drywall        | White        | 0.0             |
| 124        | 3rd Floor Lounge                 | Wall                       | Concrete       | White        | -0.1            |
| 125        | 3rd Floor Lounge                 | Door                       | Metal          | Brown        | -0.2            |
| 126        | 3rd Floor Lounge                 | Door Frame                 | Metal          | Brown        | 0.0             |
| 127        | 3rd Floor Lounge                 | Window Frame               | Metal          | Brown        | -0.2            |
| 128        | 3rd Floor Mechanical Room        | Door                       | Metal          | Brown        | 0.0             |
| 129        | 3rd Floor Mechanical Room        | Door Frame                 | Metal          | Brown        | -0.2            |
| <b>130</b> | <b>3rd Floor Mechanical Room</b> | <b>Attic Access Ladder</b> | <b>Metal</b>   | <b>Brown</b> | <b>7.5</b>      |
| 131        | 3rd Floor Mechanical Corridor    | Door                       | Metal          | Brown        | -0.2            |
| 132        | 3rd Floor Mechanical Corridor    | Door Frame                 | Metal          | Brown        | -0.2            |
| 133        | 3rd Floor Mechanical Corridor    | Door                       | Metal          | Brown        | -0.1            |
| 134        | 3rd Floor Mechanical Corridor    | Door Frame                 | Metal          | Brown        | 0.0             |
| 135        | 3rd Floor Bathroom               | Door                       | Metal          | Brown        | -0.2            |
| 136        | 3rd Floor Bathroom               | Door Frame                 | Metal          | Brown        | 0.1             |
| 137        | 3rd Floor Bathroom               | Wall                       | Concrete       | White        | 0.1             |
| <b>138</b> | <b>3rd Floor Bathroom</b>        | <b>Sink</b>                | <b>Ceramic</b> | <b>White</b> | <b>&gt;9.9</b>  |
| 139        | 3rd Floor Bathroom               | Toilet                     | Porcelain      | White        | 0.0             |
| 140        | 3rd Floor Bathroom               | Ceiling                    | Concrete       | White        | -0.1            |
| <b>141</b> | <b>Calibrate</b>                 | <b>N/A</b>                 | <b>N/A</b>     | <b>N/A</b>   | <b>1.0</b>      |
| <b>142</b> | <b>Calibrate</b>                 | <b>N/A</b>                 | <b>N/A</b>     | <b>N/A</b>   | <b>1</b>        |
| <b>143</b> | <b>Calibrate</b>                 | <b>N/A</b>                 | <b>N/A</b>     | <b>N/A</b>   | <b>1.0</b>      |
| 144        | Calibrate                        | N/A                        | N/A            | N/A          | -0.1            |
| 145        | Calibrate                        | N/A                        | N/A            | N/A          | -0.1            |
| 146        | Calibrate                        | N/A                        | N/A            | N/A          | -0.2            |

**Bold = Lead-Based Paint**

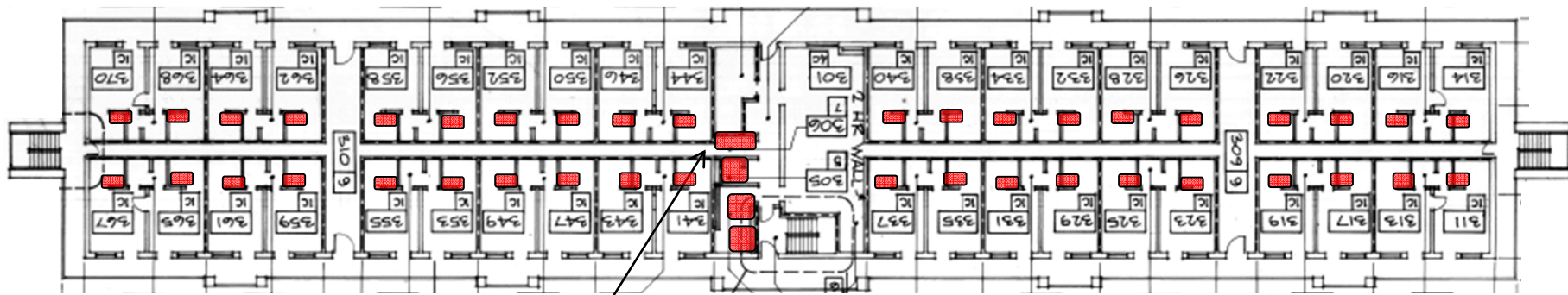


- ⊗ Sample Location
- ⊗ Sample Positive



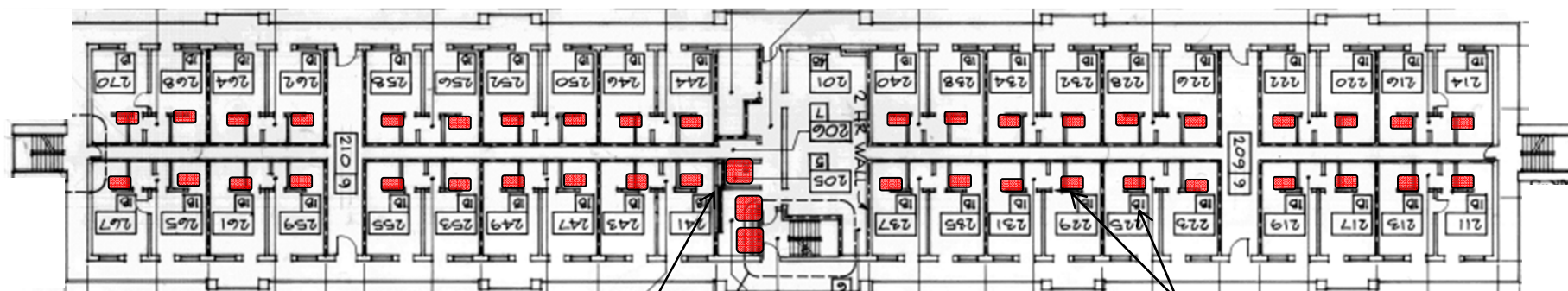
**ASBESTOS SAMPLE LOCATIONS**  
 MCAS CHERRY POINT - BUILDING 4200  
 HAVELOCK, CRAVEN COUNTY, NORTH CAROLINA  
 ECS PROJECT NO. 22-21996





Third Floor

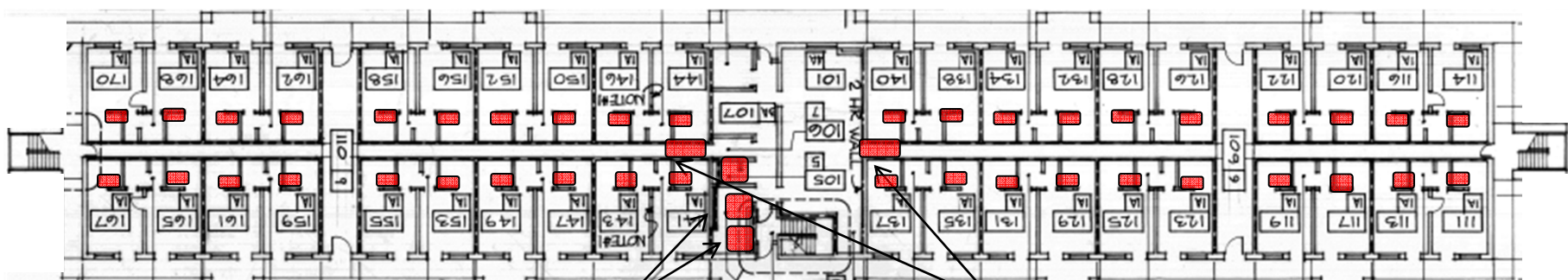
Attic Access Ladder



Second Floor

Common Bathroom Sinks

Vanity Sinks



First Floor

Laundry Room Sinks

Access Ladders



NORTH



Lead-Based  
Paint

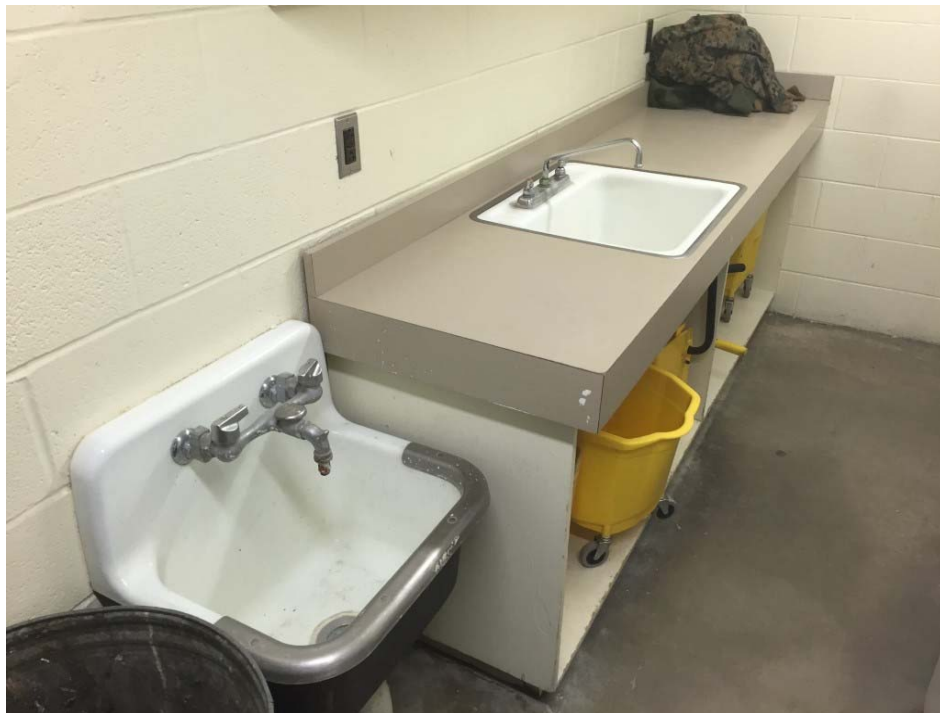


**LEAD-BASED PAINT LOCATIONS**  
MCAS CHERRY POINT - BUILDING 4200  
HAVELOCK, CRAVEN COUNTY, NORTH CAROLINA  
ECS PROJECT NO. 22-21996

*Limited Asbestos and Lead Paint Survey  
MCAS Cherry Point - Building 4200  
Havelock, Craven County, North Carolina  
ECS Project No. 22-21996*



**Photograph No. 1** – View of the exterior of Building 4200.

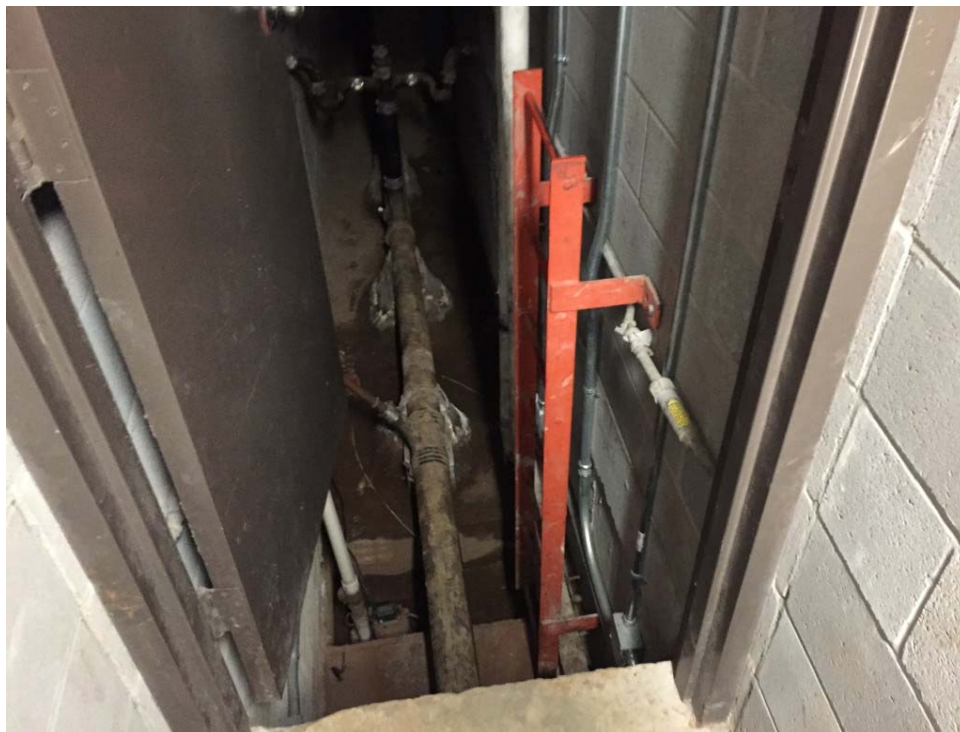


**Photograph No. 2** – View of the sinks in the laundry rooms.





**Photograph No. 3** – View of the sinks in the common bathrooms.



**Photograph No. 4** – View of the orange access ladders on the first floor.



**Photograph No. 5** – View of the brown access ladders on the first floor.



**Photograph No. 6** – View of the attic access ladder (locked).

*Limited Asbestos and Lead Paint Survey  
MCAS Cherry Point - Building 4200  
Havelock, Craven County, North Carolina  
ECS Project No. 22-21996*



**Photograph No. 7** – View of the typical sinks in the units.

**EMSL Analytical, Inc.**

2500 Gateway Centre Blvd., Suite 600, Morrisville, NC 27560

Phone/Fax: (919) 465-3900 / (919) 465-3950

<http://www.EMSL.com>[raleighlab@emsl.com](mailto:raleighlab@emsl.com)

EMSL Order: 291407703

CustomerID: ECS62

CustomerPO: 21996

ProjectID:

Attn: **Braxton Dawson**  
**ECS Carolinas, LLP**  
**6714 Netherlands Drive**  
**Wilmington, NC 28405**

Phone: (910) 686-9114  
Fax: (910) 686-9666  
Received: 12/18/14 10:00 AM  
Analysis Date: 12/18/2014  
Collected: 12/15/2014

Project: **Cherry Point, Building 4200**

## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

| Sample                            | Description              | Appearance                          | Non-Asbestos |                          | Asbestos      |  |
|-----------------------------------|--------------------------|-------------------------------------|--------------|--------------------------|---------------|--|
|                                   |                          |                                     | % Fibrous    | % Non-Fibrous            | % Type        |  |
| HA1-1<br>291407703-0001           | Grey Cove Base           | Gray<br>Non-Fibrous<br>Homogeneous  |              | 100% Non-fibrous (other) | None Detected |  |
| HA1-2<br>291407703-0002           | Grey Cove Base           | Gray<br>Non-Fibrous<br>Homogeneous  |              | 100% Non-fibrous (other) | None Detected |  |
| HA2-1<br>291407703-0003           | Grey Cove Base<br>Mastic | Yellow<br>Fibrous<br>Homogeneous    | 2% Cellulose | 98% Non-fibrous (other)  | None Detected |  |
| HA2-2<br>291407703-0004           | Grey Cove Base<br>Mastic | Yellow<br>Fibrous<br>Homogeneous    | 3% Cellulose | 97% Non-fibrous (other)  | None Detected |  |
| HA3-1-Cove Base<br>291407703-0005 | Brown Cove Base          | Brown<br>Non-Fibrous<br>Homogeneous |              | 100% Non-fibrous (other) | None Detected |  |
| HA3-1-Mastic<br>291407703-0005A   | Brown Cove Base          | Yellow<br>Fibrous<br>Homogeneous    | 2% Cellulose | 98% Non-fibrous (other)  | None Detected |  |
| HA3-2-Cove Base<br>291407703-0006 | Brown Cove Base          | Brown<br>Non-Fibrous<br>Homogeneous |              | 100% Non-fibrous (other) | None Detected |  |
| HA3-2-Mastic<br>291407703-0006A   | Brown Cove Base          | Yellow<br>Fibrous<br>Homogeneous    | 3% Cellulose | 97% Non-fibrous (other)  | None Detected |  |

Analyst(s)

Anupriya Tyagi (34)

Essie Spencer (3)

Essie Spencer, Laboratory Manager  
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200671-0, VA 3333 000278, WVA LT000296

Initial report from 12/18/2014 17:03:27

**EMSL Analytical, Inc.**

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<http://www.EMSL.com>[raleighlab@emsl.com](mailto:raleighlab@emsl.com)

EMSL Order: 291407703

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ProjectID:

Attn: **Braxton Dawson**  
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**6714 Netherlands Drive**  
**Wilmington, NC 28405**

Phone: (910) 686-9114  
 Fax: (910) 686-9666  
 Received: 12/18/14 10:00 AM  
 Analysis Date: 12/18/2014  
 Collected: 12/15/2014

Project: **Cherry Point, Building 4200**

## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

| Sample                             | Description                     | Appearance                          | <u>Non-Asbestos</u> |   | <u>Asbestos</u>      |
|------------------------------------|---------------------------------|-------------------------------------|---------------------|---|----------------------|
|                                    |                                 |                                     | % Fibrous           | % Non-Fibrous                               | % Type               |
| HA4-1-Floor Tile<br>291407703-0007 | Grey Floor Tile & Black Mastic  | Gray<br>Fibrous<br>Homogeneous      | <1% Cellulose       | 45% Ca Carbonate<br>55% Non-fibrous (other) | <b>None Detected</b> |
| HA4-1-Mastic<br>291407703-0007A    | Grey Floor Tile & Black Mastic  | Black<br>Fibrous<br>Homogeneous     | 3% Cellulose        | 97% Non-fibrous (other)                     | <b>None Detected</b> |
| HA4-2-Floor Tile<br>291407703-0008 | Grey Floor Tile & Black Mastic  | Gray<br>Fibrous<br>Homogeneous      | 2% Cellulose        | 40% Ca Carbonate<br>58% Non-fibrous (other) | <b>None Detected</b> |
| HA4-2-Mastic<br>291407703-0008A    | Grey Floor Tile & Black Mastic  | Black<br>Fibrous<br>Homogeneous     | <1% Cellulose       | 100% Non-fibrous (other)                    | <b>None Detected</b> |
| HA5-1-Floor Tile<br>291407703-0009 | White Floor Tile & Black Mastic | White<br>Non-Fibrous<br>Homogeneous |                     | 35% Ca Carbonate<br>65% Non-fibrous (other) | <b>None Detected</b> |
| HA5-1-Mastic<br>291407703-0009A    | White Floor Tile & Black Mastic | Black<br>Fibrous<br>Homogeneous     | 3% Cellulose        | 97% Non-fibrous (other)                     | <b>None Detected</b> |
| HA5-2-Floor Tile<br>291407703-0010 | White Floor Tile & Black Mastic | White<br>Non-Fibrous<br>Homogeneous |                     | 40% Ca Carbonate<br>60% Non-fibrous (other) | <b>None Detected</b> |
| HA5-2-Mastic<br>291407703-0010A    | White Floor Tile & Black Mastic | Black<br>Fibrous<br>Homogeneous     | 2% Cellulose        | 98% Non-fibrous (other)                     | <b>None Detected</b> |

Analyst(s)

Anupriya Tyagi (34)

Essie Spencer (3)

Essie Spencer, Laboratory Manager  
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200671-0, VA 3333 000278, WVA LT000296

Initial report from 12/18/2014 17:03:27



**EMSL Analytical, Inc.**

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Phone: (910) 686-9114  
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 Received: 12/18/14 10:00 AM  
 Analysis Date: 12/18/2014  
 Collected: 12/15/2014

Project: **Cherry Point, Building 4200**

## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

| Sample   | Description                          | Appearance                        | <u>Non-Asbestos</u>                           |   | <u>Asbestos</u>      |
|--|--------------------------------------|-----------------------------------|---|---|----------------------|
|  |                                      |                                   | % Fibrous                                     | % Non-Fibrous                               | % Type               |
| HA6-1<br>291407703-0011  | HVAC Mastic                          | Gray<br>Fibrous<br>Homogeneous    | 3% Cellulose<br>2% Wollastonite               | 95% Non-fibrous (other)                     | <b>None Detected</b> |
| HA6-2<br>291407703-0012  | HVAC Mastic                          | Gray<br>Fibrous<br>Homogeneous    | 2% Wollastonite                               | 98% Non-fibrous (other)                     | <b>None Detected</b> |
| HA7-1-Floor Tile<br>291407703-0013                             | Tan Floor Tile & Black Mastic        | Tan<br>Fibrous<br>Homogeneous     | <1% Cellulose                                 | 40% Ca Carbonate<br>60% Non-fibrous (other) | <b>None Detected</b> |
| HA7-1-Mastic<br>291407703-0013A                                | Tan Floor Tile & Black Mastic        | Black<br>Fibrous<br>Homogeneous   | 3% Cellulose                                  | 97% Non-fibrous (other)                     | <b>None Detected</b> |
| HA7-2-Floor Tile<br>291407703-0014                             | Tan Floor Tile & Black Mastic        | Tan<br>Non-Fibrous<br>Homogeneous |   | 45% Ca Carbonate<br>55% Non-fibrous (other) | <b>None Detected</b> |
| HA7-2-Mastic<br>291407703-0014A                                | Tan Floor Tile & Black Mastic        | Black<br>Fibrous<br>Homogeneous   | 2% Cellulose                                  | 98% Non-fibrous (other)                     | <b>None Detected</b> |
| HA8-1<br>291407703-0015  | Drywall & Joint Compound (Composite) | White<br>Fibrous<br>Homogeneous   | 15% Cellulose<br><1% Wollastonite             | 85% Non-fibrous (other)                     | <b>None Detected</b> |
| This is a composite result of drywall, jt. compound, and tape. |                                      |                                   |   |   |                      |
| HA8-2<br>291407703-0016  | Drywall & Joint Compound (Composite) | White<br>Fibrous<br>Homogeneous   | <1% Wollastonite<br>20% Cellulose<br>2% Glass | 78% Non-fibrous (other)                     | <b>None Detected</b> |
| This is a composite result of drywall, jt. compound, and tape. |                                      |                                   |   |   |                      |

Analyst(s)

Anupriya Tyagi (34)

Essie Spencer (3)

Essie Spencer, Laboratory Manager  
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200671-0, VA 3333 000278, WVA LT000296

Initial report from 12/18/2014 17:03:27

**EMSL Analytical, Inc.**

2500 Gateway Centre Blvd., Suite 600, Morrisville, NC 27560

Phone/Fax: (919) 465-3900 / (919) 465-3950

<http://www.EMSL.com>[raleighlab@emsl.com](mailto:raleighlab@emsl.com)

EMSL Order: 291407703

CustomerID: ECS62

CustomerPO: 21996

ProjectID:

Attn: **Braxton Dawson**  
**ECS Carolinas, LLP**  
**6714 Netherlands Drive**  
**Wilmington, NC 28405**

Phone: (910) 686-9114  
 Fax: (910) 686-9666  
 Received: 12/18/14 10:00 AM  
 Analysis Date: 12/18/2014  
 Collected: 12/15/2014

Project: **Cherry Point, Building 4200**

## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

| Sample   | Description                          | Appearance                            | Non-Asbestos                                 |                          | Asbestos      |
|--|--------------------------------------|---------------------------------------|--|--------------------------|---------------|
|  |                                      |                                       | % Fibrous                                    | % Non-Fibrous            | % Type        |
| HA8-3<br>291407703-0017  | Drywall & Joint Compound (Composite) | Brown/Tan/White Fibrous Heterogeneous | 15% Cellulose<br>5% Glass<br>3% Wollastonite | 77% Non-fibrous (other)  | None Detected |
| This is a composite result of drywall, jt. compound, and tape. |                                      |                                       |  |                          |               |
| HA9-1<br>291407703-0018  | Ceiling Texture                      | Tan/White Fibrous Homogeneous         | <1% Cellulose                                | 100% Non-fibrous (other) | None Detected |
| HA9-2<br>291407703-0019  | Ceiling Texture                      | Tan/White Fibrous Homogeneous         | <1% Wollastonite                             | 100% Non-fibrous (other) | None Detected |
| HA9-3<br>291407703-0020  | Ceiling Texture                      | Tan/White Fibrous Homogeneous         | <1% Wollastonite                             | 100% Non-fibrous (other) | None Detected |
| HA9-4<br>291407703-0021  | Ceiling Texture                      | Tan/White Non-Fibrous Homogeneous     |  | 100% Non-fibrous (other) | None Detected |
| HA9-5<br>291407703-0022  | Ceiling Texture                      | Tan/White Fibrous Homogeneous         | 2% Cellulose                                 | 98% Non-fibrous (other)  | None Detected |
| HA9-6<br>291407703-0023  | Ceiling Texture                      | Tan/White Fibrous Homogeneous         | <1% Cellulose                                | 100% Non-fibrous (other) | None Detected |
| HA9-7<br>291407703-0024  | Ceiling Texture                      | Gray/White Fibrous Homogeneous        | <1% Cellulose<br><2% Wollastonite            | 100% Non-fibrous (other) | None Detected |

Analyst(s)

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Essie Spencer (3)

Essie Spencer, Laboratory Manager  
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200671-0, VA 3333 000278, WVA LT000296

Initial report from 12/18/2014 17:03:27

**EMSL Analytical, Inc.**

2500 Gateway Centre Blvd., Suite 600, Morrisville, NC 27560

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<http://www.EMSL.com>[raleighlab@emsl.com](mailto:raleighlab@emsl.com)

EMSL Order: 291407703

CustomerID: ECS62

CustomerPO: 21996

ProjectID:

Attn: **Braxton Dawson**  
**ECS Carolinas, LLP**  
**6714 Netherlands Drive**  
**Wilmington, NC 28405**

Phone: (910) 686-9114  
Fax: (910) 686-9666  
Received: 12/18/14 10:00 AM  
Analysis Date: 12/18/2014  
Collected: 12/15/2014

Project: **Cherry Point, Building 4200**

## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

| Sample                   | Description  | Appearance                              | Non-Asbestos                                  |                          | Asbestos      |
|--------------------------|--------------|---|---|--------------------------|---------------|
|                          |              |   | % Fibrous                                     | % Non-Fibrous            | % Type        |
| HA10-1<br>291407703-0025 | TSI          | White<br>Fibrous<br>Homogeneous         | 45% Cellulose<br>25% Glass<br>2% Wollastonite | 28% Non-fibrous (other)  | None Detected |
| HA10-2<br>291407703-0026 | TSI          | White<br>Fibrous<br>Homogeneous         | 50% Cellulose<br>20% Glass                    | 30% Non-fibrous (other)  | None Detected |
| HA10-3<br>291407703-0027 | TSI          | Silver/Yellow<br>Fibrous<br>Homogeneous | 25% Cellulose<br>50% Glass                    | 25% Non-fibrous (other)  | None Detected |
| HA11-1<br>291407703-0028 | Window Caulk | Black<br>Non-Fibrous<br>Homogeneous     |   | 100% Non-fibrous (other) | None Detected |
| HA11-2<br>291407703-0029 | Window Caulk | Black<br>Non-Fibrous<br>Homogeneous     |   | 100% Non-fibrous (other) | None Detected |

Analyst(s)

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Essie Spencer, Laboratory Manager  
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200671-0, VA 3333 000278, WVA LT000296

Initial report from 12/18/2014 17:03:27



## Asbestos Chain of Custody

EMSL ANALYTICAL, INC.  
2500 GATEWAY CENTRE  
BLVD. SUITE 600  
MORRISVILLE, NC 27560  
PHONE: (919) 465-3900  
FAX: (919) 465-3950

ECS Carolinas, LLP  
Cherry Point, Building 4200  
12/18/2014 10:0  
PLM

TAT: 72 Hour  
Bulk

Order ID: 291407703  
No Samples: 29  
Due: 12/22 10.00 AM  
Fax: 910-686-9666

| Company : ECS Carolinas, LLP  |                                      | EMSL-Bill to: <input checked="" type="checkbox"/> Same <input type="checkbox"/> Different<br>If Bill to is Different note instructions in Comments**   |                      |
|---|--------------------------------------|--|----------------------|
| Street: 6714 Neatherlands Drive   |                                      | Third Party Billing requires written authorization from third party  |                      |
| City: Wilmington  | State/Province: NC                   | Zip/Postal Code: 28405   | Country: USA         |
| Report To (Name): Braxton Dawson  |                                      | Fax #: 910-686-9666  |                      |
| Telephone #: 910-686-9114   |                                      | Email Address: bdawson@ecslimited.com  |                      |
| Project Name/Number: <u>Cherry Point - Building 4200</u>  |                                      |  |                      |
| Please Provide Results: <input type="checkbox"/> Fax <input checked="" type="checkbox"/> Email Purchase Order: <u>210916</u> U.S. State Samples Taken: <u>NC</u>  |                                      |  |                      |
| Turnaround Time (TAT) Options* - Please Check   |                                      |  |                      |
| <input type="checkbox"/> 3 Hours <input type="checkbox"/> 6 Hours <input type="checkbox"/> 24 Hrs <input type="checkbox"/> 48 Hrs <input checked="" type="checkbox"/> 3 Days <input type="checkbox"/> 4 Days <input type="checkbox"/> 5 Days <input type="checkbox"/> 10 Days   |                                      |  |                      |
| *For TEM Air 3 hours/6 hours, please call ahead to schedule *There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide   |                                      |  |                      |
| <b>PCM - Air</b><br><input type="checkbox"/> NIOSH 7400<br><input type="checkbox"/> w/ OSHA 8hr. TWA<br><b>PLM - Bulk (reporting limit)</b><br><input checked="" type="checkbox"/> PLM EPA 600/R-93/116 (<1%)<br><input type="checkbox"/> PLM EPA NOB (<1%)<br>Point Count<br><input type="checkbox"/> 400 (<0.25%) <input type="checkbox"/> 1000 (<0.1%)<br>Point Count w/Gravimetric<br><input type="checkbox"/> 400 (<0.25%) <input type="checkbox"/> 1000 (<0.1%)<br><input type="checkbox"/> NYS 198.1 (friable in NY)<br><input type="checkbox"/> NYS 198.6 NOB (non-friable-NY)<br><input type="checkbox"/> NIOSH 9002 (<1%) |                                      | <b>TEM - Air</b><br><input type="checkbox"/> AHERA 40 CFR, Part 763<br><input type="checkbox"/> NIOSH 7402<br><input type="checkbox"/> EPA Level II<br><input type="checkbox"/> ISO 10312<br><b>TEM - Bulk</b><br><input type="checkbox"/> TEM EPA NOB<br><input type="checkbox"/> NYS NOB 198.4 (non-friable-NY)<br><input type="checkbox"/> Chatfield SOP<br><input type="checkbox"/> TEM Mass Analysis-EPA 600 sec. 2.5<br><b>TEM - Water: EPA 100.2</b><br>Fibers >10µm <input type="checkbox"/> Waste <input type="checkbox"/> Drinking<br>All Fiber Sizes <input type="checkbox"/> Waste <input type="checkbox"/> Drinking                       |                      |
|   |                                      | <b>TEM- Dust</b><br><input type="checkbox"/> Microvac - ASTM D 5755<br><input type="checkbox"/> Wipe - ASTM D6480<br><input type="checkbox"/> Carpet Sonication (EPA 600/J-93/167)<br><b>Soil/Rock/Vermiculite</b><br><input type="checkbox"/> PLM CARB 435 - A (0.25% sensitivity)<br><input type="checkbox"/> PLM CARB 435 - B (0.1% sensitivity)<br><input type="checkbox"/> TEM CARB 435 - B (0.1% sensitivity)<br><input type="checkbox"/> TEM CARB 435 - C (0.01% sensitivity)<br><input type="checkbox"/> EPA Protocol (Semi-Quantitative)<br><input type="checkbox"/> EPA Protocol (Quantitative)<br><b>Other:</b><br><input type="checkbox"/> |                      |
| <input checked="" type="checkbox"/> Check For Positive Stop - Clearly Identify Homogenous Group   |                                      |  |                      |
| Samplers Name: <u>Braxton Dawson</u>  |                                      | Samplers Signature: <u>[Signature]</u>   |                      |
| Sample #  | Sample Description                   | Volume/Area (Air)<br>HA # (Bulk)   | Date/Time<br>Sampled |
| HA1-1,2   | Grey Cove Base                       | 1  | 12-15-14             |
| HA2-1,2   | Grey Cove Base Mastic                | 2  | 15:00                |
| HA3-1,2   | Brown Cove Base                      | 3  |                      |
| HA4-1,2   | Grey Floor Tile & Black Mastic       | 4  |                      |
| HA5-1,2   | White Floor Tile & Black Mastic      | 5  |                      |
| HA6-1,2   | MVAL Mastic                          | 6  |                      |
| HA7-1,2   | Tan Floor Tile & Black Mastic        | 7  |                      |
| HA8-1,2,3   | Drywall & Joint Compound (composite) | 8  |                      |
| Client Sample # (s): <u>1-29</u>  |                                      | Total # of Samples: <u>29</u>  |                      |
| Relinquished (Client): <u>[Signature]</u>   |                                      | Date: <u>12-16-14</u> Time: <u>05:00</u>   |                      |
| Received (Lab): <u>[Signature]</u>  |                                      | Date: <u>12/18/14</u> Time: <u>10a</u>   |                      |
| Comments/Special Instructions:  |                                      |  |                      |
| FC 8737 9337 5456   |                                      |  |                      |

EMSL ANALYTICAL, INC  
2500 GATEWAY CENTRE  
BLVD. SUITE 600  
MORRISVILLE, NC 27560  
PHONE: (919) 465-3900  
FAX: (919) 465-3950

**Order ID:** 291407703  
**No Samples:** 29  
**Due:** 12/22 10:00 AM  
**Fax:** 910-686-3666

[illegible]

Page 2 of 2

## SECTION 01 91 00.15

TOTAL BUILDING COMMISSIONING  
05/16

## PART 1 GENERAL

## 1.1 SUMMARY

Commission the building systems listed herein. Employ the services of an independent Commissioning Firm. The Commissioning Firm must be a 1st tier subcontractor of the General or Prime Contractor and must be financially and corporately independent of all other subcontractors. The Commissioning Firm must employ a Lead Commissioning Specialist that coordinates all aspects of the commissioning process. Conform to the commissioning procedures outlined in this specification.

## 1.2 SYSTEMS TO BE COMMISSIONED

Commission the following systems:

Heating, Ventilating, Air Conditioning, and Refrigeration Systems (HVAC)  
Plumbing Systems

## 1.3 REFERENCES

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

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

ASHRAE 202 (2013) Commissioning Process for Buildings  
and Systems

ASSOCIATED AIR BALANCE COUNCIL (AABC)

ACG Commissioning Guideline (2005) Commissioning Guideline

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

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

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

SMACNA 1429 (1994) HVAC Systems Commissioning Manual,  
1st Edition

## 1.4 COMMUNICATION WITH THE GOVERNMENT

The Lead Commissioning Specialist (Cx/C) must submit all plans, schedules, reports, and documentation directly to the Contracting Officer

Representative Contracting Officer's Technical Representative concurrent with submission to the CQC System ManagerQC Manager. The Lead Commissioning Specialist must have direct communication with the Contracting Officer's Representative Contracting Officer's Technical Representative regarding all elements of the commissioning process; however, the Government has no direct contract authority with the Lead Commissioning Specialist.

## 1.5 SEQUENCING AND SCHEDULING

### 1.5.1 Sequencing

Complete Functional Performance Tests of HVAC systems prior to Performance Verification Tests required by Specification Section 23 09 23.13 22 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC. Complete the following prior to starting Functional Performance Tests of mechanical systems:

- a. All equipment and systems have been completed, cleaned, flushed, disinfected, calibrated, tested, and operate in accordance with contract documents and construction plans and specifications.
- b. Performance Verification Tests of the controls systems have been completed and the Performance Verification Test Report has been submitted and approved in accordance with Specification Section 23 09 23.13 22 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.
- cb. Testing, Adjusting, and Balancing has been completed and the Testing, Adjusting, and Balancing Report, and all TAB and DALT related submittals prerequisite to the TAB Report, have has been submitted and approved in accordance with Specification Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- dc. The building envelope is enclosed according to contract documents with final construction completed.
- ed. The Pre-Functional Checklists have been submitted and approved.
- fe. The Certificate of Readiness for mechanical systems has been submitted and approved.

### 1.5.2 Project Schedule

Include the following tasks in the project schedule. Ensure sufficient time is scheduled to accommodate the requirements of this specification section. The order of items listed below is not intended to imply a specified sequence:

- a. Submission and approval of the Commissioning Firm and Commissioning Specialist
- b. Submission and approval of the Testing, Adjusting, and Balancing (TAB) Firm and TAB Specialist specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- c. Submission of the Design Review Report specified herein.
- d. Submission of the Design Review Report specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

- e. Submission and approval of the Construction Phase Commissioning Plan
- f. Installation of permanent utilities (gas, water, electric)
- g. Drainage and Vent, Building Sewers, Water Supply Systems and Backflow Prevention Assembly Tests specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE
- h. Factory Acceptance Testing for each of the systems to be commissioned as required by technical specifications
- i. Manufacturer's Equipment Start-Up for each of the systems to be commissioned.
- j. Submission and approval of the TAB Schematic Drawings, Report Forms, and Procedures specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- k. Submission and approval of Duct Air Leakage Test Procedures specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- l. Duct Air Leakage Test Execution specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- m. Submission and approval of the Final Duct Air Leakage Test Report specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- n. Testing, Adjusting, and Balancing (TAB) Field Work required by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- o. Submission and approval of the TAB Report specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- p. TAB Field Acceptance Testing required by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- q. Submission and approval of the Start-Up Testing Report specified in Section 23 09 23.13 22 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC .
- r. Submission and approval of the Performance Verification Test Procedures specified in Section 23 09 23.13 22 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC .
- s. Performance Verification Tests required by Section 23 09 23.13 22 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC
- t. Performance Verification Test Report specified in Section 23 09 23.13 22 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC
- aa. Pre-Functional Checklist Submittal
- bb. Functional Performance Testing for each system to be commissioned
- cc. Integrated Systems Tests
- dd. Post-Test Deficiency Correction for each system to be commissioned
- ee. Re-Testing

- ff. Training for each of the systems to be commissioned
- gg. Systems Manual, Maintenance Plan, and Service Life Plan submission and approval
- hh. Seasonal Testing

#### 1.6 SUBMITTALS

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

##### SD-01 Preconstruction Submittals

- Commissioning Firm
- Lead Commissioning Specialist
- Technical Commissioning Specialists
- Commissioning Firm's Contract

##### SD-06 Test Reports

- Interim Construction Phase Commissioning Plan
- Final Construction Phase Commissioning Plan
- Pre-Functional Checklists
- Issues Log
- Commissioning Report

##### SD-07 Certificates

- Certificate of Readiness

##### SD-10 Operation and Maintenance Data

- Training Plan
- Training Attendance Rosters
- Systems Manual

##### SD-11 Closeout Submittals

- Construction Phase Commissioning Plan
- Final Commissioning Report

#### 1.7 COMMISSIONING FIRM

Provide a Commissioning Firm that is certified in commissioning by one of the following: the AABC Commissioning Group (ACG); the National Environmental Balancing Bureau (NEBB); the International Certification Board/Testing, Adjusting, and Balancing Bureau (ICB/TABB), the Building Commissioning Association (BCA); the Association of Energy Engineers (AEE).

The Commissioning Firm may employ a commissioning professional certified by the University of Wisconsin-Madison or the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) as required in paragraph LEAD COMMISSIONING SPECIALIST as an alternative to certification of the Commissioning Firm. The Commissioning Firm must be certified in all systems to be commissioned to the extent such certifications are available from the certifying body. Describe any lapses in certification or disciplinary action taken by the certifying body against the proposed Commissioning Firm or Lead Commissioning Specialist in detail. Any firm or commissioning professional that has been the subject of disciplinary action by the certifying body within the five years preceding contract award is not eligible to perform any duties related to commissioning.

- a. Submit the Commissioning Firm's certification of qualifications including the name of the firm and certifications no later than 30 calendar days after Notice to Proceed. Submit one hard copy and an electronic copy.
- b. The Commissioning Firm's and Commissioning Specialists' certifications must be maintained for the entire duration of the duties specified herein. If, for any reason, the firm or a specialist loses a certification during this period, immediately notify the Contracting Officer's Representative/Contracting Officer's Technical Representative and submit another Commissioning Firm or Commissioning Specialist for approval. All work specified in this specification section performed by the Commissioning Firm or associated Commissioning Specialists is invalid if the Commissioning Firm or Commissioning Specialist loses its certification prior to contract completion and must be performed by an approved successor.
- c. The Commissioning Firm must oversee and assist the General or Prime Contractor with the work specified herein. Submit the Commissioning Firm's Contract including the Scope of Work associated with the paragraph POST-CONSTRUCTION SUPPORT no later than 30 calendar days after approval of the Commissioning Firm. Submit one hard copy and an electronic copy.

#### 1.7.1 Lead Commissioning Specialist

The Commissioning Firm must provide a Lead Commissioning Specialist (Cx/C) that has a minimum of five years of commissioning experience, including two projects of similar size and complexity, and that is one of the following: a NEBB qualified Systems Commissioning Administrator (SCA); ACG Certified Commissioning Authority (CxA); ICB/TABB Certified Commissioning Supervisor; BCA Certified Commissioning Professional (CCP); AEE Certified Building Commissioning Professional (CBCP); University of Wisconsin-Madison Qualified Commissioning Process Provider (QCxP); ASHRAE Commissioning Process Management Professional (CPMP).

- a. Submit the Lead Commissioning Specialist's certification of qualifications including the name of the specialist and firm; certifications; years of experience; and a listing of representative projects of similar size and complexity no later than 30 calendar days after Notice to Proceed. Submit one hard copy and an electronic copy.
- b. The Lead Commissioning Specialists certifications must be maintained for the entire duration of the duties specified herein. If, for any reason, the specialist loses a certification during this period, immediately notify the Contracting Officer's Representative/Contracting

Officer's Technical Representative and submit another Lead Commissioning Specialist for approval. All work specified in this specification section to be performed by the Lead Commissioning Specialist is invalid if the Lead Commissioning Specialist loses its certification prior to contract completion and must be performed by an approved successor.

- c. The Lead Commissioning Specialist must lead and oversee the commissioning work specified herein and be the primary point of contact for the Government regarding the commissioning work.

#### 1.7.2 Technical Commissioning Specialists

Technical Commissioning Specialists, employed by the Commissioning Firm and that have the following qualifications, must perform the technical work specified herein associated with each system to be commissioned:

- a. The technical work associated with mechanical systems including Heating, Ventilating, Air Conditioning, and Refrigeration Systems must be performed by a Commissioning Specialist certified by NEBB, ACG, ICB/TABB, AEE, University of Wisconsin-Madison, ASHRAE, or BCA in the commissioning of HVAC systems with five years of experience in the commissioning of HVAC systems.
- b. Submit the Technical Commissioning Specialist's certification of qualifications including the name of the specialist and firm; certifications; years of experience; and a listing of representative projects of similar size and complexity no later than 30 calendar days after Notice to Proceed. Submit one hard copy and an electronic copy.

#### 1.7.3 Commissioning Standard

Comply with the requirements of the commissioning standard under which the Commissioning Firm and Specialists qualifications are approved. When the firm and specialists are certified by BCA, AEE, ASHRAE, or the University of Wisconsin-Madison, comply with the requirements of one of the acceptable standards unless otherwise stated herein. The acceptable standards are ACG Commissioning Guideline, NEBB Commissioning Standard, SMACNA 1429, or ASHRAE 202. Comply with applicable NETA and NICET testing standards for electrical systems.

- a. Implement all recommendations and suggested practices contained in the Commissioning Standard and electrical test standards.
- b. Use the Commissioning Standard for all aspects of Commissioning, including calibration of instruments.
- c. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the Commissioning Standard, adhere to the manufacturer calibration recommendations.
- d. All quality assurance provisions of the Commissioning Standard such as performance guarantees are part of this contract.
- e. The Commissioning Specialists must develop commissioning procedures for any systems or system components not covered in the Commissioning Standard.
- f. Use any new requirements, recommendations, and procedures published or



adopted prior to contract solicitation by the body responsible for the Commissioning Standard.

#### 1.8 ISSUES LOG

The Lead Commissioning Specialist must develop and maintain an Issues Log for tracking and resolution of all deficiencies discovered through commissioning review, inspection, and testing. Include the date of final resolution of issues as confirmed by the Commissioning Specialist. Submit the Issues Log to the Contracting Officer's Technical Representative on a monthly basis at a minimum, and provide an electronic copy to the Government Acceptance Engineer concurrently. At any point during construction, any commissioning team member finding deficiencies may communicate those deficiencies in writing to the Commissioning Specialist for inclusion into the Issues Log.

Track construction deficiencies identified in the Issues Log in accordance with the Quality Control Plan required by Specification Section 01 45 00.00 20 QUALITY CONTROL.

#### 1.9 CERTIFICATE OF READINESS

Prior to scheduling Functional Performance Tests for each system, issue a Certificate of Readiness for the system certifying that the system is ready for Functional Performance Testing. The Certificate of Readiness must include, for each system to be commissioned, all equipment and system start-up reports; Performance Verification Test Reports; completed Building Envelope Inspection Checklists; completed Pre-Functional Checklists; Testing, Adjusting, and Balancing (TAB) Report; HVAC Controls Start-Up Reports to the extent applicable to the system. The Contractor; the Lead Commissioning Specialist; the Contractor's Quality Control Representative; the Mechanical, Electrical, Controls, and TAB subcontractor representatives must sign and date the Certificate of Readiness. Submit the Certificate of Readiness for each system no later than 14 calendar days prior to Functional Performance Tests of that system. Submit one hard copy and an electronic copy. Do not schedule Functional Performance Tests for a system until the Certificate of Readiness for that system receives approval by the Government.

### PART 2 PRODUCTS

Not used

### PART 3 EXECUTION

#### 3.1 CONSTRUCTION PHASE

##### 3.1.1 Construction Commissioning Coordination Meeting

The Lead Commissioning Specialist must lead a Construction Commissioning Coordination Meeting no later than 14 days after approval of the Commissioning Firm and Commissioning Specialists to discuss the commissioning process including contract requirements, lines of communication, roles and responsibilities, schedules, documentation requirements, inspection and test procedures, and logistics as specified in this specification section. The Contractor's Superintendent or Project Manager, the Contractor's Quality Control Representative, and the Government must attend this meeting. Invite the User and a Public Works Division Representative, to attend this meeting.

### 3.1.2 Construction Phase Commissioning Plan

#### 3.1.2.1 Interim Construction Phase Commissioning Plan

The Lead Commissioning Specialist (CxC) must prepare the Interim Construction Phase Commissioning Plan. Submit the Interim Construction Phase Commissioning Plan no later than 30 calendar days after the Construction Commissioning Coordination Meeting. Submit one hard copy and an electronic copy.

Identify the commissioning and testing standards and outline the overall commissioning process, the commissioning schedule, the commissioning team members and responsibilities, lines of communication, documentation requirements for the construction phase of the project, and Template Building Envelope Inspection Checklists in the Interim Construction Phase Commissioning Plan.

##### 3.1.2.1.1 Checklists

Download example Building Envelope Inspection Checklists, Pre-Functional Checklists, Functional Performance Test Checklists for specification section 01 91 00.15 TOTAL BUILDING COMMISSIONING at the following location: <http://www.wbdg.org/FFC/NAVGRAPH/graphoc.pdf>. The checklists submitted in the Interim and Final Construction Phase Commissioning Plans must contain the same level of detail shown in the examples. The submitted checklists are not required to match the format of the examples.

#### 3.1.2.2 Final Construction Phase Commissioning Plan

The Lead Commissioning Specialist (CxC) must prepare the Final Construction Phase Commissioning Plan. Submit the Final Construction Phase Commissioning Plan no later than 30 calendar days prior to the start of Pre-Functional Checks. Submit one hard copy and an electronic copy.

Include the information provided in the Interim Construction Phase Commissioning Plan. In addition, the Technical Commissioning Specialist must develop the Pre-Functional Checklists, and Functional Performance Test Checklists for each building, for each system required to be commissioned, and for each component for inclusion in the Final Construction Phase Commissioning Plan.

##### 3.1.2.2.1 Pre-Functional Checklists

The Pre-Functional Checklists must include items for physical inspection or testing that demonstrate that installation and start-up of equipment and systems is complete. See paragraph Pre-Functional Checks for more information. Functional Performance test procedures must explain, step-by-step, the actions and expected results that will demonstrate that the system performs in accordance with the contract in the Functional Performance Test Checklists. See paragraph Functional Performance Tests for more information.

##### 3.1.2.2.2 Functional Performance Test Checklists

Functional Performance Test Checklists must include procedures that explain, step-by-step, the actions and expected results that will demonstrate that the system performs in accordance with the contract. See

paragraph Functional Performance Tests for more information. Include the following sections and details appropriate to the systems being tested in the Functional Performance Test Checklists:

- a. Notable system features including information about such attributes as system sizing and controls to facilitate understanding of system operation
- b. Conclusions and recommendations based on control system feature, point-to-point, actuator, and system operation observations. Conclusions must clearly indicate if system does or does not perform in accordance with contract requirements. Recommendation must clearly indicate that the system should or should not be accepted by the Government.
- c. Test conditions including date, beginning and ending time, and beginning and ending outdoor air conditions
- d. Attendees present throughout the entire system test
- e. Identification of the equipment involved in the test
- f. Control system feature identification including control point description, embedded/visible type, adjustable/monitoring type, actual value, and setpoint value/alarm range
- g. Point-to-point observations including demonstrating system flow meters and sensors have been calibrated and are correctly displayed on the Operator work station
- h. Actuator operation observations demonstrating actuator responses to commands from the control system
- i. As-found condition of the system operation
- j. List of test items with step numbers along with the corresponding feature or control operation, intended test procedure, expected system response, and pass/fail indication.
- k. Space for comments for each test item.
- i. System operation observations for system-based tests demonstrating each control algorithm, operation mode, and alarm condition resulting from control point(s) manipulation. System operation observations must contain the following:
  - (1) introduction identifying testing methodology
  - (2) as-found conditions prior to control point(s) manipulation
  - (3) clear list of test items (step numbers)
  - (4) control algorithm (design control sequence) segmented by unique functions
  - (5) intended test procedures following each segmented control algorithm identifying control point(s) required to be manipulated to initiate system response

- (6) expected system response
- (7) space for comments for each test item complete including resulting control signal such as 0-volts, 10-volts, active, or inactive
- (8) pass or fail indication for each test item

### 3.1.3 Construction Submittals

Provide all submittals associated with the systems to be commissioned, including shop drawings; equipment submittals; test plans, procedures, and reports; and resubmittal's to the Commissioning Specialists. The Technical Commissioning Specialist must review the submittals to the extent necessary verify that the equipment and system installation will comply with the contract requirements .

### 3.1.4 Inspection and Testing

Demonstrate that all system components have been installed, that each control device and item of equipment operates, and that the systems operate and perform, including interactive operation between systems, in accordance with contract documents and the Owner's Project Requirements. Requirements in related specification sections are independent from the requirements of this section and do not satisfy any of the requirements specified in this specification section. Provide all materials, services, and labor required to perform the Pre-Functional Checks, Building Envelope Inspection and Functional Performance Tests.

#### 3.1.4.1 Commissioning Team

Provide a commissioning representative for each sub-contractor associated with the systems to be commissioned. Each commissioning representative is responsible for coordination of their respective sub-contractor's execution of the commissioning activities and participation in the inspection and testing required by this specification section. The designers listed below are the designers of record for their respective systems. Substitutes must be approved by the Contracting Officer's Representative Contracting Officer's Technical Representative.

##### 3.1.4.1.1 Mechanical System Pre-Functional Checks Team

The following team members must participate in Pre-Functional checks of mechanical systems:

| Designation | Function   |
|-------------|--|
| CxM         | Mechanical System Technical Commissioning Specialist   |
| QAR         | Contracting Officer's Quality Assurance Representative |
| CQC         | Contractor's Quality Control Personnel                 |
| MC          | Contractor's Mechanical Commissioning Representative   |
| EC          | Contractor's Electrical Commissioning Representative   |

| Designation | Function   |
|-------------|--|
| CC          | Contractor's Controls Commissioning Representative   |
| TABC        | Contractor's TAB Commissioning Representative        |
| PC          | Contractor's Plumbing Commissioning Representative   |
| IC          | Contractor's Irrigation Commissioning Representative |

#### 3.1.4.1.2 Mechanical Systems Test Team

The following team members must participate in Functional Performance, Seasonal, Testing of mechanical systems:

|      |  |
|------|--|
| CxM  | Mechanical System Technical Commissioning Specialist   |
| QAR  | Contracting Officer's Quality Assurance Representative |
| CQC  | Contractor's Quality Control Personnel                 |
| MC   | Contractor's Mechanical Commissioning Representative   |
| EC   | Contractor's Electrical Commissioning Representative   |
| CC   | Contractor's Controls Commissioning Representative     |
| TABC | Contractor's TAB Commissioning Representative          |
| PC   | Contractor's Plumbing Commissioning Representative     |
| IC   | Contractor's Irrigation Commissioning Representative   |

#### 3.1.4.2 Pre-Functional Checks

Pre-Functional Checklists from the approved Final Construction Phase Commissioning Plan must be completed by the commissioning team. Complete one Pre-Functional Checklist for each individual item of equipment or system for each system required to be commissioned including, but not limited to, ductwork, piping, equipment, fixtures (lighting and plumbing), and controls. Indicate commissioning team member inspection and acceptance of each Pre-Functional Checklist item by initials. Acceptance of each Pre-Functional Checklist item by each team member indicates that item conforms to the construction contract requirements in their area of responsibility. Technical Commissioning Specialist acceptance of each Pre-Functional Checklist item indicates that each item has been installed correctly and in accordance with contract documents and the Owner's Project Requirements. Submit the completed and initialed Pre-Functional Checklists no later than 7 calendar days after completion of inspection of all checklists items for each system. Submit one hard copy and an electronic copy. Include manufacturer start-up checklists associated with equipment with the submission of the Pre-Functional Checklists.

#### 3.1.4.3 Testing, Adjusting, and Balancing (TAB) Report and Field Acceptance Testing

The Mechanical System Technical Commissioning Specialist must review the pre-final TAB Report required by Specification Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC. Identify any deficiencies to the Contracting Officer's Representative Contracting Officer's Technical Representative and the Contractor's Quality Control Personnel. Resolve all deficiencies prior to TAB Field Acceptance Testing.

The Mechanical System Technical Commissioning Specialist must witness the TAB Field Acceptance Testing specified by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC. Include a certification by the Mechanical Technical Specialist that no outstanding deficiencies exist in the systems relative to Testing, Adjusting, and Balancing with the final TAB Report submittal.

#### 3.1.4.4 HVAC Controls Test Reports

The Mechanical System Technical Commissioning Specialist must review the Performance Verification Testing Plan, Checklists, and Report required by Specification Section 23 09 23.13 22 BACNET DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC. Include a certification by the Mechanical System Technical Commissioning Specialist that the submittals contain no deficiencies or that the submittals do not indicate any deficiencies in the HVAC systems or HVAC control systems with each of these submittals.

#### 3.1.4.5 Tests

##### 3.1.4.5.1 Functional Performance Tests

Schedule Functional Performance Tests for each system only after the Certificate of Readiness has been approved by the Government for the system. Correct all deficiencies identified through any prior review, inspection, or test activity before the start of Functional Performance Tests.

- a. Functional Performance Tests must be performed with the Contracting Officer's Quality Assurance Representative present.
- b. Abort Functional Performance Tests when any system deficiency prevents the successful completion of the test.
- ac. Technical Commissioning Specialists must lead and document all Functional Performance Tests for the systems to be commissioned with the Contractor and appropriate sub-contractors performing the Functional Performance Tests. The representatives listed in the paragraph Commissioning Team must attend the tests. Abort Functional Performance Tests when any required commissioning team member is not present for the test.

##### 3.1.4.5.1.1 Checklist

Use the Functional Performance Test Checklists from the approved Final Construction Phase Commissioning Plan to guide the Functional Performance Tests. Functional Performance Tests must be performed for each item of equipment and each system required to be commissioned and verify all sensor calibrations, control responses, safeties, interlocks, operating modes, sequences of operation, capacities, lighting levels, and all other

performance requirements comply with construction contract and accepted design requirements regardless of the specific items listed within the Functional Performance Test Checklists provided. Testing must progress from equipment or components to subsystems to systems to interlocks and connections between systems. The order of components and systems to be tested must be determined by the Technical Commissioning Specialists.

#### 3.1.4.5.1.2 Acceptance

Indicate acceptance of each item of equipment and systems tested by signature of each commissioning team member for each Functional Performance Test. The Contractor's Quality Control Representative and the Technical Commissioning Specialists must indicate acceptance after the equipment and systems are free of deficiencies.

#### 3.1.4.5.2 HVAC Test Methods

Perform Functional Performance Tests in accordance with the following:

##### 3.1.4.5.2.1 Prior to Testing

Prior to testing operating modes, sequences of operation, interlocks, and safeties, complete control point-to-point observations, test sensor calibrations, and test actuator commands. Prior to system testing, complete control system feature, point-to-point, and actuator observations.

##### 3.1.4.5.2.2 Simulating Conditions

Over-writing control input (actual) values through the controls system is not acceptable, unless approved by the Contracting Officer's Representative Contracting Officer's Technical Representative. Identify proposed exceptions in a protocol submitted to the Contracting Officer's Representative Contracting Officer's Technical Representative for approval. Before simulating conditions, overwriting values (if approved), or changing set-points, calibrate all sensors, transducers and devices. Below are several examples of exceptions that would be considered acceptable:

- a. When varying static pressures inside ductwork can not be simulated within the duct, and where a sensor signals the controls system to initiate sequences at various duct static pressures, it is acceptable to simulate the various pressures with a Pneumatic Squeeze-Bulb Type Signaling Device with gauge temporarily attached to the sensing tube leading to the transmitter. It is not acceptable to reset the various set-points, nor to simulate an electric analog signal (unless approved as noted above).
- b. Dirty filter pressure drops can be simulated using sheets of cardboard at filter face.
- c. Freeze-stat safeties can be simulated by packing portion of sensor with ice.
- d. High outside air temperatures can be simulated with a hair blower.
- e. High entering cooling coil temperatures can be used to simulate entering cooling coil conditions.
- f. Do not use signal generators to simulate sensor signals unless approved by the Contracting Officer's Representative Contracting Officer's

Technical Representative, as noted above, for special cases.

- g. Control set points can be altered. For example, to see the air conditioning compressor lockout work at an outside air temperature below 55 degrees F, when the outside air temperature is above 55 degrees F, temporarily change the lockout set point to be 0 degrees F above the current outside air temperature. Caution: Set points are not to be raised or lowered to a point such that damage to the components, systems, or the building structure and/or contents will occur.
- h. Test duct mounted smoke detectors in accordance with the manufacturer's recommendations. Perform the tests with air system at minimum airflow condition in ductwork.
- i. Test current sensing relays used for fan and pump status signals to control system to indicate unit failure and run status by resetting the set point on the relay to simulate a lost belt or unit failure while the unit is running. Confirm that the failure alarm was generated and received at the control system. After the test is conducted, return the set point to its original set-point or a set-point as indicated by the Contracting Officer's Representative Contracting Officer's Technical Representative.

#### 3.1.4.5.2.3 Setup

Perform each test under conditions that simulate actual conditions as close as is practically possible. Provide all necessary materials and system modifications to produce the necessary flows, pressures, temperatures, and other conditions necessary to execute the test according to the specified conditions. At completion of the test, return the affected building equipment and systems to their pre-test condition.

#### 3.1.4.5.3 Seasonal Tests

##### 3.1.4.5.3.1 Initial Functional Performance Tests

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

##### 3.1.4.5.3.2 Full-Load Conditions

In addition to the Initial Functional Performance Tests, perform Functional Performance Tests of HVAC systems under full-load conditions during peak heating and cooling seasons during outdoor air condition design extremes. Test cooling equipment and systems with the building fully occupied when performing the Functional Performance Tests during peak cooling season.

Schedule Seasonal Functional Performance Tests in coordination with the Government.

##### 3.1.4.5.3.3 System Acceptance

Systems may be partially accepted prior to seasonal testing if they comply with all construction contract that can be tested during initial Functional Performance Tests. All Functional Performance Test procedures must be completed prior to full systems acceptance.



#### 3.1.4.5.4 Aborted Tests and Re-Testing

Abort Functional Performance Tests or Seasonal Tests if any deficiency prevents successful completion of the test or if any required commissioning team member is not present for the test. reimburse the Government for all costs associated with effort lost due to re-testing due to test failures and aborted tests. These costs must include salary, travel costs, and per diem for Government commissioning team members. Re-test only after all deficiencies identified during the original tests have been corrected.

##### 3.1.4.5.4.1 100 Percent Sample

Systems or equipment for which 100 percent sample size are tested fail if one or more of the test procedures results in discovery of a deficiency and the deficiency cannot be resolved within 5 minutes during the test.

Re-test to the extent necessary to confirm that the deficiencies have been corrected without negatively impacting the performance of the rest of the system.

##### 3.1.4.5.4.2 Less than 100 Percent Sample

For systems tests with a sample size less than 100 percent, if one or more of the test procedures for an item of equipment or a system results in discovery of a deficiency, regardless of whether the deficiency is corrected during the sample tests, the item of equipment or system fails the test.

- a. If the system failure rate is 5 percent or less, meaning that 5 percent or less of the equipment or systems had at least one deficiency, re-test only on the items which experienced the initial failures.
- b. If the system failure rate is higher than 5 percent, meaning that more than 5 percent of equipment or systems tested had at least one deficiency, re-test the items which experienced the initial failures to the extent necessary to confirm that the deficiencies have been corrected. In addition, test another random sample of the same size as the initial sample for the first time. If the second random sample set has any failures, re-test those failed items and all remaining equipment and systems to complete 100 percent testing of that system type.

#### 3.1.5 Training Plan

The Technical Commissioning Specialists must develop training plans which identify Develop a training plan which identifies all training required by specification sections associated with commissioned systems. Include a matrix listing each training requirement, content of the training, the trainer name, trainer contact information, and schedule and location of training. Submit one hard copy and an electronic copy of the Training Plan to the Commissioning Specialists and the Government no later than 30 calendar days prior to the associated training.

Document training attendance using training attendance rosters and provide completed attendance rosters to the Commissioning Specialists and the Government no later than 7 calendar days following the completion of training for each system to be commissioned. Submit one hard copy and an electronic copy..

### 3.1.6 Systems Manual

The Technical Commissioning Specialists must prepare and submit Prepare and submit a Systems Manual including, for all commissioned systems, the Basis of Design, system single line diagrams, as-built sequences of operation and controls drawings, as-built control setpoints, recommended schedule for sensor and actuator calibration, recommended schedule of maintenance when not in the O&M manuals, recommended re-testing schedule with proposed testing forms, and full equipment warranty information. Update and resubmit the Systems Manual based on any corrective action taken during the warranty period. The Technical Commissioning Specialists must review the Systems Manual. Include a signed certification or letter from the Lead Commissioning Specialist stating that the Systems Manual is complete, clear, and accurate with the submittal.

Submit Systems Manual no later than 30 calendar days following completion of Functional Performance Tests. Submit three hard copies and an electronic copy.

### 3.2 COMMISSIONING REPORT

Following the completion of Functional Performance Tests, with the exception of Seasonal Tests, the Lead Commissioning Specialist must prepare a Commissioning Report.

- a. Include an executive summary describing the overall commissioning process, the results of the commissioning process, any outstanding deficiencies and recommended resolutions, and any seasonal testing that must be scheduled for a later date. Indicate, in the executive summary, whether the systems meet the requirements of the construction contract and accepted design and the Owner's Project Requirements.
- b. Detail any deficiencies discovered during the commissioning process and the corrective actions taken in the report. Include the completed Pre-Functional Checklists, Functional Performance Test Checklists, the Commissioning Plans, the Issues Log, Performance Verification Test Reports, Training Attendance Rosters, the Design Review Report, the final TAB Report.
- c. Submit the Commissioning Report no later than 14 calendar days following commissioning team acceptance of all Functional Performance Tests with the exception of Seasonal Tests and following completion of the Endurance Test. Submit three hard copies and an electronic copy.
- d. Following any Seasonal Tests or Post-Construction Activities, update the Final Commissioning Report to reflect any changes and resubmit.

### 3.3 POST-CONSTRUCTION SUPPORT

#### 3.3.1 Post-Construction Site Visit

The Commissioning Specialists must visit the building site concurrent with the 9 month warranty inspection to inspect building system equipment and review building operation with the building operating/maintenance staff. The Commissioning Specialists must identify any deficiency of the building systems to operate in accordance with the contract and accepted design requirements and the Owner's Project Requirements. The Commissioning Specialists must advise the Contracting Officer's Representative

Contracting Officer's Technical Representative of any identified deficiencies and the proposed corrective action. Submit an updated commissioning report and systems manual documenting the results of the post-construction inspection.





-- End of Section --

## SECTION 02 41 00

DEMOLITION  
05/10

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI Guideline K (2009) Guideline for Containers for Recovered Non-Flammable Fluorocarbon Refrigerants

## AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.6 (2006) Safety Requirements for Demolition Operations

## ASTM INTERNATIONAL (ASTM)

ASTM F 710 (2011) Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

## CARPET AND RUG INSTITUTE (CRI)

CRI 104 (2002) Standard for Installation Specification of Commercial Carpet

## U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011; Change 7 2012) Safety and Health Requirements Manual

## U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA 4145.25 (June 2000) Storage and Handling of Liquefied and Gaseous Compressed Gases and Their Full and Empty Cylinders

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

DOD 4000.25-1-M (2004) Military Standard Requisitioning and Issue Procedures

MIL-STD-129 (2007; Rev P; Change 4) Military Marking for Shipment and Storage

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

|                |  |
|----------------|--|
| 40 CFR 61      | National Emission Standards for Hazardous Air Pollutants                 |
| 40 CFR 82      | Protection of Stratospheric Ozone  |
| 49 CFR 173.301 | Shipment of Compressed Gases in Cylinders and Spherical Pressure Vessels |

## 1.2 PROJECT DESCRIPTION

## 1.2.1 Demolition Plan

Prepare a Demolition Plan and submit proposed demolition and removal procedures for approval before work is started. Include in the plan procedures for careful removal and disposition of materials specified to be removed, coordination with other work in progress, a detailed description of methods and equipment to be used for each operation and of the sequence of operations.

## 1.2.2 General Requirements

Do not begin demolition until authorization is received from the Contracting Officer. Remove rubbish and debris from the station daily; do not allow accumulations inside or outside the building. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

## 1.3 ITEMS TO REMAIN IN PLACE

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract. Do not overload structural elements and pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

## 1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove 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 in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Existing Conditions

SD-07 Certificates

Demolition Plan  
Notification

SD-11 Closeout Submittals

Receipts

## 1.6 QUALITY ASSURANCE

Furnish timely notification of demolition and renovation projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the State's environmental protection agency and local air pollution control district/agency and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSE/SAFE A10.6. Comply with the Environmental Protection Agency requirements specified. Use of explosives will not be permitted.

### 1.6.1 Dust and Debris Control

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Vacuum and dust the work area daily.

## 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 work being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

## 1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Items to be relocated which are damaged by the Contractor shall be repaired or replaced 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.

## PART 2 PRODUCTS

## PART 3 EXECUTION

### 3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures onsite for reuse. Existing construction scheduled to be removed for reuse shall be disassembled. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified. Materials shall be designated for reuse onsite whenever possible.

#### 3.1.1 Utilities and Related Equipment

##### 3.1.1.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

##### 3.1.1.2 Disconnecting Existing Utilities

Remove existing utilities, as indicated, and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered but are not indicated on the drawings, notify the Contracting Officer prior to further work in that area.

#### 3.1.2 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs including aggregate base as indicated to full depth of the pavement. Provide neat sawcuts at existing joint locations for concrete finishes with joints. Sawcutting at locations other than joint locations is not permitted. Contractor to verify the existence and location of all utilities and conduit embedded in slab before cutting concrete.

##### 3.1.3 Masonry

Sawcut and remove masonry so as to prevent damage to surfaces to remain, and to facilitate the installation of new work. Where new masonry adjoins existing, the new work shall abut or tie into the existing construction as specified for the new work. Provide square, straight edges and corners where existing masonry adjoins new work and other locations.

##### 3.1.4 Concrete

Saw concrete along straight lines to a full depth of the pavement section. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed,

grind smooth or saw cut entirely through the concrete.

#### 3.1.5 Miscellaneous Metal

Scrap metal shall become the Contractor's property. Recycle scrap metal as part of demolition and deconstruction operations. Provide separate containers to collect scrap metal and transport to a scrap metal collection or recycling facility, in accordance with the Waste Management Plan.

#### 3.1.6 Flooring Adhesive and Resilient Tile Removal

Remove existing resilient floor covering, quarry or paver tile, all traces of old adhesives, paint or other contaminants. Do not sand, dry sweep, dry scrape, drill, saw, beadblast, or mechanically chip or pulverize existing resilient flooring, backing lining felt, asphaltic "cutback" adhesive, or other adhesive. Adhesive shall be removed by bead blasting or scarifying the substrate. Do not use solvents.

Flooring adhesive removal shall adhere to the following guidelines:

- a. The use of Hydrocarbon Petrochemical products or Solvents of any kind are prohibited and banned from use on this project.
- b. MSDS Sheets for products proposed for use must be submitted for approval 15 working days prior to use.
- c. RFCI (The Resilient Floor Covering Institute) methods must be adhered to.
- d. Concrete subfloor must free of any bond breakers or sealers of any kind.
- e. ASTM F 710 Standards apply.

#### 3.1.7 Carpet

Remove existing carpet for reclamation in accordance with manufacturer recommendations and as follows. Remove used carpet in large pieces, roll tightly, and pack neatly in a container. Remove adhesive according to recommendations of the Carpet and Rug Institute (CRI). Adhesive removal solvents shall comply with CRI 104, with the exception that adhesive removal solvents shall not be used. Recycle removed carpet cushion.

#### 3.1.8 Acoustic Ceiling Tile

Remove, neatly stack, and recycle acoustic ceiling tiles. Recycling may be available with manufacturer. Otherwise, priority shall be given to a local recycling organization.

#### 3.1.9 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated, and

shall include:

- a. Concrete and Masonry: Completely fill holes and depressions, caused by previous physical damage or left as a result of removals in existing masonry walls to remain, with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.
- b. Where existing partitions have been removed leaving damaged or missing resilient tile flooring, patch to match the existing floor tile.
- c. Patch acoustic lay-in ceiling where partitions have been removed. The transition between the different ceiling heights shall be effected by continuing the higher ceiling level over to the first runner on the lower ceiling and closing the vertical opening with a painted sheet metal strip.

#### 3.1.10 Air Conditioning Equipment

Remove air conditioning, refrigeration, and other equipment containing refrigerants without releasing chlorofluorocarbon refrigerants to the atmosphere in accordance with the Clean Air Act Amendment of 1990. Recover all refrigerants prior to removing air conditioning, refrigeration, and other equipment containing refrigerants and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS).

#### 3.1.11 Locksets on Swinging Doors

Remove all locksets from all swinging doors indicated to be removed and disposed of. Deliver the locksets and related items to a designated location for receipt by the Contracting Officer after removal.

#### 3.1.12 Mechanical Equipment and Fixtures

Disconnect mechanical hardware at the nearest connection to existing services to remain, unless otherwise noted. Disconnect mechanical equipment and fixtures at fittings. Remove service valves attached to the unit. Salvage existing chillers and disconnects and transport to a designated on station storage area as directed by the Contracting Officer. Do not remove equipment until approved.

##### 3.1.12.1 Preparation for Storage

Remove water, dirt, dust, and foreign matter from units; tanks, piping and fixtures shall be drained; interiors, if previously used to store flammable, explosive, or other dangerous liquids, shall be steam cleaned. Seal openings with caps, plates, or plugs. Secure motors attached by flexible connections to the unit. Change lubricating systems with the proper oil or grease.

##### 3.1.12.2 Piping

Disconnect piping at unions, flanges and valves, and fittings as required to reduce the pipe into straight lengths for practical storage. If the piping that remains can become pressurized due to upstream valve failure, end caps, blind flanges, or other types of plugs or fittings with a pressure gage and bleed valve shall be attached to the open end of the pipe to ensure positive leak control. Carefully dismantle piping that

previously contained gas, gasoline, oil, or other dangerous fluids, with precautions taken to prevent injury to persons and property. Store piping outdoors until all fumes and residues are removed. Box prefabricated supports, hangers, plates, valves, and specialty items according to size and type. Wrap sprinkler heads individually in plastic bags before boxing. Classify piping not designated for reuse as scrap metal.

#### 3.1.12.3 Ducts

Classify removed duct work as scrap metal.

#### 3.1.12.4 Fixtures, Motors and Machines

Remove fixtures, motors and machines associated with plumbing, heating, air conditioning, refrigeration, and other mechanical system installations.

#### 3.1.13 Electrical Equipment and Fixtures

Disconnect primary, secondary, control, communication, and signal circuits at the point of attachment to their distribution system.

##### 3.1.13.1 Fixtures

Remove electrical fixtures.

##### 3.1.13.2 Electrical Devices

Remove switches, switchgear, transformers, conductors including wire and nonmetallic sheathed and flexible armored cable, regulators, meters, instruments, plates, circuit breakers, panelboards, outlet boxes, and similar items.

##### 3.1.13.3 Wiring Ducts or Troughs

Remove wiring ducts or troughs.

#### 3.1.14 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 Reuse of Materials and Equipment

Remove and store materials and equipment indicated to be reused or relocated to prevent damage, and reinstall as the work progresses. Remove all fire alarm equipment and store for later reinstallation.

### 3.3.3 Disposal of Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in Section, 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting AHRI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. Recovered ODS shall be removed from Government property and disposed of in accordance with 40 CFR 82. Products, equipment and appliances containing ODS in a sealed, self-contained system (e.g. residential refrigerators and window air conditioners) shall be disposed of in accordance with 40 CFR 82. Submit Receipts or bills of lading, as specified. Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped to the Defense Depot, Richmond, Virginia.

#### 3.3.3.1 Special Instructions

No more than one type of ODS is permitted in each container. A warning/hazardous label shall be applied to the containers in accordance with Department of Transportation regulations. All cylinders including but not limited to fire extinguishers, spheres, or canisters containing an ODS shall have a tag with the following information:

- a. Activity name and unit identification code
- b. Activity point of contact and phone number
- c. Type of ODS and pounds of ODS contained
- d. Date of shipment
- e. Naval stock number (for information, call (804) 279-4525).

#### 3.3.3.2 Fire Suppression Containers

Deactivate fire suppression system cylinders and canisters with electrical charges or initiators prior to shipment. Also, safety caps must be used to cover exposed actuation mechanisms and discharge ports on these special cylinders.

#### 3.3.4 Transportation Guidance

Ship all ODS containers in accordance with MIL-STD-129, DLA 4145.25 (also referenced one of the following: Army Regulation 700-68, Naval Supply Instruction 4440.128C, Marine Corps Order 10330.2C, and Air Force

Regulation 67-12), 49 CFR 173.301, and DOD 4000.25-1-M.

### 3.3.5 Unsalvageable and Non-Recyclable Material

Dispose of unsalvageable and non-recyclable combustible material in the sanitary land fill 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 materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified by removing from Marine Corps Base, Cherry Point.

#### 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 to Spoil Areas on Government Property

Transport noncombustible materials removed from demolition and deconstruction structures to designated spoil areas on Government property.

#### 3.5.4 Removal from Government Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

### 3.6 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 --



## SECTION 02 50 00

## WORK UTILIZING SECTIONS REFERENCING NCDOT HWY SPECS &amp; STANDARDS

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 basic designation only.

## ASTM INTERNATIONAL (ASTM)

|             |  |
|-------------|--|
| ASTM D 698  | (2007e1) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.)) |
| ASTM D 1188 | (1989) Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens              |
| ASTM D 1556 | (2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method  |
| ASTM D 2726 | (2000) Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens        |
| ASTM D 2922 | (2004) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)                                  |
| ASTM D 3017 | (2004) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)                                      |

## STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT)

|       |   |
|-------|---|
| NCDOT | (2012) Standard Specifications for Roads and Structures |
|-------|---|

## 1.2 SUBMITTALS

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

## SD-03 Product Data

Pavement mix

Tack coat

Stone

## SD-05 Design Data

Job-mix formula

## SD-07 Certificates

Asphalt Removal Recycling Establishment - Location, Name, Address  
of Operator, and Telephone Number

## 1.2.1 Job-Mix Formula

Submit the mix design, including mixing temperature, for approval. The mix design shall include a certified laboratory analysis of mix composition with marshall stability value, void content, and flow. After mix design approval, job mixes shall conform to the range of tolerances specified in NCDOT. An identical mix design previously approved within the past 12 months by the Atlantic Division, Naval Facilities Engineering Command, may be used without further approval, provided that copies of the previous approval are submitted. Obtain acknowledgement of receipt prior to bituminous concrete placement. Submit additional data regarding materials if the source of the materials changes.

## 1.3 GENERAL REQUIREMENTS

All "Section" references refer to NCDOT, Standard Specifications for Roads and Structures. In all references

- a. The articles entitled "Method of Measurement", "Basis of Payment" and "Acceptance of Bituminous Materials" will not apply.
- b. All references to "Engineer" shall mean "Contracting Officer".
- c. All work shall conform to NCDOT, Roadway Standards.

## 1.4 ASPHALT/BITUMINOUS PAVEMENT MATERIAL OPTION

The Contractor has the option to provide either of the following pavement materials:

- a. Asphalt/Bituminous Mix with recycled aggregate material

Mix shall contain recycled/reclaimed asphalt material not to exceed 25 percent by weight of the total aggregate material. Mix design shall conform to Section 611 and the Sections for the Type of material specified. The submittal shall clearly state:

|                            |                              |
|----------------------------|------------------------------|
| Recycled Asphalt Cement    | Viscosity                    |
| New Asphalt Cement         | Grade                        |
| Recycling Agent(s), if any | Properties                   |
| Mix Composition            | Percentage of Each Component |

- or -

- b. Asphalt/Bituminous Mix conforming to Section 610 and the Sections for the Type of material specified.

## 1.5 RECYCLED ASPHALT MATERIAL

Mix may contain a maximum of 25 percent by weight of the total aggregate

material, reclaimed asphalt pavement (RAP). Mix design shall meet the requirements for the type of bituminous concrete specified. Clearly state the viscosity of reclaimed asphalt cement, grade of new asphalt cement, properties of recycled agent if used, and percentage of each in the mix. Combine asphalts and recycling agents to achieve a viscosity of 2000 plus or minus 400 poises at 140 degrees F. Furnish a new job mix formula for each change in percentage of RAP material used.

## PART 2 PRODUCTS

### 2.1 TACK COAT

Work and materials shall conform to DOT Section 605.

### 2.2 ASPHALT CONCRETE INTERMEDIATE COURSE

Shall conform to NCDOT Type I-19.0B in accordance with section 610.

### 2.3 ASPHALTIC CONCRETE SURFACE COURSE

Shall conform to NCDOT Type S-9.5A, in accordance with Section 610.

### 2.4 AGGREGATE

#### 2.4.1 Aggregate Base Course

Work and materials shall conform to Section 520, 1005 and 1010, standard size ABC.

#### 2.4.2 Stone

Work and materials shall conform to DOT Section 1005 and 1010, standard size 57.

### 2.5 ADJUSTMENT OF CATCH BASINS, MANHOLES, DROP INLETS, METER BOXES, AND VALVE BOXES

Work, including materials and installation shall conform to NCDOT Section 858. The top shall be set level with the new surface.

### 2.6 CONSTRUCTION EQUIPMENT

#### 2.6.1 Mixing Plant

Shall conform to the requirements of Section 610-5.

#### 2.6.2 Spreading and Finishing Equipment

Shall be the electronic-screed type and shall be capable of spreading the bituminous mixtures to a uniform density, striking a smooth surface true to cross section and producing a finish surface of the specified evenness. Electronic-screed type equipment will not be required on stone base course overlaying.

#### 2.6.3 Compacting Equipment

Shall include a tandem roller.

## PART 3 EXECUTION

### 3.1 CONSTRUCTION METHODS

Work shall conform to the NCDOT Standard Specifications sections referenced herein before and to the following:

### 3.2 ASPHALT CONCRETE PAVEMENT AND PATCHWORK

#### 3.2.1 Stone Base Course Placement

Begin spreading base material at the point nearest the source of supply. Permit traffic and hauling over the base, Fill ruts formed by traffic and reroll. After base course placement, continue machining and rolling until surface is smooth, compacted, well boded, and true to the designed cross section. Compact to 100 percent ASTM D 698 maximum dry density. Maintain the base smooth and true to grade and cross section until bituminous concrete placement.

#### 3.2.2 Cleaning

Before commencing the operations on any portion of the work, the surface of the existing pavement and any new base course shall be thoroughly cleaned of all foreign matter including grass by mechanical means if feasible.

#### 3.2.3 Patchwork

All asphalt surfacing and loose stone base course shall be removed. Stone base course materials removed shall be replaced with a new stone base course and asphaltic concrete mixture. The patchwork shall be accomplished in advance of placing the surface course, and the surface course placed continuously over the entire area.

#### 3.2.4 Placing of the Asphaltic Concrete

Shall be as nearly continuous as possible. The rollers shall pass over the unprotected end of the mixture only when laying is discontinued for sufficient time to permit the mixture to cool, in which case, a joint shall be made by cutting back the surface course to expose a granular surface for its full depth to bond with the fresh mixture. When laying is resumed, the exposed edge shall be coated with hot asphaltic cement and the fresh mixture raked against the joint, thoroughly tamped with hot tamps and rolled. Repaint striping to match existing. Paints shall be permanent retro reflective type conforming to NCDOT Section 1087.

#### 3.2.5 Finished Surfaces

Shall be uniform in texture and appearance and free from cracks and creases. The finished surface shall vary not more than 1/8-inch when the test for smoothness is performed with a 10-foot straightedge. The finished thickness shall be not less than the specified thickness minus 1/8-inch. Where the irregularity of the surface or the deficiency in depth is more than the specified tolerances, the defective work shall be removed and replaced with new material, as directed, without additional cost to the Government.

#### 3.2.6 Featheredges

Accomplish featheredging by raking out the larger aggregate as necessary

and sloping the pavement uniformly throughout the featheredge to create a smooth transition. Unless indicated otherwise, featheredge transition shall be 10 feet.

### 3.2.7 Bituminous Materials and/or Mixtures

Shall not be produced or placed when weather is rainy or foggy, or when the air temperature is less than 40 degrees Fahrenheit in the shade away from artificial heat.

### 3.2.8 Protection of Pavement

After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until it has cooled and hardened.

## 3.3 FIELD QUALITY CONTROL

### 3.3.1 Sampling

Provide new materials where samples are taken. Take the number and size of samples required to perform the following tests.

#### 3.3.1.1 Asphaltic Concrete Sampling

- a. Job Mix: Take one initial sample and one sample for every 400 tons or fraction thereof.
- b. Thickness: Take one sample for every 500 square yards or fraction thereof.
- c. Density: One field test for every 1000 square yards or fraction thereof, and one laboratory test for the project. Provide minimum 4-inch diameter cores if nuclear testing is not used.

#### 3.3.1.2 Stone Base Course Sampling

- a. Thickness: Take one sample for every 500 square yards or fraction thereof.
- b. Density: One field test for every 1000 square yards or fraction thereof, and one laboratory test for the project.

### 3.3.2 Testing

Provide for each sample.

#### 3.3.2.1 Bituminous Concrete Testing

- a. Job Mix: Determine gradation and bitumen content.
- b. Thickness: Maximum allowable deficiency shall be 1/4 inch less than the indicated thickness. Average thickness shall be as indicated.
- c. Density, In Place: ASTM D 2922 and ASTM D 3017; cored sample ASTM D 1188 or ASTM D 2726.

3.3.2.2 Stone Base Course Testing

- a. Thickness: Maximum allowable deficiency shall be 1/2 inch less than the indicated thickness. Average thickness shall be as indicated.
- b. Density: ASTM D 1556 or ASTM D 2922 and ASTM D 3017.

-- End of Section --

## SECTION 02 82 30

## RE-ESTABLISHING VEGETATION

03/12

## 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



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 --

## SECTION 02 82 33.13 20

REMOVAL/CONTROL AND DISPOSAL OF PAINT WITH LEAD  
08/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA)

AIHA Z88.6 (2006) Respiratory Protection - Respirator  
Use-Physical Qualifications for Personnel

## U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD 6780 (1995; Errata Aug 1996; Rev Ch. 7 - 1997)  
Guidelines for the Evaluation and Control  
of Lead-Based Paint Hazards in Housing

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

|                 |   |
|-----------------|---|
| 29 CFR 1926.103 | Respiratory Protection  |
| 29 CFR 1926.21  | Safety Training and Education   |
| 29 CFR 1926.33  | Access to Employee Exposure and Medical<br>Records  |
| 29 CFR 1926.55  | Gases, Vapors, Fumes, Dusts, and Mists  |
| 29 CFR 1926.59  | Hazard Communication  |
| 29 CFR 1926.62  | Lead  |
| 29 CFR 1926.65  | Hazardous Waste Operations and Emergency<br>Response  |
| 40 CFR 260      | Hazardous Waste Management System: General  |
| 40 CFR 261      | Identification and Listing of Hazardous<br>Waste  |
| 40 CFR 262      | Standards Applicable to Generators of<br>Hazardous Waste  |
| 40 CFR 263      | Standards Applicable to Transporters of<br>Hazardous Waste  |
| 40 CFR 264      | Standards for Owners and Operators of<br>Hazardous Waste Treatment, Storage, and<br>Disposal Facilities |
| 40 CFR 265      | Interim Status Standards for Owners and   |

Operators of Hazardous Waste Treatment,  
Storage, and Disposal Facilities

40 CFR 268

Land Disposal Restrictions

40 CFR 745

Lead-Based Paint Poisoning Prevention in  
Certain Residential Structures

49 CFR 172

Hazardous Materials Table, Special  
Provisions, Hazardous Materials  
Communications, Emergency Response  
Information, and Training Requirements

49 CFR 178

Specifications for Packagings

#### UNDERWRITERS LABORATORIES (UL)

UL 586

(2009) Standard for High-Efficiency  
Particulate, Air Filter Units

## 1.2 DEFINITIONS

### 1.2.1 Abatement

As applied to target housing and child occupied facilities, "abatement" means any set of measures designed to permanently eliminate lead-based paint hazards in accordance with standards established by appropriate Federal agencies. Such term includes:

- a. The removal of lead-based paint and lead-contaminated dust, the permanent containment or encapsulation of lead-based paint, the replacement of lead-painted surfaces or fixtures, and the removal or covering of lead contaminated soil; and
- b. All preparation, cleanup, disposal, and post-abatement clearance testing activities associated with such measures.

### 1.2.2 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 in a work environment.

### 1.2.3 Area Sampling

Sampling of lead concentrations within the lead control area and inside the physical boundaries, which is representative of the airborne lead concentrations but is not collected in the breathing zone of personnel.

### 1.2.4 Child Occupied Facility

A building or portion of a building constructed prior to 1978 visited regularly by the same child, 6 years of age or under, on a least two different days within any week, provided each days visit last at least 3 hours and the combined weekly visit last at least 6 hours and the combined annual visit last at least 60 hours. Child occupied facilities may include, but are not limited to day-care centers, preschools and kindergarten classrooms.

#### 1.2.5 Competent Person (CP)

As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations. A Certified Industrial Hygienist (CIH) certified for comprehensive practice by the American Board of Industrial Hygiene or a Certified Safety Professional (CSP) certified by the Board of Certified Safety Professionals is the best choice.

#### 1.2.6 Contaminated Room

Refers to a room for removal of contaminated personal protective equipment (PPE).

#### 1.2.7 Decontamination Shower Facility

That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.

#### 1.2.8 Deleading

Activities conducted by a person who offers to eliminate lead-based paint or lead-based paint hazards or to plan such activities in commercial buildings, bridges or other structures.

#### 1.2.9 Eight-Hour Time Weighted Average (TWA)

Airborne concentration of lead to which an employee is exposed, averaged over an 8 hour workday as indicated in 29 CFR 1926.62.

#### 1.2.10 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 or larger size particles.

#### 1.2.11 Lead

Metallic lead, inorganic lead compounds, and organic lead soaps.

#### 1.2.12 Lead-Based Paint (LBP)

Paint or other surface coating that contains lead in excess of 1.0 milligrams per centimeter squared or 0.5 percent by weight.

#### 1.2.13 Lead-Based Paint Activities

In the case of target housing or child occupied facilities, lead-based paint activities include; a lead-based paint inspection, a risk assessment, or abatement of lead-based paint hazards.

#### 1.2.14 Lead-Based Paint Hazard (LBP Hazard)

Any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, lead-based paint that is deteriorated or present in accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects.

#### 1.2.15 Paint with Lead (PWL)

Any paint that contains lead as determined by the testing laboratory using a valid test method. The requirements of this section does not apply if no detectable levels of lead are found using a quantitative method for analyzing paint using laboratory instruments with specified limits of detection (usually 0.01 percent). An X-Ray Fluorescence (XRF) instrument is not considered a valid test method.

#### 1.2.16 Lead Control Area

A system to prevent the spread of lead dust, paint chips or debris to adjacent areas that may include temporary containment, floor or ground cover protection, physical boundaries, and warning signs to prevent unauthorized entry of personnel. HEPA filtered local exhaust equipment may be used as engineering controls to further reduce personnel exposures or building/outdoor environmental contamination.

#### 1.2.17 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 eight hours in a workday, the PEL shall be determined by the following formula:

$$\text{PEL (micrograms/cubic meter of air)} = 400/\text{No. hrs worked per day}$$

#### 1.2.18 Personal Sampling

Sampling of airborne 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 employees' 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 centered at the nose or mouth of an employee.

#### 1.2.19 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 but inside the physical boundary."

#### 1.2.20 Target Housing

Housing constructed prior to 1978. It does not include housing for the elderly, or persons with disabilities unless any one or more children age 6 years and younger resides or is expected to reside in such housing.

### 1.3 DESCRIPTION

#### 1.3.1 Description of Work

Remove/control lead-based / paint with lead in good condition, located on access ladders in first floor mechanical corridors and the third floor attic access ladder as indicated on the drawings.

### 1.3.2 Coordination with Other Work

The contractor shall coordinate with work being performed in adjacent areas. Coordination procedures shall be explained in the Removal/Control Plan and shall describe how the Contractor will prevent lead exposure to other contractors and/or Government personnel performing work unrelated to lead activities.

### 1.4 SUBMITTALS

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

#### SD-03 Product Data

Vacuum Filters

Respirators

#### SD-06 Test Reports

Sampling results

Occupational and Environmental Assessment Data Report

#### SD-07 Certificates

Qualifications of CP

Testing Laboratory qualifications

Training Certification of workers and supervisors

lead-based paint/paint with lead removal/control plan including CP approval signature, date, and certification number

Rental equipment notification

Respiratory Protection Program

Hazard Communication Program

Lead Waste Management Plan

Vacuum filters

Clearance Certification

#### SD-11 Closeout Submittals

Completed and signed hazardous waste manifest from treatment or disposal facility

Certification of Medical Examinations

Employee Training Certification



## 1.5 QUALITY ASSURANCE

### 1.5.1 Qualifications

#### 1.5.1.1 Qualifications of CP

Submit name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph entitled "Competent Person (CP) Responsibilities." Provide previous experience of the CP. Submit proper documentation that the CP is trained and licensed in accordance with Federal, State, and local laws.

#### 1.5.1.2 Training Certification

Submit a certificate for each employee and supervisor, signed and dated by the training provider, stating that the employee or supervisor has received the required lead training.

#### 1.5.1.3 Testing Laboratory

Submit the name, address, and telephone number of the testing laboratory selected to perform the air and wipe sampling, testing, and reporting of airborne concentrations of lead. Use a laboratory accredited under the EPA National Lead Laboratory Accreditation Program (NLLAP) by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis. Laboratories selected to perform blood lead analysis shall be OSHA approved.

### 1.5.2 Requirements

#### 1.5.2.1 Competent Person (CP) Responsibilities

- a. Verify training meets all federal, State, and local requirements.
- b. Review and approve lead-based paint/paint with lead removal/control plan for conformance to the applicable standards. Ensure work is performed in strict accordance with specifications at all times.
- c. Continuously inspect lead-based paint removal/control work for conformance with the approved plan.
- d. Perform air and wipe sampling.
- e. Control work to prevent hazardous exposure to human beings and to the environment at all times.
- f. Certify the conditions of the work as called for elsewhere in this specification.

#### 1.5.2.2 Lead-Based Paint/Paint with Lead Removal/Control Plan (LBP/PWL R/CP)

Submit a detailed job-specific plan of the work procedures to be used in the removal/control of LBP/PWL. The plan shall include a sketch showing the location, size, and details of lead control areas, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include a description of equipment and materials, controls and job responsibilities for each activity from which lead is emitted. Include in

the plan, eating, drinking, smoking and sanitary procedures, interface of trades, sequencing of lead related work, collected waste water and paint debris disposal plan, air sampling plan, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that lead is not released outside the lead control area. Include site preparation, cleanup and clearance procedures. Include occupational and environmental sampling, training, sampling methodology, frequency, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan. Include a description of arrangements made among contractors on multi-contractor worksites to inform affected employees and to clarify responsibilities to control exposures.

#### 1.5.2.3 Occupational and Environmental Assessment Data Report

If initial monitoring is necessary, submit occupational and environmental sampling results to the Contracting Officer within three working days of collection, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the CP.

In order to reduce the full implementation of 29 CFR 1926.62, the Contractor shall provide documentation. Submit a report that supports the determination to reduce full implementation of the requirements of 29 CFR 1926.62 and supporting the Lead Removal/Control Plan.

- a. The initial monitoring shall represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures per 29 CFR 1926.62. The data shall represent the worker's regular daily exposure to lead for stated work.
- b. Submit worker exposure data gathered during the task based trigger operations of 29 CFR 1926.62 with a complete process description. This includes manual demolition, manual scraping, manual sanding, heat gun, power tool cleaning, rivet busting, cleanup of dry expendable abrasives, abrasive blast enclosure removal, abrasive blasting, welding, cutting and torch burning where lead containing coatings are present.
- c. The initial assessment shall determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the lead compliance plan per 29 CFR 1926.62.

#### 1.5.2.4 Medical Examinations

Initial medical surveillance as required by 29 CFR 1926.62 shall be made available to all employees exposed to lead at any time (1 day) above the action level. Full medical surveillance shall be made available to all employees on an annual basis who are or may be exposed to lead in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62. Adequate records shall show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62, and 29 CFR 1926.103. Maintain complete and accurate medical records of employees for a period of at least 30 years or for the duration of employment plus 30 years, whichever is longer.

#### 1.5.2.5 Training

Train each employee performing paint removal, disposal, and air sampling operations prior to the time of initial job assignment and annually

thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, and State and local regulations where appropriate.

#### 1.5.2.6 Respiratory Protection Program

- a. Provide each employee required to wear a respirator a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62.
- b. Establish and implement a respiratory protection program as required by AIHA Z88.6, 29 CFR 1926.103, 29 CFR 1926.62, and 29 CFR 1926.55.

#### 1.5.2.7 Hazard Communication Program

Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.

#### 1.5.2.8 Lead Waste Management

The Lead Waste Management Plan shall comply with applicable requirements of federal, State, and local hazardous waste regulations and address:

- a. Identification and classification of hazardous wastes associated with the work.
- b. Estimated quantities of wastes to be generated and disposed of.
- c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a 24-hour point of contact. Furnish two copies of proof of hazardous wastemanifestsand EPA Identification numbers.
- d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
- e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
- f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.
- g. Work plan and schedule for waste containment, removal and disposal. Wastes shall be cleaned up and containerized daily. Proper containment of the waste includes using acceptable waste containers (e.g., 55-gallon drums) as well as proper marking/labeling of the containers.
- h. Unit cost for waste disposal according to this plan.

#### 1.5.2.9 Environmental, 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.

### 1.5.3 Pre-Construction Conference

Along with the CP, meet with the Contracting Officer to discuss in detail the lead waste management plan and the lead-based paint/paint with lead removal/control plan, including work procedures and precautions for the removal plan.

## 1.6 EQUIPMENT

### 1.6.1 Respirators

Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead dust. Respirators shall comply with the requirements of 29 CFR 1926.62.

### 1.6.2 Special Protective Clothing

Furnish personnel who will be exposed to lead-contaminated dust with proper disposable protective whole body clothing, head covering, gloves, and foot coverings as required by 29 CFR 1926.62. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.

### 1.6.3 Rental Equipment Notification

If rental equipment is to be used during lead-based paint handling and disposal, notify the rental agency in writing concerning the intended use of the equipment. Furnish a copy of the written notification to the Contracting Officer.

### 1.6.4 Vacuum Filters

UL 586 labeled HEPA filters.

### 1.6.5 Equipment for Government Personnel

Furnish the Contracting Officer with two complete sets of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the paint removal work within the lead controlled area. Personal protective equipment shall include disposable whole body covering, including appropriate foot, head, and hand protection. PPE shall remain the property of the Contractor. The Government will provide respiratory protection for the Contracting Officer.

## 1.7 PROJECT/SITE CONDITIONS

### 1.7.1 Protection of Existing Work to Remain

Perform paint removal work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better.

## PART 2 PRODUCTS

Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

## PART 3 EXECUTION

## 3.1 PREPARATION

## 3.1.1 Protection

## 3.1.1.1 Notification

Notify the Contracting Officer 20 days prior to the start of any paint removal work.

## 3.1.1.2 Boundary Requirements

- a. Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that lead will not escape outside the lead control area.
- b. Warning Signs - Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.

## 3.1.1.3 Furnishings

The Government will remove furniture and equipment from the building before lead-based paint removal work begins.

## 3.1.1.4 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.

## 3.1.1.5 Decontamination Shower Facility

Provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62.

## 3.1.1.6 Eye Wash Station

Where eyes may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes shall be provided within the work area.

## 3.1.1.7 Mechanical Ventilation System

- a. Use adequate ventilation to control personnel exposure to lead in accordance with 29 CFR 1926.62.
- b. To the extent feasible, use local exhaust ventilation connected to HEPA filters or other collection systems, approved by the CP. Local exhaust ventilation systems shall be evaluated and maintained in accordance with 29 CFR 1926.62.
- c. Vent local exhaust outside the building only and away from building ventilation intakes.

d. Use locally exhausted, power actuated, paint removal tools.

#### 3.1.1.8 Personnel Protection

Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been appropriately trained and provided with protective equipment.

### 3.2 ERECTION

#### 3.2.1 Lead Control Area Requirements

Establish a lead control area by situating critical barriers and physical boundaries around the area or structure where LBP/PWL removal/control operations will be performed.

Full containment - Contain removal operations by the use of critical barriers and HEPA filtered exhaust and a negative pressure enclosure system with decontamination facilities and with HEPA filtered exhaust if required by the CP. For containment areas larger than 1,000 square feet install a minimum of two 18 inch square viewing ports. Locate ports to provide a view of the required work from the exterior of the enclosed contaminated area. Glaze ports with laminated safety glass.

### 3.3 APPLICATION

#### 3.3.1 Work Procedures

Perform removal of lead-based paint in accordance with approved lead-based paint/paint with lead removal/control plan. Use procedures and equipment required to limit occupational and environmental exposure to lead when lead-based paint is removed in accordance with 29 CFR 1926.62. Dispose of removed paint chips and associated waste in compliance with Environmental Protection Agency (EPA), State, and local requirements.

#### 3.3.2 Lead-Based Paint Removal/Control/Deleading

Manual or power sanding of interior and exterior surfaces is not permitted unless tools are equipped with HEPA attachments or wet methods. The dry sanding or grinding of surfaces that contain lead is prohibited. Provide methodology for LBP removal/control in work plan. Remove paint within the areas designated on the drawings in order to completely expose the substrate. Take whatever precautions necessary to minimize damage to the underlying substrate.

Avoid deterioration of the substrate. Provide surface preparations for painting in accord with Section 09 90 00 PAINTS AND COATINGS.

Provide methodology for LBP/PWL removal and abatement/control and processes to minimize contamination of work areas outside the control area with lead-contaminated dust or other lead-contaminated debris/waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead. Describe this LBP/PWL removal/control process in the LBP/PWL R/CP.

### 3.3.2.1 Indoor Paint Removal

Perform paint removal in lead control areas using enclosures, barriers, or containments and powered locally exhausted paint removal tools. Collect residue for disposal in accordance with federal, State, and local requirements.

### 3.3.2.2 Outdoor Paint Removal

Perform outdoor removal as indicated in federal, State, and local regulations and in the LBP/CPR/CP. The worksite preparation (barriers or containments) shall be job dependent and presented in the LBP/PWL R/CP.

### 3.3.3 Personnel Exiting Procedures

Whenever personnel exit the lead-controlled area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn during the work day:

- a. Vacuum themselves off.
- b. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.
- c. Shower.
- d. Wash hands and face at the site, don appropriate disposable or uncontaminated reusable clothing; move to an appropriate facility; shower.
- e. Change to clean clothes prior to leaving the physical boundary designated around the lead control area.

## 3.4 FIELD QUALITY CONTROL

### 3.4.1 Tests

#### 3.4.1.1 Air and Wipe Sampling

Air sample for lead in accordance with 29 CFR 1926.62 and as specified herein. Air and wipe sampling shall be directed or performed by the CP.

- a. The CP shall be on the job site directing the air and non-clearance wipe sampling and inspecting the lead-based paint removal/control work to ensure that the requirements of the contract have been satisfied during the entire lead-based paint removal operation.
- b. Collect personal air samples on employees who are expected to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least 25 percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.
- c. Submit results of air samples, within 72 hours after the air samples are taken.
- d. Before any work begins, collect and analyze baseline wipe samples in accordance with methods defined in federal, State, and local standards inside and outside of the physical boundary to assess the degree of dust contamination in the facility prior to lead-based paint

removal/control.

- e. Collect surface wipe samples at a location no greater than 10 feet outside the lead control area at a frequency of once per day while lead removal work is conducted. Surface wipe results shall meet criteria in paragraph "Clearance Certification."

#### 3.4.1.2 Air Sampling During Paint Removal Work

Conduct area air sampling daily, on each shift in which lead-based paint removal operations are performed, in areas immediately adjacent to the lead control area. Sufficient area monitoring shall be conducted to ensure unprotected personnel are not exposed at or above 30 micrograms per cubic meter of air. If 30 micrograms per cubic meter of air is reached or exceeded, stop work, correct the condition(s) causing the increased levels. Notify the Contracting Officer immediately. Determine if condition(s) require any further change in work methods. Removal work shall resume only after the CP and the Contracting Officer give approval. For outdoor operations, at least one sample on each shift shall be taken on the downwind side of the lead control area.

#### 3.4.1.3 Sampling After Paint Removal/Control

After the visual inspection, collect wipe samples according to the HUD protocol contained in HUD 6780 to determine the lead content of settled dust and dirt in micrograms per square meter foot of surface area.

#### 3.4.1.4 Testing of Removed Paint and Used Abrasive

Test removed paint and used abrasive in accordance with 40 CFR 261 for hazardous waste.

### 3.5 CLEANING AND DISPOSAL

#### 3.5.1 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 paint removal operation has been completed, clean the area of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the CP. Reclean areas showing dust or residual paint chips or debris. After visible dust, chips and debris is removed, wet wipe and HEPA vacuum all surfaces in the work area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then wipe sample all contaminated areas. The CP shall then certify in writing that the area has been cleaned of lead contamination before restarting work.

##### 3.5.1.1 Clearance Certification

The CP shall certify in writing that air samples collected outside the lead control area during paint removal operations are less than 30 micrograms per cubic meter of air; the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with 29 CFR 1926.62 and 40 CFR 745; and that there were no visible accumulations of material and dust containing lead left in the work site. Do not remove the lead control area or roped off boundary and warning signs prior to the



Contracting Officer's acknowledgement of receipt of the CP certification.

The third party consultant shall certify surface wipe sample results collected inside and outside the work area are less than 40 micrograms per square foot on floors, less than 250 micrograms per square foot on interior window sills and less than 400 micrograms per square foot on window troughs. Clear the lead control area in industrial facilities of all visible dust and debris.

For lead-based paint hazard abatement work, surface wipe and soil sampling shall be conducted and clearance determinations made according to the work practice standards presented in 40 CFR 745.227.

### 3.5.2 Disposal

- a. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing that may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62 and 40 CFR 262.
- b. Place waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. For hazardous waste, the collection drum requires marking/labeling in accordance with 40 CFR 262 during the accumulation/collection timeframe. The Contracting Officer or an authorized representative will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.
- c. Handle, transport, and dispose lead or lead-contaminated material classified as hazardous waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.
- d. All material, whether hazardous or non-hazardous shall be disposed in accordance with laws and provisions and Federal, State, or local regulations. Ensure waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.

#### 3.5.2.1 Disposal Documentation

Submit written evidence to demonstrate the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA, State or local regulatory agencies. Submit one copy of the completed hazardous waste manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Contractor shall provide a certificate that the waste was accepted by the disposal facility.

### 3.5.3 Payment for Hazardous Waste

Payment for disposal of hazardous and non-hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials or non-hazardous waste delivered is returned and a copy is furnished to the Government.

-- End of Section --

## SECTION 02 83 13.00 20

## LEAD IN CONSTRUCTION

08/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA)

AIHA Z88.6 (2006) Respiratory Protection - Respirator Use-Physical Qualifications for Personnel

## U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD 6780 (1995; Errata Aug 1996; Rev Ch. 7 - 1997) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing

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

|                 |   |
|-----------------|---|
| 29 CFR 1926.103 | Respiratory Protection  |
| 29 CFR 1926.21  | Safety Training and Education   |
| 29 CFR 1926.33  | Access to Employee Exposure and Medical Records   |
| 29 CFR 1926.55  | Gases, Vapors, Fumes, Dusts, and Mists  |
| 29 CFR 1926.59  | Hazard Communication  |
| 29 CFR 1926.62  | Lead  |
| 29 CFR 1926.65  | Hazardous Waste Operations and Emergency Response   |
| 40 CFR 260      | Hazardous Waste Management System: General  |
| 40 CFR 261      | Identification and Listing of Hazardous Waste   |
| 40 CFR 262      | Standards Applicable to Generators of Hazardous Waste   |
| 40 CFR 263      | Standards Applicable to Transporters of Hazardous Waste   |
| 40 CFR 264      | Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities |
| 40 CFR 265      | Interim Status Standards for Owners and   |

Operators of Hazardous Waste Treatment,  
Storage, and Disposal Facilities

40 CFR 268

Land Disposal Restrictions

40 CFR 745

Lead-Based Paint Poisoning Prevention in  
Certain Residential Structures

49 CFR 172

Hazardous Materials Table, Special  
Provisions, Hazardous Materials  
Communications, Emergency Response  
Information, and Training Requirements

49 CFR 178

Specifications for Packagings

#### UNDERWRITERS LABORATORIES (UL)

UL 586

(2009) 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.

### 1.2.2 Area Sampling

Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations but is not collected in the breathing zone of personnel (approximately 5 to 6 feet above the floor).

### 1.2.3 Competent Person (CP)

As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the lead hazard. A Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene or a Certified Safety Professional (CSP) certified by the Board of Certified Safety Professionals is the best choice.

### 1.2.4 Contaminated Room

Refers to a room for removal of contaminated personal protective equipment (PPE).

### 1.2.5 Decontamination Shower Facility

That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.

### 1.2.6 High Efficiency Particulate Arrestor (HEPA) Filter Equipment

HEPA filtered vacuuming equipment with a UL 586 filter system capable of

collecting and retaining lead-contaminated particulate. A high efficiency particulate filter demonstrates at least 99.97 percent efficiency against 0.3 micron or larger size particles.

#### 1.2.7 Lead

Metallic lead, inorganic lead compounds, and organic lead soaps. Excludes other forms of organic lead compounds.

#### 1.2.8 Lead Control Area

A system to prevent the spread of lead dust, paint chips or debris to adjacent areas that may include temporary containment, floor or ground cover protection, physical boundaries, and warning signs to prevent unauthorized entry of personnel. HEPA filtered local exhaust equipment may be used as engineering controls to further reduce personnel exposures or building/outdoor environmental contamination.

#### 1.2.9 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 eight hours in a work day, the PEL shall be determined by the following formula:

$$\text{PEL (micrograms/cubic meter of air)} = 400/\text{No. hrs worked per day}$$

#### 1.2.10 Material Containing Lead/Paint with Lead (MCL/PWL)

Any material, including paint, which contains lead as determined by the testing laboratory using a valid test method. The requirements of this section does not apply if no detectable levels of lead are found using a quantitative method for analyzing paint or MCL using laboratory instruments with specified limits of detection (usually 0.01 percent). An X-Ray Fluorescence (XRF) instrument is not considered a valid test method.

#### 1.2.11 Personal Sampling

Sampling of airborne 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 employees' 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 centered at the nose or mouth of an employee.

#### 1.2.12 Physical Boundary

Area physically roped or partitioned off around lead control area to limit unauthorized entry of personnel.

### 1.3 DESCRIPTION

#### 1.3.1 Description of Work

Construction activities impacting PWL or material containing lead which are covered by this specification include the demolition and/or removal of sinks containing lead in good condition, located in the laundry rooms, common area bathrooms, and individual unit vanities on each floor as indicated on the drawings.

### 1.3.2 Coordination with Other Work

The contractor shall coordinate with work being performed in adjacent areas. Coordination procedures shall be explained in the Plan and shall describe how the Contractor will prevent lead exposure to other contractors and/or Government personnel performing work unrelated to lead activities.

### 1.4 SUBMITTALS

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

#### SD-01 Preconstruction Submittals

Occupational and Environmental Assessment Data Report (if objective data is used to justify excluding the initial occupational exposure assessment)

Lead Compliance Plan including CP approval (signature, date, and certification number)

Competent Person qualifications

Training Certification of workers and supervisors

lead waste management plan

written evidence that TSD is approved for lead disposal

Certification of Medical Examinations

#### SD-06 Test Reports

sampling results

Occupational and Environmental Assessment Data Report

#### SD-07 Certificates

Testing laboratory qualifications

Third party consultant qualifications

Clearance Certification

#### SD-11 Closeout Submittals

Completed and signed hazardous waste manifest from treatment or disposal facility

Waste turn-in documents or weight tickets for non-hazardous wastes that are disposed of at sanitary or construction and demolition landfills

## 1.5 QUALITY ASSURANCE

### 1.5.1 Qualifications

#### 1.5.1.1 Competent Person (CP)

Submit name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph entitled "Competent Person (CP) Responsibilities." Provide documented construction project-related experience with implementation of OSHA's Lead in Construction standard ( 29 CFR 1926.62) which shows ability to assess occupational and environmental exposure to lead, experience with the use of respirators, personal protective equipment and other exposure reduction methods to protect employee health. Submit proper documentation that the CP is trained and licensed in accordance with federal, State and local laws.

#### 1.5.1.2 Training Certification

Submit a certificate for each worker and supervisor, signed and dated by the training provider, stating that the employee has received the required lead training specified in 29 CFR 1926.62(1) and is certified to perform or supervise deleading, lead removal or demolition activities in the State of North Carolina.

#### 1.5.1.3 Testing Laboratory

Submit the name, address, and telephone number of the testing laboratory selected to perform the air and wipe analysis, testing, and reporting of airborne concentrations of lead. Use a laboratory participating in the EPA National Lead Laboratory Accreditation Program (NLLAP) by being accredited by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis. Laboratories selected to perform blood lead analysis shall be OSHA approved.

#### 1.5.1.4 Third Party Consultant Qualifications

Submit the name, address and telephone number of the third party consultant selected to perform the wipe sampling for determining concentrations of lead in dust. Submit proper documentation that the consultant is trained and certified as an inspector technician or inspector/risk assessor by the USEPA authorized State (or local) certification and accreditation program.

### 1.5.2 Requirements

#### 1.5.2.1 Competent Person (CP) Responsibilities

- a. Verify training meets all federal, State, and local requirements.
- b. Review and approve Lead Compliance Plan for conformance to the applicable referenced standards.
- c. Continuously inspect PWL or MCL work for conformance with the approved plan.
- d. Perform (or oversee performance of) air sampling. Recommend upgrades or downgrades (whichever is appropriate based on exposure) on the use of PPE (respirators included) and engineering controls.

- e. Ensure work is performed in strict accordance with specifications at all times.
- f. Control work to prevent hazardous exposure to human beings and to the environment at all times.
- g. Supervise final cleaning of the lead control area, take clearance wipe samples if necessary; review clearance sample results and make recommendations for further cleaning.
- h. Certify the conditions of the work as called for elsewhere in this specification.

#### 1.5.2.2 Lead Compliance Plan

Submit a detailed job-specific plan of the work procedures to be used in the disturbance of PWL or MCL. The plan shall include a sketch showing the location, size, and details of lead control areas, critical barriers, physical boundaries, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include a description of equipment and materials, work practices, controls and job responsibilities for each activity from which lead is emitted. Include in the plan, eating, drinking, smoking, hygiene facilities and sanitary procedures, interface of trades, sequencing of lead related work, collected waste water and dust containing lead and debris, air sampling, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that lead is not released outside of the lead control area. Include site preparation, cleanup and clearance procedures. Include occupational and environmental sampling, training and strategy, sampling and analysis strategy and methodology, frequency of sampling, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan. Include a description of arrangements made among contractors on multicontractor worksites to inform affected employees and to clarify responsibilities to control exposures.

In occupied buildings, the plan shall also include an occupant protection program that describes the measures that will be taken during the work to notify and protect the building occupants.

#### 1.5.2.3 Occupational and Environmental Assessment Data Report

If initial monitoring is necessary, submit occupational and environmental sampling results to the Contracting Officer within three working days of collection, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the CP.

In order to reduce the full implementation of 29 CFR 1926.62, the Contractor shall provide documentation. Submit a report that supports the determination to reduce full implementation of the requirements of 29 CFR 1926.62 and supporting the Lead Compliance Plan.

- a. The initial monitoring shall represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures per 29 CFR 1926.62. The data shall represent the worker's regular daily exposure to lead for stated work.
- b. Submit worker exposure data gathered during the task based trigger

operations of 29 CFR 1926.62 with a complete process description. This includes manual demolition, manual scraping, manual sanding, heat gun, power tool cleaning, rivet busting, cleanup of dry expendable abrasives, abrasive blast enclosure removal, abrasive blasting, welding, cutting and torch burning where lead containing coatings are present.

- c. The initial assessment shall determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the lead compliance plan per 29 CFR 1926.62.

#### 1.5.2.4 Medical Examinations

Initial medical surveillance as required by 29 CFR 1926.62 shall be made available to all employees exposed to lead at any time (1 day) above the action level. Full medical surveillance shall be made available to all employees on an annual basis who are or may be exposed to lead in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62. Adequate records shall show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62 and 29 CFR 1926.103. Provide medical surveillance to all personnel exposed to lead as indicated in 29 CFR 1926.62. Maintain complete and accurate medical records of employees for the duration of employment plus 30 years.

#### 1.5.2.5 Training

Train each employee performing work that disturbs lead, who performs MCL/PWL disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, and State and local regulations where appropriate.

#### 1.5.2.6 Respiratory Protection Program

- a. Provide each employee required to wear a respirator a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62.
- b. Establish and implement a respiratory protection program as required by AIHA Z88.6, 29 CFR 1926.103, 29 CFR 1926.62, and 29 CFR 1926.55.

#### 1.5.2.7 Hazard Communication Program

Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.

#### 1.5.2.8 Lead Waste Management

The Lead Waste Management Plan shall comply with applicable requirements of federal, State, and local hazardous waste regulations. and address:

- a. Identification and classification of wastes associated with the work.
- b. Estimated quantities of wastes to be generated and disposed of.
- c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a 24-hour point of contact. Furnish two copies of manifests.



- d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
- e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
- f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.
- g. Work plan and schedule for waste containment, removal and disposal. Proper containment of the waste includes using acceptable waste containers (e.g., 55-gallon drums) as well as proper marking/labeling of the containers. Wastes shall be cleaned up and containerized daily.
- h. Include any process that may alter or treat waste rendering a hazardous waste non hazardous.
- i. Unit cost for hazardous waste disposal according to this plan.

#### 1.5.2.9 Environmental, 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 lead. 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. State and local laws, ordinances, criteria, rules and regulations regarding removing, handling, storing, transporting, and disposing of lead-contaminated materials apply

#### 1.5.3 Pre-Construction Conference

Along with the CP, meet with the Contracting Officer to discuss in detail the Lead Waste Management Plan and the Lead Compliance Plan, including procedures and precautions for the work.

### 1.6 EQUIPMENT

#### 1.6.1 Respirators

Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead dust, fume and mist. Respirators shall comply with the requirements of 29 CFR 1926.62.

#### 1.6.2 Special Protective Clothing

Furnish personnel who will be exposed to lead-contaminated dust with proper disposable protective whole body clothing, head covering, gloves, eye, and foot coverings as required by 29 CFR 1926.62. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.

#### 1.6.3 Rental Equipment Notification

If rental equipment is to be used during PWL or MCL handling and disposal, notify the rental agency in writing concerning the intended use of the

equipment.

#### 1.6.4 Vacuum Filters

UL 586 labeled HEPA filters.

#### 1.6.5 Equipment for Government Personnel

Furnish the Contracting Officer with two complete sets of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the lead removal work within the lead controlled area. Personal protective equipment shall include disposable whole body covering, including appropriate foot, head, eye, and hand protection. PPE shall remain the property of the Contractor. The Government will provide respiratory protection for the Contracting Officer.

### 1.7 PROJECT/SITE CONDITIONS

#### 1.7.1 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better as determined by the Contracting Officer.

## PART 2 PRODUCTS

Not applicable.

## PART 3 EXECUTION

### 3.1 PREPARATION

#### 3.1.1 Protection

##### 3.1.1.1 Notification

Notify the Contracting Officer 20 days prior to the start of any lead work.

##### 3.1.1.2 Lead Control Area

- a. Physical Boundary - Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that lead will not escape outside of the lead control area.
- b. Warning Signs - Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.

##### 3.1.1.3 Furnishings

The Government will remove furniture and equipment from the building before lead work begins.

##### 3.1.1.4 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.

#### 3.1.1.5 Decontamination Shower Facility

Provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62.

#### 3.1.1.6 Eye Wash Station

Where eyes may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes shall be provided within the work area.

#### 3.1.1.7 Mechanical Ventilation System

- a. To the extent feasible, use local exhaust ventilation or other collection systems, approved by the CP. Local exhaust ventilation systems shall be evaluated and maintained in accordance with 29 CFR 1926.62.
- b. Vent local exhaust outside the building and away from building ventilation intakes or ensure system is connected to HEPA filters.
- c. Use locally exhausted, power actuated tools or manual hand tools.

#### 3.1.1.8 Personnel Protection

Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been appropriately trained and provided with protective equipment.

### 3.2 ERECTION

#### 3.2.1 Lead Control Area Requirements

Establish a lead control area by completely establishing barriers and physical boundaries around the area or structure where PWL or MCL removal operations will be performed.

### 3.3 APPLICATION

#### 3.3.1 Lead Work

Perform lead work in accordance with approved Lead Compliance Plan. Use procedures and equipment required to limit occupational exposure and environmental contamination with lead when the work is performed in accordance with 29 CFR 1926.62 or 40 CFR 745, and as specified herein. Dispose of all PWL or MCL and associated waste in compliance with federal, State, and local requirements.

#### 3.3.2 Paint with Lead or Material Containing Lead Removal

Manual or power sanding or grinding of lead surfaces or materials is not permitted unless tools are equipped with HEPA attachments or wet methods. The dry sanding or grinding of surfaces that contain lead is prohibited. Provide methodology for removing lead in the Lead Compliance Plan. Select

lead removal processes to minimize contamination of work areas outside the control area with lead-contaminated dust or other lead-contaminated debris or waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead. Describe this removal process in the Lead Compliance Plan.

#### 3.3.2.1 Paint with Lead or Material Containing Lead - Indoor Removal

Perform removal in the lead control areas using enclosures, barriers or containments, as needed. Collect residue debris for disposal in accordance with federal, State, and local requirements.

#### 3.3.2.2 Paint with Lead or Material Containing Lead - Outdoor Removal

Perform outdoor removal as indicated in federal, State, and local regulations and in the Lead Compliance Plan. The worksite preparation (barriers or containments) shall be job dependent and presented in the Lead Compliance Plan.

#### 3.3.3 Personnel Exiting Procedures

Whenever personnel exit the lead-controlled area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn in the control area:

- a. Vacuum all clothing before entering the contaminated change room.
- b. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.
- c. Shower.
- d. Change to clean clothes prior to leaving the clean clothes storage area.

#### 3.4 FIELD QUALITY CONTROL

##### 3.4.1 Tests

##### 3.4.1.1 Air and Wipe Sampling

Conduct sampling for lead in accordance with 29 CFR 1926.62 and as specified herein. Air and wipe sampling shall be directed or performed by the CP.

- a. The CP shall be on the job site directing the air and wipe sampling and inspecting the PWL or MCL removal work to ensure that the requirements of the contract have been satisfied during the entire PWL or MCL operation.
- b. Collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least twenty-five percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.
- c. Submit results of air samples, signed by the CP, within 72 hours after the air samples are taken.
- d. Conduct area air sampling daily, on each shift in which lead-based paint

removal operations are performed, in areas immediately adjacent to the lead control area. Sufficient area monitoring shall be conducted to ensure unprotected personnel are not exposed at or above 30 micrograms per cubic meter of air. If 30 micrograms per cubic meter of air is reached or exceeded, stop work, correct the condition(s) causing the increased levels. Notify the Contracting Officer immediately. Determine if condition(s) require any further change in work methods. Removal work shall resume only after the CP and the Contracting Officer give approval.

- e. Before any work begins, collect and analyze baseline wipe samples in accordance with methods defined by federal, State, and local standards inside and outside of the physical boundary to assess the degree of dust contamination in the facility prior to lead disturbance or removal.
- f. Surface Wipe Samples - Collect surface wipe samples on floors at a location no greater than 10 feet outside the lead control area at a frequency of once per day while lead removal work is conducted in occupied buildings. Surface wipe results shall meet criteria in paragraph "Clearance Certification."

#### 3.4.1.2 Sampling After Removal

After the visual inspection, collect wipe samples according to the HUD protocol contained in HUD 6780 to determine the lead content of settled dust in micrograms per square meter foot of surface area and parts per million (ppm) for soil.

#### 3.4.1.3 Testing of Material Containing Lead Residue

Test residue in accordance with 40 CFR 261 for hazardous waste.

### 3.5 CLEANING AND DISPOSAL

#### 3.5.1 Cleanup

Maintain surfaces of the lead control area free of accumulations of dust and debris. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use pressurized air to clean up the area. At the end of each shift and when the lead operation has been completed, clean the controlled area of visible contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the Lead Compliance Plan. Reclean areas showing dust or debris. After visible dust and debris is removed, wet wipe and HEPA vacuum all surfaces in the controlled area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then wipe sample all contaminated areas. The CP shall then certify in writing that the area has been cleaned of lead contamination before clearance testing.

##### 3.5.1.1 Clearance Certification

The CP shall certify in writing that, if needed, air samples collected outside the lead control area during paint removal operations are less than 30 micrograms per cubic meter of air; the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with 29 CFR 1926.62; and that there were no visible accumulations of material and dust containing lead left in the work site. Do not remove the lead control area or roped off boundary and warning signs

prior to the Contracting Officer's acknowledgement of receipt of the CP certification.

The third party consultant shall certify that, if needed, surface wipe sample results collected inside and outside the work area are less than 40 micrograms per square foot on floors, less than 250 micrograms per square foot on interior window sills and less than 400 micrograms per square foot on window troughs.

### 3.5.2 Disposal

- a. All material, whether hazardous or non-hazardous shall be disposed in accordance with all laws and provisions and all federal, State or local regulations. Ensure all waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.
- b. Contractor is responsible for segregation of waste. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing that may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62 and 40 CFR 261.
- c. Dispose of lead-contaminated material classified as hazardous waste at an approved hazardous waste treatment, storage, or disposal facility off Government property.
- d. Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. For hazardous waste, the collection drum requires marking/labeling in accordance with 40 CFR 262 during the accumulation/collection timeframe. The Contracting Officer or an authorized representative will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.
- e. Handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.

#### 3.5.2.1 Disposal Documentation

Submit written evidence to demonstrate the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA, State or local regulatory agencies. Submit one copy of the completed hazardous waste manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Contractor shall provide a certificate that the waste was accepted by the disposal facility. Provide turn-in documents or weight tickets for non-hazardous waste disposal.

#### 3.5.2.2 Payment for Hazardous Waste

Payment for disposal of hazardous and non-hazardous waste will not be made

until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials or non-hazardous waste delivered is returned and a copy is furnished to the Government.

-- End of Section --

SECTION 03 01 30.71  
CONCRETE REHABILITATION  
04/06

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

|                   |  |
|-------------------|--|
| ASTM C 144        | (2004) Standard Specification for Aggregate for Masonry Mortar                           |
| ASTM C 31/C 31M   | (2008) Standard Practice for Making and Curing Concrete Test Specimens in the Field      |
| ASTM C 33         | (2003) Standard Specification for Concrete Aggregates                                    |
| ASTM C 39/C 39M   | (2005e1) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens |
| ASTM C 881/C 881M | (2002) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete          |

1.2 DEFINITIONS

1.2.1 Epoxy Resin Binder

A two-component epoxy bonding system in low and medium viscosities used by itself as a primer or for producing epoxy concrete or mortars when mixed with aggregate.

1.2.2 Epoxy Concrete

A combination of epoxy resin binder and fine and coarse aggregate used in the repair of spalling along joints or cracks, small surface spalls or "popouts."

1.2.3 Epoxy Mortar

A combination of epoxy resin binder and fine aggregate used in the surface repair of non-structural cracks and filling of saw kerfs.

1.2.4 Non-Pressure Epoxy Grout

A combination of epoxy resin binder, a mineral filler and a thixotropic agent used in cementing dowels in place and the repair of non-structural cracks.



#### 1.2.5 Pressure Grouting Epoxy

A low viscosity epoxy resin system pumped under pressure into structural cracks in walls or pavements.

#### 1.3 SUBMITTALS

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

##### SD-05 Design Data

Job mix formula

##### SD-06 Test Reports

Sieve analysis test for aggregate

Epoxy resin binder tests

##### SD-08 Manufacturer's Instructions

Epoxy repair material

Submit for mixing and applying.

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Design Data

##### 1.4.1.1 Job Mix Formula

Submit, at least 15 days before work commences, a job-mix formula for each use of epoxy concrete and epoxy mortar. Test reports shall accompany the mix design. Identify the proposed source of the materials and state the proportions of aggregates and epoxy resin. When determining job mix, use samples of materials to be used on the job.

- a. Trial batches: Perform a minimum of three trial batchings in a certified testing laboratory. Try different aggregate-resin proportions to obtain satisfactory placing and finishing characteristics but keep the proportion by weight of aggregate to epoxy resin binder at least five to one. When mixing, add the fine aggregates first, and then the coarse aggregates. The final trial batch should be sufficiently wet so that some fines will "bleed" to the surface during finishing operations.
- b. Supporting criteria: Include in the submittal the following data for each trial batch:
  - (1) Proportions by weight
  - (2) Unit weights and specific gravities of constituents
  - (3) Batch weights
  - (4) Compressive strengths of 3 by 6 inch cylinders, made in accordance with ASTM C 31/C 31M, air cured for 7 days and tested in accordance with ASTM C 39/C 39M. Compressive strength shall be a minimum of 5000 psi.

(5) Curing time

1.4.2 Test Reports

1.4.2.1 Epoxy Resin Binder

Include the following:

- a. Viscosity
- b. Consistency
- c. Gel time
- d. Absorption
- e. Shrinkage
- f. Thermal compatibility

1.4.2.2 Epoxy Resin Grout

Include the following:

- a. Epoxy number
- b. Consistency
- c. Compressive single shear strength
- d. Pot life

1.5 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to site for damage, unload and store with a minimum of handling. Deliver epoxy resin components and aggregate materials in original sealed containers and store in dry covered areas at temperatures below 90 degrees F. Remove from job site unused mixed materials which have reached end of working or pot life.

1.6 WEATHER LIMITATIONS

Halt work when weather conditions detrimentally affect the quality of patching or bonding concrete. Apply epoxy resin materials only when the contact surfaces are completely dry and if the atmospheric and surface temperature ranges are suitable for the specified epoxy material. Follow manufacturer's instructions for weather conditions and temperature ranges.

1.7 TRAFFIC CONTROL

Do not permit vehicular or heavy equipment traffic on the pavement in the work area during the curing period. At the end of the curing period, light local traffic may be permitted on the pavement if approved by the Contracting Officer.

1.8 EQUIPMENT

Use a container recommended by the epoxy manufacturer as the mixing vessel.

Use a power drive (air or spark-proof) propeller type blade for mixing except that hand mixing may be used for small batches. Use equipment specified by epoxy manufacturer for field mixing of aggregates and epoxy resin.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Epoxy

##### 2.1.1.1 Epoxy Resin Binder for Concrete and Mortar

ASTM C 881/C 881M, Type III, Grade 1, Class C without mineral filler. For walls and ceilings use ASTM C 881/C 881M, Type III, Grade 3, Class C with filler.

#### 2.1.2 Aggregate

For material passing No. 200 sieve provide a non-plastic material composed of a minimum of 75 percent limestone dust, talc or silica inert filler. Provide dry aggregate.

- a. For epoxy concrete: ASTM C 33 Conform to the following requirements:

| <u>Sieve Designation</u> | <u>Percent Passing by Weight</u> |
|--------------------------|----------------------------------|
| 1/2 in.                  |                                  |
| 3/8 in.                  | 100                              |
| No. 4                    | 93-100                           |
| No. 8                    | 70-80                            |
| No. 16                   | 50-65                            |
| No. 30                   | 37-53                            |
| No. 50                   | 20-37                            |
| No. 100                  | 10-20                            |
| No. 200                  | 5-10                             |
|                          | 3-5                              |

- b. For epoxy mortar: ASTM C 144, 1/4 inch.

## PART 3 EXECUTION

### 3.1 PREPARATION

#### 3.1.1 Epoxy Concrete

##### 3.1.1.1 Patch Areas

Remove loose concrete from the spalled areas indicated. Inspect the cavity for remaining defective concrete by tapping with a hammer or steel rod and listening for dull or hollow sounds. In areas where tapping does not produce a solid tone, remove additional concrete until testing produces a solid tone. Make the entire cavity at least one inch deep. Sawcut edges of cavity to avoid feather edging. Prepare surface of cavity by sandblasting, grinding, or water blasting. Remove dust, dirt, and loosely bonded material resulting from cleaning. Ensure cavity surfaces are dry.

### 3.2 MIXING MATERIALS

Make batches small enough to ensure placement before binder sets. Mix materials in accordance with manufacturer's recommendations.

### 3.3 PLACEMENT

#### 3.3.1 Epoxy Concrete

Prime dry cavity surfaces with epoxy resin using a stiff bristle brush. Make coating approximately 20 mils thick. Place epoxy concrete while primer is still tacky and in layers not exceeding one inch thick. Use vibratory floats, plates, or hand tampers to consolidate the concrete. Level each layer and screed the final surface to match the adjoining surfaces. Remove excess epoxy concrete on adjacent surfaces before the concrete hardens. Do not feather epoxy concrete out onto adjacent surfaces.

#### 3.3.2 Epoxy Mortar

Prime surfaces with epoxy resin binder. Scrub prime coat into surface with a stiff bristle brush. Make coating approximately 20 mils thick. Place epoxy mortar while primer is still tacky. Apply at a thickness recommended by the manufacturer. Work mortar into place and consolidate thoroughly so that contact surfaces are wetted by the mortar. Finish surface of mortar to the required texture. Do not feather edge epoxy mortar onto adjacent surfaces.

### 3.4 CURING

Cure epoxy materials in accordance with manufacturer's recommendations.

### 3.5 FIELD QUALITY CONTROL

#### 3.5.1 Sampling

As soon as epoxy resin and aggregate materials are available for sampling, obtain by random selection a sample of each batch. Clearly identify samples by designated name, specification number, batch number, project contract number, intended use and quantity involved.

#### 3.5.2 Inspection

Check each repaired area for cracks, spalls, popouts and loss of bond between repaired area and surrounding concrete. Check each repaired area for voids by tapping with a hammer or steel rod and listening for dull or hollow sounds. Immediately repair defects.

-- End of Section --

## SECTION 03 30 00

## CAST-IN-PLACE CONCRETE

01/08

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ACI INTERNATIONAL (ACI)

|           |   |
|-----------|---|
| ACI/MCP-1 | (2007) Manual of Concrete Practice Part 1:<br>ACI 104-71R-97 to 223-98    |
| ACI/MCP-2 | (2007) Manual of Concrete Practice Part 2<br>- ACI 224R-01 to ACI 313R-97 |
| ACI/MCP-3 | (2007) Manual of Concrete Practice Part 3<br>- ACI 315-99 to ACI 343R-95  |
| ACI/MCP-4 | (2006) Manual of Concrete Practice Part 4<br>- ACI 345R-05 to 355.2R-04   |

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

|              |  |
|--------------|--|
| AASHTO M 182 | (2005) Standard Specification for Burlap<br>Cloth Made from Jute or Kenaf and Cotton<br>Mats |
|--------------|--|

## AMERICAN WELDING SOCIETY (AWS)

|                |   |
|----------------|---|
| AWS D1.4/D1.4M | (2011) Structural Welding Code -<br>Reinforcing Steel |
|----------------|---|

## ASTM INTERNATIONAL (ASTM)

|                     |   |
|---------------------|---|
| ASTM A 53/A 53M     | (2007) Standard Specification for Pipe,<br>Steel, Black and Hot-Dipped, Zinc-Coated,<br>Welded and Seamless |
| ASTM A 615/A 615M   | (2007) Standard Specification for Deformed<br>and Plain Carbon-Steel Bars for Concrete<br>Reinforcement     |
| ASTM C 1017/C 1017M | (2007) Standard Specification for Chemical<br>Admixtures for Use in Producing Flowing<br>Concrete           |
| ASTM C 1107/C 1107M | (2007a) Standard Specification for<br>Packaged Dry, Hydraulic-Cement Grout<br>(Nonshrink)                   |
| ASTM C 1116/C 1116M | (2006) Standard Specification for   |

## Fiber-Reinforced Concrete

|                   |  |
|-------------------|--|
| ASTM C 1240       | (2005) Standard Specification for Silica Fume Used in Cementitious Mixtures  |
| ASTM C 1260       | (2007) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)  |
| ASTM C 143/C 143M | (2005a) Standard Test Method for Slump of Hydraulic-Cement Concrete  |
| ASTM C 150        | (2007) Standard Specification for Portland Cement  |
| ASTM C 156        | (2005) Standard Test Method for Water Retention by Concrete Curing Materials   |
| ASTM C 1567       | (2007) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method) |
| ASTM C 171        | (2007) Standard Specification for Sheet Materials for Curing Concrete  |
| ASTM C 172        | (2007) Standard Practice for Sampling Freshly Mixed Concrete   |
| ASTM C 173/C 173M | (2007) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method   |
| ASTM C 192/C 192M | (2007) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory   |
| ASTM C 231        | (2004) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method   |
| ASTM C 233        | (2007) Standard Test Method for Air-Entraining Admixtures for Concrete   |
| ASTM C 260        | (2006) Standard Specification for Air-Entraining Admixtures for Concrete   |
| ASTM C 295        | (2003) Petrographic Examination of Aggregates for Concrete   |
| ASTM C 309        | (2007) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete  |
| ASTM C 31/C 31M   | (2008) Standard Practice for Making and Curing Concrete Test Specimens in the Field  |
| ASTM C 311        | (2005) Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral  |

|                   |   |
|-------------------|---|
|                   | Admixture in Portland-Cement Concrete   |
| ASTM C 33         | (2003) Standard Specification for Concrete Aggregates   |
| ASTM C 39/C 39M   | (2005e1) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens  |
| ASTM C 42/C 42M   | (2004) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete   |
| ASTM C 494/C 494M | (2010a) Standard Specification for Chemical Admixtures for Concrete   |
| ASTM C 595        | (2007) Standard Specification for Blended Hydraulic Cements   |
| ASTM C 618        | (2005) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete   |
| ASTM C 881/C 881M | (2002) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete   |
| ASTM C 920        | (2011) Standard Specification for Elastomeric Joint Sealants  |
| ASTM C 932        | (2006) Standard Specification for Surface-Applied Bonding Compounds for Exterior Plastering   |
| ASTM C 94/C 94M   | (2015) Standard Specification for Ready-Mixed Concrete  |
| ASTM C 989        | (2010) Standard Specification for Slag Cement for Use in Concrete and Mortars   |
| ASTM D 1190       | (1997) Standard Specification for Concrete Joint Sealer, Hot-Applied Elastic Type   |
| ASTM D 1557       | (2009) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft <sup>3</sup> ) (2700 kN-m/m <sup>3</sup> ) |
| ASTM D 1751       | (2004) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)  |
| ASTM D 5759       | (1995; R 2005) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses  |
| ASTM D 7116       | (2005) Standard Specification for Joint   |

Sealants, Hot Applied, Jet Fuel Resistant  
Types, for Portland Cement Concrete

ASTM E 1155 (1996; R 2001) Standard Test Method for  
Determining Floor Flatness and Floor  
Levelness Numbers

ASTM E 329 (2008) Standard Specification for Agencies  
Engaged in the Testing and/or Inspection  
of Materials Used in Construction

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP (2001; 27Ed) Manual of Standard Practice

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS MMM-A-001993 (1978) Adhesive, Epoxy, Flexible, Filled  
(For Binding, Sealing, and Grouting)

FS SS-S-200 (Rev E; Am 2) Sealant, Joint,  
Two-Component, Jet-Blast-Resistant,  
Cold-Applied, for Portland Cement Concrete  
Pavement

FS UU-B-790 (Rev A) Building Paper, Vegetable Fiber:  
(Kraft, Waterproofed, Water Repellent and  
Fire Resistant)

## 1.2 DEFINITIONS

- a. "Cementitious material" as used herein must include all portland cement, pozzolan, fly ash, ground granulated blast-furnace slag, and silica fume.
- b. "Exposed to public view" means situated so that it can be seen from eye level from a public location after completion of the building. A public location is accessible to persons not responsible for operation or maintenance of the building.
- c. "Chemical admixtures" are materials in the form of powder or fluids that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes.
- d. "Workability (or consistence)" is the ability of a fresh (plastic) concrete mix to fill the form/mould properly with the desired work (vibration) and without reducing the concrete's quality. Workability depends on water content, chemical admixtures, aggregate (shape and size distribution), cementitious content and age (level of hydration).

## 1.3 SUBMITTALS

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

SD-05 Design Data

Concrete mix design;



Thirty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, fly ash, pozzolans, silica fume, ground slag polypropylene fibers, and admixtures; and applicable reference specifications. Provide mix proportion data using at least three different water-cement ratios for each type of mixture, which produce a range of strength encompassing those required for each class and type of concrete required. If source material changes, resubmit mix proportion data using revised source material. Provide only materials that have been proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Contracting Officer. Indicate clearly in the submittal where each mix design is used when more than one mix design is submitted. Submit additional data regarding concrete aggregates if the source of aggregate changes. Submit copies of the fly ash, silica fume, polypropylene fibers and pozzolan test results, in addition. The approval of fly ash, silica fume, and pozzolan, and polypropylene fibers test results must be within 6 months of submittal date. Obtain acknowledgement of receipt prior to concrete placement.

#### Calculations

#### SD-06 Test Reports

Concrete mix design;

Fly ash

Pozzolan

Ground granulated blast-furnace slag

Aggregates

Fiber-reinforced concrete

Tolerance report

Compressive strength tests

Ion concentration

Air Content

Slump

Air Entrainment

#### SD-07 Certificates

Curing concrete elements

#### SD-08 Manufacturer's Instructions

Fly ash

Ground granulated blast-furnace slag

Welding Procedures must be in accordance with AWS D1.4/D1.4M.

Submit mill certificates for Steel Bar according to the paragraph entitled, "Fabrication," of this section.

Provide certificates for concrete that are in accordance with the paragraph entitled, "Classification and Quality of Concrete," of this section. Provide certificates that contain project name and number, date, name of Contractor, name of concrete testing service, source of concrete aggregates, material manufacturer, brand name of manufactured materials, material name, values as specified for each material, and test results. Provide certificates for Welder Qualifications that are in accordance with the paragraph entitled, "Qualifications for Welding Work," of this section.

Welding Procedures

SD-11 Closeout Submittals

#### 1.4 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Contracting Officer.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Do not deliver concrete until vapor barrier, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. ACI/MCP-2 for job site storage of materials. Protect materials from contaminants such as grease, oil, and dirt. Ensure materials can be accurately identified after bundles are broken and tags removed. Do not store concrete curing compounds or sealers with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store concrete curing compounds or sealers in occupied spaces.

##### 1.5.1 Reinforcement

Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

#### 1.6 QUALITY ASSURANCE

##### 1.6.1 Design Data

##### 1.6.2 Test Reports

##### 1.6.2.1 Concrete Mix Design

Submit copies of laboratory test reports showing that the mix has been successfully tested to produce concrete with the properties specified and that mix must be suitable for the job conditions. Include mill test and all other test for cement, silica fume, aggregates, and admixtures in the

laboratory test reports. Provide maximum nominal aggregate size, gradation analysis, percentage retained and passing sieve, and a graph of percentage retained versus sieve size. Submit test reports along with the concrete mix design. Obtain approval before concrete placement.

#### 1.6.2.2 Fly Ash and Pozzolan

Submit test results in accordance with ASTM C 618 for fly ash and pozzolan. Submit test results performed within 6 months of submittal date. Submit manufacturer's policy statement on fly ash use in concrete.

#### 1.6.2.3 Ground Granulated Blast-Furnace Slag

Submit test results in accordance with ASTM C 989 for ground granulated blast-furnace slag. Submit test results performed within 6 months of submittal date. Submit manufacturer's policy statement on slag use in concrete.

#### 1.6.2.4 Aggregates

ASTM C 1260 for potential alkali-silica reactions, ASTM C 295 for petrographic analysis.

#### 1.6.2.5 Fiber-Reinforced Concrete

Test to determine flexural toughness index I5 in accordance with ASTM C 1116/C 1116M.

### 1.7 ENVIRONMENTAL REQUIREMENTS

Provide space ventilation according to manufacturer recommendations, at a minimum, during and following installation of concrete curing compound and sealer. Maintain one of the following ventilation conditions during the curing compound/sealer curing period or for 72 hours after installation:

- a. Supply 100 percent outside air 24 hours a day.
- b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 55 degrees F and 84 degrees F and humidity is between 30 percent and 60 percent.
- c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

#### 1.7.1 Submittals for Environmental Performance

- a. Provide data indication the percentage of post-industrial pozzolan (fly ash, blast furnace slag) cement substitution as a percentage of the full product composite by weight.
- b. Provide data indicating the percentage of post-industrial and post-consumer recycled content aggregate.
- c. Provide product data indicating the percentage of post-consumer recycled steel content in each type of steel reinforcement as a percentage of the full product composite by weight.
- d. Provide product data stating the location where all products were manufactured

- e. For projects using FSC certified formwork, provide chain-of-custody documentation for all certified wood products.
- f. For projects using reusable formwork, provide data showing how formwork is reused.
- g. Provide MSDS product information data showing that form release agents meet any environmental performance goals such as using vegetable and soy based products.
- h. Provide MSDS product information data showing that concrete adhesives meet any environmental performance goals including low emitting, low volatile organic compound products.

#### 1.8 QUALIFICATIONS FOR CONCRETE TESTING SERVICE

Perform concrete testing by an approved laboratory and inspection service experienced in sampling and testing concrete. Testing agency must meet the requirements of ASTM E 329.

#### 1.9 CONCRETE SAMPLING AND TESTING

Testing by the Contractor must include sampling and testing concrete materials proposed for use in the work and testing the design mix for each class of concrete. Perform quality control testing during construction.

Sample and test concrete aggregate materials proposed for use in the work in accordance with ASTM C 33.

Sample and test portland cement in accordance with ASTM C 150.

Sample and test air-entraining admixtures in accordance with ASTM C 233.

Testing must be performed by a Grade I Testing Technician.

### PART 2 PRODUCTS

#### 2.1 CONCRETE

##### 2.1.1 Contractor-Furnished Mix Design

ACI/MCP-1, ACI/MCP-2, and ACI/MCP-3 except as otherwise specified.

Indicate the compressive strength (f'c) of the concrete for each portion of the structure(s) and as specified below.

| Location                      | f'c<br>(Min. 28-<br>Day Comp.<br>Strength)<br>(psi) | ASTM C 33<br>Maximum<br>Nominal<br>Aggregate<br>(Size No.) | Range<br>of<br>Slump<br>(inches) | Maximum<br>Water-<br>Cement<br>Ratio<br>(by weight) | Air<br>Entr.<br>(percent) |
|-------------------------------|---|--|----------------------------------|---|---------------------------|
| Floor slabs<br>and foundation | 3500  | 67   | 4                                | 0.50  | 1.5                       |

Maximum slump shown above may be increased 1 inch for methods of

consolidation other than vibration. Slump may be increased to 8 inches when superplasticizers are used. Provide air entrainment using air-entraining admixture. Provide air entrainment within plus or minus 1.5 percent of the value specified. The water soluble chloride ion concentrations in hardened concrete at ages from 28 to 42 days must not exceed 0.30.

Proportion concrete mixes for strength at 28 days.

#### 2.1.1.1 Mix Proportions for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified are the responsibility of the Contractor. Base mixture proportions on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39/C 39M. Samples of all materials used in mixture proportioning studies must be representative of those proposed for use in the project and must be accompanied by the manufacturer's or producer's test report indicating compliance with these specifications. Base trial mixtures having proportions, consistencies, and air content suitable for the work on methodology described in ACI/MCP-1. In the trial mixture, use at least three different water-cement ratios for each type of mixture, which must produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratio required must be based on equivalent water-cement ratio calculations as determined by the conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast-furnace slag by weight equivalency method. Design laboratory trial mixture for maximum permitted slump and air content. Each combination of material proposed for use must have separate trial mixture, except for accelerator or retarder use can be provided without separate trial mixture. Report the temperature of concrete in each trial batch. For each water-cement ratio, at least three test cylinders for each test age must be made and cured in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39/C 39M for 7 and 28 days. From these results, plot a curve showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, plot a curve showing the relationship between 7 and 28 day strengths.

#### 2.1.1.2 Required Average Strength of Mix Design

The selected mixture must produce an average compressive strength exceeding the specified strength by the amount indicated in ACI/MCP-2. When a concrete production facility has a record of at least 15 consecutive tests, the standard deviation must be calculated and the required average compressive strength must be determined in accordance with ACI/MCP-2. When a concrete production facility does not have a suitable record of tests to establish a standard deviation, the required average strength must follow ACI/MCP-2 requirements.

#### 2.1.2 Ready-Mix Concrete

Provide concrete that meets the requirements of ASTM C 94/C 94M.

Ready-mixed concrete manufacturer must provide duplicate delivery tickets with each load of concrete delivered. Provide delivery tickets with the following information in addition to that required by ASTM C 94/C 94M:

Type and brand cement

Cement content in 95-pound bags per cubic yard of concrete

Maximum size of aggregate

Amount and brand name of admixtures

Total water content expressed by water/cement ratio

### 2.1.3 Concrete Curing Materials

#### 2.1.3.1 Absorptive Cover

Provide burlap cloth cover for curing concrete made from jute or kenaf, weighing 10 ounces plus or minus 5 percent per square yard when clean and dry, conforming to ASTM C 171, Class 3; or cover may be cotton mats as approved.

#### 2.1.3.2 Moisture-Retaining Cover

Provide waterproof paper cover for curing concrete conforming to ASTM C 171, regular or white, or polyethylene sheeting conforming to ASTM C 171, or polyethylene-coated burlap consisting of a laminate of burlap and a white opaque polyethylene film permanently bonded to the burlap; burlap must conform to ASTM C 171, Class 3, and polyethylene film must conform to ASTM C 171. When tested for water retention in accordance with ASTM C 156, weight of water lost 72 hours after application of moisture retaining covering material must not exceed 0.039 gram per square centimeter of the mortar specimen surface.

#### 2.1.3.3 Membrane-Forming Curing Compound

Provide liquid type compound conforming to ASTM C 309, Type 1, clear, Type 1D with fugitive dye for interior work and Type 2, white, pigmented for exterior work.

## 2.2 MATERIALS

### 2.2.1 Cement

ASTM C 150, Type I or II or ASTM C 595, Type IP(MS) blended cement except as modified herein. Provide blended cement that consists of a mixture of ASTM C 150, Type II, cement and one of the following materials: ASTM C 618 pozzolan or fly ash, ASTM C 989 ground granulated blast-furnace slag. For portland cement manufactured in a kiln fueled by hazardous waste, maintain a record of source for each batch. For exposed concrete, use one manufacturer for each type of cement, ground slag, fly ash, and pozzolan.

#### 2.2.1.1 Fly Ash and Pozzolan

ASTM C 618, Type N, F, or C, except that the maximum allowable loss on ignition must be 6 percent for Types N and F. Add with cement. Fly ash content must be a minimum of 15 percent by weight of cementitious material, provided the fly ash does not reduce the amount of cement in the concrete mix below the minimum requirements of local building codes. Where the use of fly ash cannot meet the minimum level, provide the maximum amount of fly ash permissible that meets the code requirements for cement content. Report the chemical analysis of the fly ash in accordance with ASTM C 311.

Evaluate and classify fly ash in accordance with ASTM D 5759.

High contents of supplementary cementitious materials can have some detrimental effects on the concrete properties, such as slowing excessively the strength gain rate, and delaying and increasing the difficulty of finishing. The recommended maximum content (by weight of the total cementitious material) for these materials are:

1. For GGBF slag: 50 percent
2. For fly ash or natural pozzolan: 40 percent (25 percent in cold climates)
3. For silica fume: 10 percent

#### 2.2.1.2 Ground Granulated Blast-Furnace Slag

ASTM C 989, Grade 120. Slag content must be a minimum of 70 percent by weight of cementitious material.

#### 2.2.1.3 Silica Fume

ASTM C 1240, provide silica fume that is a by-product of silicon or ferrosilicon production. Provide 10 percent by weight of the total cementitious material.

#### 2.2.1.4 Portland Cement

Provide cement that conforms to ASTM C 150, Type I, IA, II, or IIA. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.

#### 2.2.2 Water

Minimize the amount of water in the mix. The amount of water must not exceed 45 percent by weight of cementitious materials (cement + pozzolans), and in general, improve workability by adjusting the grading rather than by adding water. Water must be fresh, clean, and potable; free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete.

#### 2.2.3 Aggregates

ASTM C 33, except as modified herein. Furnish aggregates for exposed concrete surfaces from one source. Provide aggregates that do not contain any substance which may be deleteriously reactive with the alkalis in the cement.

Fine and coarse aggregates must show expansions less than 0.08 percent at 16 days after casting when testing in accordance with ASTM C 1260. Should the test data indicate an expansion of 0.08 percent or greater, reject the aggregate(s) or perform additional testing using ASTM C 1567 using the Contractor's proposed mix design. In this case, include the mix design low alkali portland cement and one of the following supplementary cementitious materials:

1. GGBF slag at a minimum of 40 percent of total cementitious
2. Fly ash or natural pozzolan at a minimum of total cementitious of

- a. 30 percent if (SiO<sub>2</sub>+Al<sub>2</sub>O<sub>3</sub>+Fe<sub>2</sub>O<sub>3</sub>) is 65 percent or more,
- b. 25 percent if (SiO<sub>2</sub>+Al<sub>2</sub>O<sub>3</sub>+Fe<sub>2</sub>O<sub>3</sub>) is 70 percent or more,
- c. 20 percent if (SiO<sub>2</sub>+Al<sub>2</sub>O<sub>3</sub>+Fe<sub>2</sub>O<sub>3</sub>) is 80 percent or more,
- d. 15 percent if (SiO<sub>2</sub>+Al<sub>2</sub>O<sub>3</sub>+Fe<sub>2</sub>O<sub>3</sub>) is 90 percent or more.

3. Silica fume at a minimum of 7 percent of total cementitious.

If a combination of these materials is chosen, the minimum amount must be a linear combination of the minimum amounts above. Include these materials in sufficient proportion to show less than 0.08 percent expansion at 16 days after casting when tested in accordance with ASTM C 1567.

Aggregates must not possess properties or constituents that are known to have specific unfavorable effects in concrete when tested in accordance with ASTM C 295.

#### 2.2.3.1 Aggregates/Combined Aggregate Gradation (Floor Slabs Only)

ASTM C 33, uniformly graded and as follows: Nominal maximum aggregate size of 3/4 inch. A combined sieve analysis must indicate a well graded aggregate from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 (0.3mm) sieve, and less than 8 percent may be retained on sieves finer than No. 50 (0.3mm). Provide sand that is at least 50 percent natural sand.

#### 2.2.4 Nonshrink Grout

ASTM C 1107/C 1107M.

#### 2.2.5 Admixtures

ASTM C 494/C 494M: Type A, water reducing; Type B, retarding; Type C, accelerating; Type D, water-reducing and retarding; and Type E, water-reducing and accelerating admixture. Do not use calcium chloride admixtures.

##### 2.2.5.1 Air-Entraining

ASTM C 260.

##### 2.2.5.2 High Range Water Reducer (HRWR) (Superplasticizers)

ASTM C 494/C 494M, Type F and Type G (HRWR retarding admixture) and ASTM C 1017/C 1017M. Silica fume and HRWR must come from the same manufacturer.

##### 2.2.5.3 Pozzolan

Provide fly ash or other pozzolans used as admixtures that conform to ASTM C 618.

#### 2.2.6 Vapor Barrier

Waterproof Paper. Kraft paper, glass reinforcing fibers and layers of polyethylene laminated under heat and pressure to form a single layer meeting the requirements of FS UU-B-790, Type I, Grade A, Style 4; or waterproof paper, regular, conforming to ASTM C 171, consisting of two sheets of kraft paper cemented together with bituminous material in which



are embedded cords or strands of fiber running in both directions not more than 1 1/4 inch apart.

#### 2.2.7 Materials for Curing Concrete

Use water-based curing compounds, sealers, and coatings with low (maximum 160 grams/liter, less water and less exempt compounds).

Consider the use of water based or vegetable or soy based curing agents in lieu of petroleum based products. Consider agents that are not toxic and emit low or no Volatile Organic Compounds (VOC). Consider the use of admixtures that offer high performance to increase durability of the finish product but also have low toxicity and are made from bio-based materials such as soy, and emit low levels of Volatile Organic Compounds (VOC).

##### 2.2.7.1 Impervious Sheeting

ASTM C 171; waterproof paper, clear or white polyethylene sheeting, or polyethylene-coated burlap.

##### 2.2.7.2 Pervious Sheeting

AASHTO M 182.

##### 2.2.7.3 Liquid Membrane-Forming Compound

ASTM C 309, white-pigmented, Type 2, Class B.

#### 2.2.8 Liquid Chemical Sealer-Hardener Compound

Provide magnesium fluorosilicate compound which when mixed with water seals and hardens the surface of the concrete. Do not use on exterior slabs exposed to freezing conditions. Provide compound that does not reduce the adhesion of resilient flooring, tile, paint, roofing, waterproofing, or other material applied to concrete.

#### 2.2.9 Expansion/Contraction Joint Filler

Provide 30 lb felt.

##### 2.2.9.1 Preformed Joint Filler Strips

Provide nonextruding and resilient bituminous type filler strips conforming to ASTM D 1751.

##### 2.2.10 Joint Sealants

###### 2.2.10.1 Horizontal Surfaces, 3 Percent Slope, Maximum

ASTM D 1190 or ASTM C 920, Type M, Class 25, Use T. ASTM D 7116 for surfaces subjected to jet fuel.

###### 2.2.10.2 Vertical Surfaces Greater Than 3 Percent Slope

ASTM C 920, Type M, Grade NS, Class 25, Use T..

###### 2.2.10.3 Waterstops

Provide waterstops that are flat dumbbell type, not less than 3/16 inch for

widths up to 5 inches, and not less than 3/8 inch for widths 5 inches and over.

#### 2.2.10.4 Joint Sealant Compound

Provide cold-applied, two-component, elastomeric polymer type compound conforming to FS SS-S-200.

#### 2.2.11 Epoxy Bonding Compound

ASTM C 881/C 881M. Provide Type I for bonding hardened concrete to hardened concrete; Type II for bonding freshly mixed concrete to hardened concrete; and Type III as a binder in epoxy mortar or concrete, or for use in bonding skid-resistant materials to hardened concrete. Provide Grade 1 or 2 for horizontal surfaces and Grade 3 for vertical surfaces. Provide Class A if placement temperature is below 40 degrees F; Class B if placement temperature is between 40 and 60 degrees F; or Class C if placement temperature is above 60 degrees F.

#### 2.2.12 Biodegradable Form Release Agent

Provide form release agent that is colorless, biodegradable, and with a low (maximum of 55 grams/liter (g/l)) VOC content. A minimum of 85 percent of the total product must be biobased material. Provide product that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces. Provide form release agent that does not contain diesel fuel, petroleum-based lubricating oils, waxes, or kerosene.

### 2.3 REINFORCEMENT

Galvanize bars, fabrics, connectors, and chairs.

#### 2.3.1 Fiber-Reinforced Concrete

In addition to the requirements specified above, provide fiber reinforced concrete in accordance with ASTM C 1116/C 1116M Type III, synthetic fiber reinforced concrete, and as follows. Synthetic reinforcing fibers must be 100 percent virgin monofilament polypropylene fibers. Fibers may contain post-consumer or post-industrial recycled content. Provide fibers that have a specific gravity of 0.9, a minimum tensile strength of 70 ksi, graded per manufacturer, and specifically manufactured to an optimum gradation for use as concrete secondary reinforcement. Use a minimum of 1.5 pounds of fibers per cubic yard of concrete. Add fibers at the batch plant. Toughness indices must meet requirements for performance level I.

#### 2.3.2 Dowels for Load Transfer in Floors

Provide dowels for load transfer in floors of the type, design, weight, and dimensions indicated. Provide dowel bars that are plain-billet steel conforming to ASTM A 615/A 615M, Grade 40. Provide dowel pipe that is steel conforming to ASTM A 53/A 53M.

#### 2.3.3 Supports for Reinforcement

Supports include bolsters, chairs, spacers, and other devices necessary for proper spacing, supporting, and fastening reinforcing bars and wire fabric in place.

Provide wire bar type supports conforming to ACI/MCP-3 and CRSI 10MSP.

Legs of supports in contact with formwork must be hot-dip galvanized, or plastic coated after fabrication, or stainless-steel bar supports.

## 2.4 BONDING MATERIALS

### 2.4.1 Concrete Bonding Agent

Provide aqueous-phase, film-forming, nonoxidizing, freeze and thaw-resistant compound agent suitable for brush or spray application conforming to ASTM C 932.

### 2.4.2 Epoxy-Resin Adhesive Binder

Provide two-component, epoxy-polysulfide polymer type binder with an amine-type curing-agent conforming to FS MMM-A-001993, Type I or ASTM C 881/C 881M.

## 2.5 FLOOR FINISH MATERIALS

### 2.5.1 Liquid Chemical Floor Hardener

Hardener must be a colorless aqueous solution containing a blend of magnesium fluorosilicate and zinc fluorosilicate combined with a wetting agent. Solution must contain not less than 1/2 pounds of fluorosilicates per gallon. An approved proprietary chemical hardener may be used provided hardener is delivered ready for use in manufacturer's original containers.

## 2.6 CLASSIFICATION AND QUALITY OF CONCRETE

### 2.6.1 Concrete Classes and Usage

Provide concrete classes, compressive strength, requirements for air entrainment, and usage as follows:

| CONCRETE<br>CLASS | MIN. 28-DAY<br>COMPRESSIVE<br>STRENGTH<br>POUNDS PER<br>SQ. IN. | REQUIREMENT<br>FOR AIR<br>ENTRAINMENT | USAGE   |
|-------------------|---|---------------------------------------|---|
| 3N                | 3,500   | Nonair-<br>entrained                  | For foundation concrete work not exposed to freezing and thawing or subjected to hydraulic pressure, such as footings, pile caps, foundation mats. For interior slabs on ground to be covered with resilient flooring |
| 4A                | 4,000   | Air-<br>entrained                     | For structural concrete work exposed to freezing and thawing, unless otherwise indicated or specified,  |

| <u>CONCRETE CLASS</u> | MIN. 28-DAY<br>COMPRESSIVE<br>STRENGTH<br>POUNDS PER<br>SQ. IN. | REQUIREMENT<br>FOR AIR<br>ENTRAINMENT | <u>USAGE</u><br>such as exterior<br>columns and spandrels                   |
|-----------------------|---|---------------------------------------|---|
| 2.5N                  | 2,500   | Nonair-<br>entrained                  | For concrete not re-<br>inforced and not exposed<br>to freezing and thawing |
| 5A                    | 5,000   | Air-<br>entrained                     | For structural con-<br>crete work as<br>indicated                           |
| 5N                    | 5,000   | Nonair-<br>entrained                  | For structural con-<br>crete work as<br>indicated                           |

### 2.6.2 Limits for Concrete Proportions

Provide limits for maximum water/cement ratio and minimum cement content for each concrete class as follows:

| <u>CONCRETE CLASS</u> | MAX. WATER/CEMENT RATIO<br>BY WEIGHT | MIN. CEMENT FOR 3- TO<br>4-INCH SLUMP, (NO. OF 94-<br>POUND SACKS) PER CU. YD. |
|-----------------------|--------------------------------------|--|
| 3N                    | 0.54                                 | 5.25   |
| 4A                    | 0.46                                 | 6.0  |

\* Weight of water to weight of cement in pounds in one cubic yard of concrete

### 2.6.3 Maximum Size of Aggregate

Size of aggregate, designated by the sieve size on which maximum amount of retained coarse aggregate is 5 to 10 percent by weight, must be as follows:

| <u>MAXIMUM<br/>SIZE OF<br/>AGGREGATE</u> | <u>ASTM C 33<br/>SIZE<br/>NUMBER</u> | <u>TYPE OF CONSTRUCTION</u>  |
|--|--------------------------------------|--|
| 2 inches                                 | 357                                  | Nonreinforced footings and<br>other flat work having a depth<br>of not less than 6 inches, and<br>nonreinforced walls and other<br>formed sections having a<br>dimension between forms of not<br>less than 10 inches |
| 1-1/2 inches                             | 467                                  | Monolithic slabs on ground,<br>concrete fill, and other flat-<br>work having a depth of not less<br>than 5 inches and a clear  |

| <u>MAXIMUM<br/>SIZE OF<br/>AGGREGATE</u> | <u>ASTM C 33<br/>SIZE<br/>NUMBER</u> | <u>TYPE OF CONSTRUCTION</u>   |
|--|--------------------------------------|---|
|  |                                      | distance between reinforcing bars of not less than 2 inches   |
| 3/4 inch                                 | 67                                   | Reinforced walls, columns, girders, beams, and other formed sections having a dimension between forms of not less than 6 inches and clear distance between reinforcing bars or reinforcing bar and face of form of not less than 1 inch |
| 3/4 inch                                 | 67                                   | Monolithic concrete slabs and other flatwork having a depth of not less than 2-1/2 inches and a clear distance between reinforcing bars of not less than 1 inch   |
| 1/2 inch                                 | 7                                    | Concrete joist construction, beams, reinforced walls, and other formed work having a clear distance between reinforcing bars and face of form of less than 1 inch   |
| 3/8 inch                                 | 8                                    | Nonreinforced slabs and other flatwork having a depth of less than 2-1/2 inches   |

Maximum size of aggregate may be that required for most critical type of construction using that concrete class.

Specify gradation of aggregates for separate floor topping.

#### 2.6.4 Slump

Provide slump for concrete at time and in location of placement as follows:

| <u>TYPE OF CONSTRUCTION</u>                        | <u>SLUMP</u>                                |
|--|---|
| Footings, unreinforced walls                       | Not less than 1 inch nor more than 3 inches |
| Columns, beams, reinforced walls, monolithic slabs | Not less than 1 inch nor more than 4 inches |
| Ramps and other sloping surfaces                   | 0 nor more than 3 inches                    |

#### 2.6.5 Total Air Content

Air content of exposed concrete and interior concrete must be in accordance

with ASTM C 260 and/or as follows:

| LIMITS<br>CONCRETE<br><u>EXPOSURE</u>   | REQUIREMENT<br>FOR AIR<br><u>ENTRAINMENT</u> | MAXIMUM SIZE<br><u>OF AGGREGATE</u> | TOTAL AIR CONTENT<br><u>BY VOLUME</u> |
|---|--|-------------------------------------|---------------------------------------|
| Exposed to<br>freezing<br>and thawing<br>or subjected<br>to hydraulic<br>pressure | Air-<br>entrained                            | 1-1/2 or<br>2 inches<br>3/4 inch    | 4 to 6 percent<br>5 to 7 percent      |
|   |  | 1/2 or<br>3/8 inch                  | 6 to 8.5 percent                      |

Provide concrete exposed to freezing and thawing or subjected to hydraulic pressure that is air-entrained by addition of approved air-entraining admixture to concrete mix.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Do not begin installation until substrates have been properly constructed; verify that substrates are plumb and true.

If substrate preparation is the responsibility of another installer, notify Architect/Engineer of unsatisfactory preparation before processing.

Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Architect/Engineer and wait for instructions before beginning installation.

#### 3.2 PREPARATION

Determine quantity of concrete needed and minimize the production of excess concrete. Designate locations or uses for potential excess concrete before the concrete is poured.

##### 3.2.1 General

Surfaces against which concrete is to be placed must be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.

Remove standing water without washing over freshly deposited concrete. Divert flow of water through side drains provided for such purpose.

##### 3.2.2 Subgrade Under Foundations and Footings

When subgrade material is semiporous and dry, sprinkle subgrade surface with water as required to eliminate suction at the time concrete is deposited. When subgrade material is porous, seal subgrade surface by covering surface with specified water barrier subgrade cover; this may also be used over semiporous, dry subgrade material instead of water sprinkling.

##### 3.2.3 Subgrade Under Slabs on Ground

Before construction of slabs on ground, have underground work on pipes and conduits completed and approved.

Previously constructed subgrade or fill must be cleaned of foreign

materials and inspected by the Contractor for adequate compaction and surface tolerances as specified.

Actual density of top 12 inches of subgrade soil material-in-place must not be less than the following percentages of maximum density of same soil material compacted at optimum moisture content in accordance with ASTM D 1557.

| <u>SOIL MATERIAL</u>       | <u>PERCENT MAXIMUM DENSITY</u> |
|----------------------------|--------------------------------|
| Drainage fill              | 100                            |
| Cohesionless soil material | 100                            |
| Cohesive soil material     | 95                             |

Finish surface of drainage fill under interior slabs on ground must not show deviation in excess of 1/4 inch when tested with a 10-foot straightedge parallel with and at right angles to building lines.

Finished surface of subgrade or fill under exterior slabs on ground must not be more than 0.02-foot above or 0.10-foot below elevation indicated.

Cover drainage fill surface under interior slabs on ground with specified water-vapor barrier subgrade cover immediately prior to placing reinforcement. Install subgrade cover to avoid puncture or tear. Patch punctures or tears over 12 inches with separate sheets lapped not less than 6 inches. Seal all punctures or tears less than 12 inches with pressure-sensitive vapor barrier tape not less than 2-inches wide. Seal lapped joints with vapor barrier adhesive or pressure-sensitive vapor barrier tape not less than 2-inches wide. Lay subgrade cover sheets with not less than a 6-inch lap at edges and ends and in direction in which concrete is to be placed.

Prepare subgrade or fill surface under exterior slabs on ground as specified for subgrade under foundations and footings.

#### 3.2.4 Formwork

Complete and approve formwork. Remove debris and foreign material from interior of forms before start of concrete placing.

#### 3.2.5 Edge Forms and Screed Strips for Slabs

Set edge forms or bulkheads and intermediate screed strips for slabs to obtain indicated elevations and contours in finished slab surface and must be strong enough to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment. Align concrete surface to elevation of screed strips by use of strike-off templates or approved compacting-type screeds.

#### 3.2.6 Reinforcement and Other Embedded Items

Secure reinforcement, joint materials, and other embedded materials in position, inspected, and approved before start of concrete placing.

### 3.3 FORMS

ACI/MCP-2. Provide forms, shoring, and scaffolding for concrete

placement. Set forms mortar-tight and true to line and grade. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch unless otherwise indicated. Provide formwork with clean-out openings to permit inspection and removal of debris. Forms submerged in water must be watertight.

### 3.3.1 General

Construct forms to conform, within the tolerances specified, to shapes dimensions, lines, elevations, and positions of cast-in-place concrete members as indicated. Forms must be supported, braced, and maintained sufficiently rigid to prevent deformation under load.

### 3.3.2 Design and Construction of Formwork

Provide formwork design and construction that conforms to and ACI/MCP-2, Chapter 4.

Provide forms that are tight to prevent leakage of cement paste during concrete placing.

Support form facing materials by structural members spaced close to prevent deflection of form facing material. Fit forms placed in successive units for continuous surfaces to accurate alignment to ensure a smooth completed surface within the tolerances specified. Where necessary to maintain the tolerances specified, such as long spans where immediate supports are not possible, camber formwork for anticipated deflections in formwork due to weight and pressure of fresh concrete and to construction loads.

Chamfer exposed joints, edges, and external corners a minimum of 3/4 inch by moldings placed in corners of column, beam, and wall forms.

Provide shores and struts with a positive means of adjustment capable of taking up formwork settlement during concrete placing operations. Obtain adjustment with wedges or jacks or a combination thereof. When adequate foundations for shores and struts cannot be secured, provide trussed supports.

Provide temporary openings in wall forms, column forms, and at other points where necessary to permit inspection and to facilitate cleaning.

Provide forms that are readily removable without impact, shock, or damage to concrete.

### 3.3.3 Coating

Before concrete placement, coat the contact surfaces of forms with a nonstaining mineral oil, nonstaining form coating compound, or two coats of nitrocellulose lacquer. Do not use mineral oil on forms for surfaces to which adhesive, paint, or other finish material is to be applied.

### 3.3.4 Reshoring

Reshore concrete elements where forms are removed prior to the specified time period. Do not permit elements to deflect or accept loads during form stripping or reshoring. Forms on columns, walls, or other load-bearing members may be stripped after 2 days if loads are not applied to the members. After forms are removed, reshore slabs and beams over 10 feet in span and cantilevers over 4 feet for the remainder of the specified time



period in accordance with paragraph entitled "Removal of Forms." Perform reshoring operations to prevent subjecting concrete members to overloads, eccentric loading, or reverse bending. Provide reshoring elements with the same load-carrying capabilities as original shoring and spaced similar to original shoring. Firmly secure and brace reshoring elements to provide solid bearing and support.

### 3.3.5 Reuse

Reuse forms providing the structural integrity of concrete and the aesthetics of exposed concrete are not compromised.

### 3.3.6 Forms for Standard Rough Form Finish

Give rough form finish concrete formed surfaces that are to be concealed by other construction, unless otherwise specified.

Form facing material for standard rough form finish must be the specified concrete form plywood or other approved form facing material that produces concrete surfaces equivalent in smoothness and appearance to that produced by new concrete form plywood panels.

For concrete surfaces exposed only to the ground, undressed, square-edge, 1-inch nominal thickness lumber may be used. Provide horizontal joints that are level and vertical joints that are plumb.

### 3.3.7 Forms for Standard Smooth Form Finish

Give smooth form finish concrete formed surfaces that are to be exposed to view or that are to be covered with coating material applied directly to concrete or with covering material bonded to concrete, such as waterproofing, dampproofing, painting, or other similar coating system.

Form facing material for standard smooth finish must be the specified overlaid concrete form plywood or other approved form facing material that is nonreactive with concrete and that produce concrete surfaces equivalent in smoothness and appearance to that produced by new overlaid concrete form plywood panels.

Maximum deflection of form facing material between supports and maximum deflection of form supports such as studs and wales must not exceed 0.0025 times the span.

Provide arrangement of form facing sheets that are orderly and symmetrical, and sheets that are in sizes as large as practical.

Arrange panels to make a symmetrical pattern of joints. Horizontal and vertical joints must be solidly backed and butted tight to prevent leakage and fins.

### 3.3.8 Form Ties

Provide ties that are factory fabricated metal, adjustable in length, removable or snap-off type that do allow form deflection or do not spall concrete upon removal. Portion of form ties remaining within concrete after removal of exterior parts must be at least 1-1/2 inches back from concrete surface. Provide form ties that are free of devices that leave a hole larger than 7/8 inch or less than 1/2 inch in diameter in concrete surface. Form ties fabricated at the project site or wire ties of any type

are not acceptable.

### 3.3.9 Tolerances for Form Construction

Construct formwork to ensure that after removal of forms and prior to patching and finishing of formed surfaces, provide concrete surfaces in accordance with tolerances specified in ACI/MCP-1 and ACI/MCP-2.

### 3.3.10 Removal of Forms and Supports

After placing concrete, forms must remain in place for the time periods specified in ACI/MCP-4. Do not remove forms and shores (except those used for slabs on grade and slip forms) until the client determines that the concrete has gained sufficient strength to support its weight and superimposed loads. Base such determination on compliance with one of the following:

- a. The plans and specifications stipulate conditions for removal of forms and shores, and such conditions have been followed, or

- b. The concrete has been properly tested with an appropriate ASTM standard test method designed to indicate the concrete compressive strength, and the test results indicate that the concrete has gained sufficient strength to support its weight and superimposed loads.

Prevent concrete damage during form removal. Clean all forms immediately after removal.

#### 3.3.10.1 Special Requirements for Reduced Time Period

Forms may be removed earlier than specified if ASTM C 39/C 39M test results of field-cured samples from a representative portion of the structure indicate that the concrete has reached a minimum of 85 percent of the design strength.

### 3.4 WATERSTOP SPLICES

Fusion weld in the field.

### 3.5 FORMED SURFACES

#### 3.5.1 Preparation of Form Surfaces

Coat contact surfaces of forms with form-coating compound before reinforcement is placed. Provide a commercial formulation form-coating compound that does not bond with, stain, nor adversely affect concrete surfaces and impair subsequent treatment of concrete surfaces that entails bonding or adhesion nor impede wetting of surfaces to be cured with water or curing compounds. Do not allow excess form-coating compound to stand in puddles in the forms nor to come in contact with concrete against which fresh concrete is placed. Make thinning of form-coating compound with thinning agent of the type, in the amount, and under the conditions recommended by form-coating compound manufacturer's printed or written directions.

#### 3.5.2 Tolerances

ACI/MCP-4 and as indicated.

### 3.5.3 As-Cast Form

Provide form facing material producing a smooth, hard, uniform texture on the concrete. Arrange facing material in an orderly and symmetrical manner and keep seams to a practical minimum. Support forms as necessary to meet required tolerances. Do not use material with raised grain, torn surfaces, worn edges, patches, dents, or other defects which can impair the texture of the concrete surface.

## 3.6 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

ACI/MCP-2. Provide bars, wire fabric, wire ties, supports, and other devices necessary to install and secure reinforcement. Reinforcement must not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per unit length has been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.

### 3.6.1 General

Provide details of reinforcement that are in accordance with, and ACI/MCP-4 and as specified.

### 3.6.2 Vapor Barrier

Provide beneath the on-grade concrete floor slab. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of 12 inches and tape or cement joints. Remove torn, punctured, or damaged vapor barrier material and provide with new vapor barrier prior to placing concrete. Concrete placement must not damage vapor barrier material.

### 3.6.3 Future Bonding

Plug exposed, threaded, mechanical reinforcement bar connectors with a greased bolt. Provide bolt threads that match the connector. Countersink the connector in the concrete. Calk the depression after the bolt is installed.

### 3.6.4 Cover

ACI/MCP-2 for minimum coverage, unless otherwise indicated.

### 3.6.5 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

### 3.6.6 Construction Joints

Locate joints to least impair strength. Continue reinforcement across joints unless otherwise indicated.

### 3.6.7 Expansion Joints and Contraction Joints

Provide expansion joint at edges of interior floor slabs on grade abutting

vertical surfaces, and as indicated. Make expansion joints 1/2 inch wide unless indicated otherwise. Fill expansion joints not exposed to weather with preformed joint filler material. Completely fill joints exposed to weather with joint filler material and joint sealant. Do not extend reinforcement or other embedded metal items bonded to the concrete through any expansion joint unless an expansion sleeve is used. Provide contraction joints, either formed or saw cut or cut with a jointing tool, to the indicated depth after the surface has been finished. Complete saw joints within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.

### 3.7 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

ASTM C 94/C 94M, and ACI/MCP-2, except as modified herein. Batching equipment must be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

#### 3.7.1 Measuring

Make measurements at intervals as specified in paragraphs entitled "Sampling" and "Testing."

#### 3.7.2 Mixing

ASTM C 94/C 94M and ACI/MCP-2. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 84 degrees F. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than 84 degrees F except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded. When additional water is added, an additional 30 revolutions of the mixer at mixing speed is required. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch.

#### 3.7.3 Transporting

Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

### 3.8 PLACING CONCRETE

Place concrete as soon as practicable after the forms and the reinforcement have been inspected and approved. Do not place concrete when weather conditions prevent proper placement and consolidation; in uncovered areas during periods of precipitation; or in standing water. Prior to placing concrete, remove dirt, construction debris, water, snow, and ice from within the forms. Deposit concrete as close as practicable to the final position in the forms. Do not exceed a free vertical drop of 3 feet from the point of discharge. Place concrete in one continuous operation from

one end of the structure towards the other. Position grade stakes on 10 foot centers maximum in each direction when pouring interior slabs and on 20 foot centers maximum for exterior slabs.

### 3.8.1 General Placing Requirements

Deposit concrete continuously or in layers of such thickness that no concrete is placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as specified. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic. Deposit concrete as nearly as practical in its final position to avoid segregation due to rehandling or flowing. Do not subject concrete to procedures which cause segregation.

Concrete to receive other construction must be screeded to proper level to avoid excessive skimming or grouting.

Do not use concrete which becomes nonplastic and unworkable or does not meet quality control limits as specified or has been contaminated by foreign materials. Use of retempered concrete is permitted. Remove rejected concrete from the site.

### 3.8.2 Footing Placement

Concrete for footings may be placed in excavations without forms upon inspection and approval by the Contracting Officer. Excavation width must be a minimum of 4 inches greater than indicated.

### 3.8.3 Vibration

ACI/MCP-2. Furnish a spare, working, vibrator on the job site whenever concrete is placed. Consolidate concrete slabs greater than 4 inches in depth with high frequency mechanical vibrating equipment supplemented by hand spading and tamping. Consolidate concrete slabs 4 inches or less in depth by wood tampers, spading, and settling with a heavy leveling straightedge. Operate internal vibrators with vibratory element submerged in the concrete, with a minimum frequency of not less than 6000 impulses per minute when submerged. Do not use vibrators to transport the concrete in the forms. Insert and withdraw vibrators approximately 20 inches apart. Penetrate the previously placed lift with the vibrator when more than one lift is required. Place concrete in 20 inch maximum vertical lifts. Use external vibrators on the exterior surface of the forms when internal vibrators do not provide adequate consolidation of the concrete.

### 3.8.4 Application of Epoxy Bonding Compound

Apply a thin coat of compound to dry, clean surfaces. Scrub compound into the surface with a stiff-bristle brush. Place concrete while compound is stringy. Do not permit compound to harden prior to concrete placement. Follow manufacturer's instructions regarding safety and health precautions when working with epoxy resins.

### 3.8.5 Pumping

ACI/MCP-2. Pumping must not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment must not exceed

2 inches. Do not convey concrete through pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of course aggregate to 33 percent of the diameter of the pipe. Limit maximum size of well rounded aggregate to 40 percent of the pipe diameter. Take samples for testing at both the point of delivery to the pump and at the discharge end.

### 3.8.6 Cold Weather

ACI/MCP-2. Do not allow concrete temperature to decrease below 50 degrees F. Obtain approval prior to placing concrete when the ambient temperature is below 40 degrees F or when concrete is likely to be subjected to freezing temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain 50 degrees F minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to 37 degrees F in any 1 hour and 50 degrees F per 24 hours after heat application.

### 3.8.7 Hot Weather

Maintain required concrete temperature using Figure 2.1.5 in ACI/MCP-2 to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

### 3.8.8 Follow-up

Check concrete within 24 hours of placement for flatness, levelness, and other specified tolerances. Adjust formwork and placement techniques on subsequent pours to achieve specified tolerances.

### 3.8.9 Placing Concrete in Forms

Deposit concrete placed in forms in horizontal layers not exceeding 24 inches.

Remove temporary spreaders in forms when concrete placing has reached elevation of spreaders.

Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Design vibrators to operate with vibratory element submerged in concrete and maintain a speed of not less than 9,000 impulses per minute when submerged in concrete. Provide vibrating equipment adequate in number of units and power of each unit to properly consolidate concrete. Vibration of forms and reinforcement is not be permitted. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced points not farther apart than visible effectiveness of machine. Do not insert vibrator into lower courses of concrete that have begun to set. At each insertion, limit duration of vibration to time

necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of concrete mix.

Do not start placing of concrete in supporting elements until concrete previously placed in columns and walls is no longer plastic and has been in place a minimum of 2 hours.

### 3.8.10 Placing Concrete Slabs

Place and consolidate concrete for slabs in a continuous operation, within the limits of approved construction joints until placing of panel or section is completed.

During concrete placing operations, consolidate concrete by mechanical vibrating equipment so that concrete is worked around reinforcement and other embedded items and into corners. Consolidate concrete placed in beams and girders of supported slabs and against bulkheads of slabs on ground by mechanical vibrators as specified. Consolidate concrete in remainder of slabs by vibrating bridge screeds, roller pipe screeds, or other approved method. Limit consolidation operations to time necessary to obtain consolidation of concrete without bringing an excess of fine aggregate to the surface. Concrete to be consolidated must be as dry as practical and surfaces thereof must not be manipulated prior to finishing operations. Bring concrete correct level with a straightedge and struck-off. Use bull floats or darbies to smooth surface, leaving it free of humps or hollows. Sprinkling of water on plastic surface is not permitted.

Provide finish of slabs as specified.

### 3.8.11 Bonding

Surfaces of set concrete at joints, except where bonding is obtained by use of concrete bonding agent, must be roughened and cleaned of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, nor damaged concrete at the surface.

Obtain bonding of fresh concrete that has set as follows:

At joints between footings and walls or columns, between walls or columns and the beams or slabs they support, and elsewhere unless otherwise specified; roughened and cleaned surface of set concrete must be dampened, but not saturated, immediately prior to placing of fresh concrete.

At joints in exposed-to-view work; at vertical joints in walls; at joints near midpoint of span in girders, beams, supported slabs, other structural members; in work designed to contain liquids; the roughened and cleaned surface of set concrete must be dampened but not saturated and covered with a cement grout coating.

Provide cement grout that consists of equal parts of portland cement and fine aggregate by weight with not more than 6 gallons of water per sack of cement. Apply cement grout with a stiff broom or brush to a minimum thickness of 1/16 inch. Deposit fresh concrete before cement grout has attained its initial set.

Bonding of fresh concrete to concrete that has set may be obtained by

use of a concrete bonding agent. Apply such bonding material to cleaned concrete surface in accordance with approved printed instructions of bonding material manufacturer.

### 3.9 SURFACE FINISHES EXCEPT FLOOR, SLAB, AND PAVEMENT FINISHES

#### 3.9.1 Defects

Repair formed surfaces by removing minor honeycombs, pits greater than 1 square inch surface area or 0.25 inch maximum depth, or otherwise defective areas. Provide edges perpendicular to the surface and patch with nonshrink grout. Patch tie holes and defects when the forms are removed. Concrete with extensive honeycomb including exposed steel reinforcement, cold joints, entrapped debris, separated aggregate, or other defects which affect the serviceability or structural strength will be rejected, unless correction of defects is approved. Obtain approval of corrective action prior to repair. The surface of the concrete must not vary more than the allowable tolerances of ACI/MCP-4. Exposed surfaces must be uniform in appearance and finished to a smooth form finish unless otherwise specified.

#### 3.9.2 Not Against Forms (Top of Walls)

Surfaces not otherwise specified must be finished with wood floats to even surfaces. Finish must match adjacent finishes.

#### 3.9.3 Formed Surfaces

##### 3.9.3.1 Tolerances

ACI/MCP-1 and as indicated.

##### 3.9.3.2 As-Cast Rough Form

Provide for surfaces not exposed to public view. Patch these holes and defects and level abrupt irregularities. Remove or rub off fins and other projections exceeding 0.25 inch in height.

##### 3.9.3.3 Standard Smooth Finish

Finish must be as-cast concrete surface as obtained with form facing material for standard smooth finish. Repair and patch defective areas as specified; and all fins and remove other projections on surface.

### 3.10 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

ACI/MCP-2, unless otherwise specified. Slope floors uniformly to drains where drains are provided. Depress the concrete base slab where quarry tile, ceramic tile, are indicated. Steel trowel and fine-broom finish concrete slabs that are to receive quarry tile, ceramic tile, or paver tile.

Where straightedge measurements are specified, Contractor must provide straightedge.

#### 3.10.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous



materials. Do not use dry cement to absorb bleedwater.

#### 3.10.1.1 Scratched

Use for surfaces intended to receive bonded applied cementitious applications. After the concrete has been placed, consolidated, struck off, and leveled to a Class C tolerance as defined below, roughen the surface with stiff brushes or rakes before final set.

#### 3.10.1.2 Floated

Use for surfaces to receive, waterproofing membranes, and exterior slabs where not otherwise specified. After the concrete has been placed, consolidated, struck off, and leveled, do not work the concrete further, until ready for floating. Whether floating with a wood, magnesium, or composite hand float, with a bladed power trowel equipped with float shoes, or with a powered disc, float must begin when the surface has stiffened sufficiently to permit the operation. During or after the first floating, check surface with a 10 foot straightedge applied at no less than two different angles, one of which is perpendicular to the direction of strike off. Cut down high spots and fill low spots during this procedure to produce a surface level within 1/4 inch in 10 feet.

#### 3.10.1.3 Concrete Containing Silica Fume

Finish using magnesium floats or darbies.

#### 3.10.1.4 Steel Troweled

Use for floors intended as walking surfaces, and for reception of floor coverings. First, provide a floated finish. Next, the finish must be power troweled three times, and finally hand troweled. The first troweling after floating needs to produce a smooth surface which is relatively free of defects but which may still show some trowel marks. Perform additional trowelings done by hand after the surface has hardened sufficiently. The final troweling is done when a ringing sound is produced as the trowel is moved over the surface. Thoroughly consolidate the surface by the hand troweling operations. The finished surface must be essentially free of trowel marks and uniform in texture and appearance. The finished surface must produce a surface level to within 1/4 inch in 10 feet. On surfaces intended to support floor coverings, remove any defects of sufficient magnitude to show through the floor covering by grinding.

#### 3.10.1.5 Broomed

Use on surfaces of exterior walks, platforms, patios, and ramps, unless otherwise indicated. Perform a floated finish, then draw a broom or burlap belt across the surface to produce a coarse scored texture. Permit surface to harden sufficiently to retain the scoring or ridges. Broom transverse to traffic or at right angles to the slope of the slab.

#### 3.10.1.6 Pavement

Screed the concrete with a template advanced with a combined longitudinal and crosswise motion. Maintain a slight surplus of concrete ahead of the template. After screeding, float the concrete longitudinally. Use a straightedge to check slope and flatness; correct and refloat as necessary. Obtain final finish by belting. Lay belt flat on the concrete surface and advance with a sawing motion; continue until a uniform but

gritty nonslip surface is obtained. Round edges and joints with an edger having a radius of 1/8 inch.

#### 3.10.1.7 Chemical-Hardener Treatment

Apply liquid-chemical floor hardener where indicated after curing and drying concrete surface. Dilute liquid hardener with water and apply in three coats. First coat must be one-third strength, second coat one-half strength, and third coat two-thirds strength. Apply each coat evenly and allow to dry 24 hours between coats.

Approved proprietary chemical hardeners must be applied in accordance with manufacturer's printed directions.

#### 3.10.2 Flat Floor Finishes

ACI/MCP-2. Construct in accordance with one of the methods recommended in Table 7.15.3, "Typical Composite Ff/FL Values for Various Construction Methods." ACI/MCP-1 for tolerance tested by ASTM E 1155.

##### a. Specified Conventional Value:

Floor Flatness (Ff) 20 minimum  
Floor Levelness (FL) 15 minimum

##### b. Specified Industrial:

1/8" in 10" radius

#### 3.10.2.1 Measurement of Floor Tolerances

Test slab within 24 hours of the final troweling. Provide tests to Contracting Officer within 12 hours after collecting the data. Floor flatness inspector is required to provide a tolerance report which must include:

##### a. Key plan showing location of data collected.

##### b. Results required by ASTM E 1155.

#### 3.10.2.2 Remedies for Out of Tolerance Work

Contractor is required to repair and retest any floors not meeting specified tolerances. Prior to repair, Contractor must submit and receive approval for the proposed repair, including product data from any materials proposed. Repairs must not result in damage to structural integrity of the floor. For floors exposed to public view, repairs must prevent any uneven or unusual coloring of the surface.

#### 3.10.3 Concrete Walks

Provide 5 inches thick minimum. Provide contraction joints spaced every 5 linear feet unless otherwise indicated. Cut contraction joints one inch deep with a jointing tool after the surface has been finished. Provide 0.5 inch thick transverse expansion joints at changes in direction where sidewalk abuts curb, steps, rigid pavement, or other similar structures; space expansion joints every 50 feet maximum. Give walks a broomed finish. Unless indicated otherwise, provide a transverse slope of 1/48.

Limit variation in cross section to 1/4 inch in 5 feet.

#### 3.10.4 Pits and Trenches

Place bottoms and walls monolithically or provide waterstops and keys.

#### 3.10.5 Curbs and Gutters

Provide contraction joints spaced every 10 feet maximum unless otherwise indicated. Cut contraction joints 3/4 inch deep with a jointing tool after the surface has been finished. Provide expansion joints 1/2 inch thick and spaced every 100 feet maximum unless otherwise indicated. Perform pavement finish.

### 3.11 CURING AND PROTECTION

ACI/MCP-2 unless otherwise specified. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by blasting, pile driving, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer-hardener or epoxy coating. Allow curing compound/sealer installations to cure prior to the installation of materials that adsorb VOCs.

#### 3.11.1 General

Protect freshly placed concrete from premature drying and cold or hot temperature and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of cement and proper hardening of concrete.

Start initial curing as soon as free water has disappeared from surface of concrete after placing and finishing. Keep concrete moist for minimum 72 hours.

Final curing must immediately follow initial curing and before concrete has dried. Continue final curing until cumulative number of hours or fraction thereof (not necessarily consecutive) during which temperature of air in contact with the concrete is above 50 degrees F has totaled 168 hours. Alternatively, if tests are made of cylinders kept adjacent to the structure and cured by the same methods, final curing may be terminated when the average compressive strength has reached 70 percent of the 28-day design compressive strength. Prevent rapid drying at end of final curing period.

#### 3.11.2 Moist Curing

Remove water without erosion or damage to the structure. Prevent water run-off.

### 3.11.2.1 Ponding or Immersion

Continually immerse the concrete throughout the curing period. Water must not be more than 50 degrees F less than the temperature of the concrete. For temperatures between 40 and 50 degrees F, increase the curing period by 50 percent.

### 3.11.2.2 Fog Spraying or Sprinkling

Apply water uniformly and continuously throughout the curing period. For temperatures between 40 and 50 degrees F, increase the curing period by 50 percent.

### 3.11.2.3 Pervious Sheeting

Completely cover surface and edges of the concrete with two thicknesses of wet sheeting. Overlap sheeting 6 inches over adjacent sheeting. Provide sheeting that is at least as long as the width of the surface to be cured. During application, do not drag the sheeting over the finished concrete nor over sheeting already placed. Wet sheeting thoroughly and keep continuously wet throughout the curing period.

### 3.11.2.4 Impervious Sheeting

Wet the entire exposed surface of the concrete thoroughly with a fine spray of water and cover with impervious sheeting throughout the curing period. Lay sheeting directly on the concrete surface and overlap edges 12 inches minimum. Provide sheeting not less than 18 inches wider than the concrete surface to be cured. Secure edges and transverse laps to form closed joints. Repair torn or damaged sheeting or provide new sheeting. Cover or wrap columns, walls, and other vertical structural elements from the top down with impervious sheeting; overlap and continuously tape sheeting joints; and introduce sufficient water to soak the entire surface prior to completely enclosing.

### 3.11.3 Liquid Membrane-Forming Curing Compound

Seal or cover joint openings prior to application of curing compound. Prevent curing compound from entering the joint. Apply in accordance with the recommendations of the manufacturer immediately after any water sheen which may develop after finishing has disappeared from the concrete surface. Provide and maintain compound on the concrete surface throughout the curing period. Do not use this method of curing where the use of Figure 2.1.5 in ACI/MCP-2 indicates that hot weather conditions cause an evaporation rate exceeding 0.2 pound of water per square foot per hour.

#### 3.11.3.1 Application

Unless the manufacturer recommends otherwise, apply compound immediately after the surface loses its water sheen and has a dull appearance, and before joints are sawed. Mechanically agitate curing compound thoroughly during use. Use approved power-spraying equipment to uniformly apply two coats of compound in a continuous operation. The total coverage for the two coats must be 200 square feet maximum per gallon of undiluted compound unless otherwise recommended by the manufacturer's written instructions. The compound must form a uniform, continuous, coherent film that does not check, crack, or peel. Immediately apply an additional coat of compound to areas where the film is defective. Re-spray concrete surfaces subjected to rainfall within 3 hours after the curing compound application.

### 3.11.3.2 Protection of Treated Surfaces

Prohibit pedestrian and vehicular traffic and other sources of abrasion at least 72 hours after compound application. Maintain continuity of the coating for the entire curing period and immediately repair any damage.

### 3.11.4 Liquid Chemical Sealer-Hardener

Apply sealer-hardener to interior floors not receiving floor covering and floors located under access flooring. Apply the sealer-hardener in accordance with manufacturer's recommendations. Seal or cover joints and openings in which joint sealant is to be applied as required by the joint sealant manufacturer. Do not apply the sealer hardener until the concrete has been moist cured and has aged for a minimum of 30 days. Apply a minimum of two coats of sealer-hardener.

### 3.11.5 Requirements for Type III, High-Early-Strength Portland Cement

The curing periods are required to be not less than one-fourth of those specified for portland cement, but in no case less than 72 hours.

### 3.11.6 Curing Periods

ACI/MCP-2 except 10 days for retaining walls, pavement or chimneys, 21 days for concrete that is in full-time or intermittent contact with seawater, salt spray, alkali soil or waters. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing are subject to approval by the Contracting Officer.

### 3.11.7 Curing Methods

Accomplish curing by moist curing, by moisture-retaining cover curing, by membrane curing, and by combinations thereof, as specified.

#### Moist curing:

Accomplish moisture curing by any of the following methods:

Keeping surface of concrete wet by covering with water

Continuous water spraying

Covering concrete surface with specified absorptive cover for curing concrete saturated with water and keeping absorptive cover wet by water spraying or intermittent hosing. Place absorptive cover to provide coverage of concrete surfaces and edges with a slight overlap over adjacent absorptive covers.

#### Moisture-cover curing:

Accomplish moisture-retaining cover curing by covering concrete surfaces with specified moisture-retaining cover for curing concrete. Place cover directly on concrete in widest practical width, with sides and ends lapped at least 3 inches. Weight cover to prevent displacement; immediately repair tears or holes appearing during curing

period by patching with pressure-sensitive, waterproof tape or other approved method.

#### Membrane curing:

Accomplish membrane curing by applying specified membrane-forming curing compound to damp concrete surfaces as soon as moisture film has disappeared. Apply curing compound uniformly in a two-coat operation by power-spraying equipment using a spray nozzle equipped with a wind guard. Apply second coat in a direction at right angles to direction of first coat. Total coverage for two coats must be not more than 200 square feet per gallon of curing compound. Respray concrete surfaces which are subjected to heavy rainfall within 3 hours after curing compound has been applied by method and at rate specified. Maintain continuity of coating for entire curing period and immediately repair damage to coating during this period.

Membrane-curing compounds must not be used on surfaces that are to be covered with coating material applied directly to concrete or with a covering material bonded to concrete, such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, painting, and other coatings and finish materials.

#### 3.11.8 Curing Formed Surfaces

Accomplish curing of formed surfaces, including undersurfaces of girders, beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed before end of curing period, accomplish final curing of formed surfaces by any of the curing methods specified above, as applicable.

#### 3.11.9 Curing Unformed Surfaces

Accomplish initial curing of unformed surfaces, such as monolithic slabs, floor topping, and other flat surfaces, by membrane curing.

Unless otherwise specified, accomplish final curing of unformed surfaces by any of curing methods specified above, as applicable.

Accomplish final curing of concrete surfaces to receive liquid floor hardener or finish flooring by moisture-retaining cover curing.

#### 3.11.10 Temperature of Concrete During Curing

When temperature of atmosphere is 41 degrees F and below, maintain temperature of concrete at not less than 55 degrees F throughout concrete curing period or 45 degrees F when the curing period is measured by maturity. When necessary, make arrangements before start of concrete placing for heating, covering, insulation, or housing as required to maintain specified temperature and moisture conditions for concrete during curing period.

When the temperature of atmosphere is 80 degrees F and above or during other climatic conditions which cause too rapid drying of concrete, make arrangements before start of concrete placing for installation of wind breaks, of shading, and for fog spraying, wet sprinkling, or moisture-retaining covering of light color as required to protect concrete during curing period.

Changes in temperature of concrete must be uniform and not exceed 37 degrees F in any 1 hour nor 80 degrees F in any 24-hour period.

#### 3.11.11 Protection from Mechanical Injury

During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration and from damage caused by rain or running water.

#### 3.11.12 Protection After Curing

Protect finished concrete surfaces from damage by construction operations.

### 3.12 FIELD QUALITY CONTROL

#### 3.12.1 Sampling

ASTM C 172. Collect samples of fresh concrete to perform tests specified. ASTM C 31/C 31M for making test specimens.

#### 3.12.2 Testing

##### 3.12.2.1 Slump Tests

ASTM C 143/C 143M. Take concrete samples during concrete placement. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cement ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 20 cubic yards (maximum) of concrete.

##### 3.12.2.2 Temperature Tests

Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 20 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

##### 3.12.2.3 Compressive Strength Tests

ASTM C 39/C 39M. Make five test cylinders for each set of tests in accordance with ASTM C 31/C 31M. Take precautions to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and hold one cylinder in reserve. Take samples for strength tests of each mix design of and for concrete placed each day not less than once a day, nor less than once for each 160 cubic yards of concrete, nor less than once for each 5400 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result must be the average of two cylinders from the same concrete sample tested at 28 days. If the average of any three consecutive strength test results is less than  $f'_c$  or if any strength test result falls below  $f'_c$  by more than 450 psi, take a minimum of three ASTM C 42/C 42M core samples from the in-place work represented by the low test cylinder results and test. Concrete represented by core test is considered structurally adequate if the average of three cores is equal to at least 85 percent of  $f'_c$  and if no single core is less than 75 percent of  $f'_c$ . Retest locations represented by erratic core strengths. Remove

concrete not meeting strength criteria and provide new acceptable concrete. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

#### 3.12.2.4 Air Content

ASTM C 173/C 173M or ASTM C 231 for normal weight concrete. Test air-entrained concrete for air content at the same frequency as specified for slump tests.

#### 3.12.2.5 Ion Concentration

ACI/MCP-3. Determine water soluble ion concentration. Perform test once for each mix design.

#### 3.12.2.6 Strength of Concrete Structure

Compliance with the following is considered deficient if it fails to meet the requirements which control strength of structure in place, including following conditions:

Failure to meet compressive strength tests as evaluated

Reinforcement not conforming to requirements specified

Concrete which differs from required dimensions or location in such a manner as to reduce strength

Concrete curing and protection of concrete against extremes of temperature during curing, not conforming to requirements specified

Concrete subjected to damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration

Poor workmanship likely to result in deficient strength

#### 3.12.2.7 Testing Concrete Structure for Strength

When there is evidence that strength of concrete structure in place does not meet specification requirements, make cores drilled from hardened concrete for compressive strength determination in accordance with ASTM C 42/C 42M, and as follows:

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

Test cores after moisture conditioning in accordance with ASTM C 42/C 42M if concrete they represent is more than superficially wet under service.

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

Strength of cores from each member or area are considered satisfactory if their average is equal to or greater than 85 percent of the 28-day design compressive strength of the class of concrete.



Core specimens will be taken and tested by the Government. If the results of core-boring tests indicate that the concrete as placed does not conform to the drawings and specification, the cost of such tests and restoration required must be borne by the Contractor.

Fill core holes solid with patching mortar and finished to match adjacent concrete surfaces.

Correct concrete work that is found inadequate by core tests in a manner approved by the Contracting Officer.

### 3.13 JOINTS

#### 3.13.1 Construction Joints

Make and locate joints not indicated so as not to impair strength and appearance of the structure, as approved. Locate construction joints as follows:

- a. In walls at not more than 60 feet in any horizontal direction; at top of footing; at top of slabs on ground; at top and bottom of door and window openings or where required to conform to architectural details; and at underside of deepest beam or girder framing into wall
- b. In columns or piers, at top of footing; at top of slabs on ground; and at underside of deepest beam or girder framing into column or pier
- c. Near midpoint of spans for supported slabs, beams, and girders unless a beam intersects a girder at the center, in which case construction joints in girder must offset a distance equal to twice the width of the beam. Make transfer of shear through construction joint by use of inclined reinforcement.
- d. In slabs on ground, so as to divide slab into areas not in excess of 1,200 square feet

Provide keyways at least 1-1/2-inches deep in construction joints in walls and slabs and between walls and footings; approved bulkheads may be used for slabs.

Joints must be perpendicular to main reinforcement. Reinforcement must be continued across construction joints.

#### 3.13.2 Isolation Joints in Slabs on Ground

Provide joints at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

Fill joints with premolded joint filler strips 1/2 inch thick, extending full slab depth. Install filler strips at proper level below finish floor elevation with a slightly tapered, dress-and-oiled wood strip temporarily secured to top of filler strip to form a groove not less than 3/4 inch in depth where joint is sealed with sealing compound and not less than 1/4 inch in depth where joint sealing is not required. Remove wood strip after concrete has set. Contractor must clean groove of foreign matter and loose particles after surface has dried.

### 3.13.3 Control Joints in Slabs on Ground

Provide joints to form panels as indicated.

Under and on exact line of each control joint, cut 50 percent of welded wire fabric reinforcement before placing concrete.

Joints must be 1/8-inch wide by 1/5 to 1/4 of slab depth and formed by inserting hand-pressed fiberboard strip into fresh concrete until top surface of strip is flush with slab surface or by cutting the concrete with a saw after the concrete has set. After concrete has cured for at least 7 days, the Contractor must remove inserts and clean groove of foreign matter and loose particles.

In Hawaii, sawcutting will be limited to within 12 hours after set and at 1/4 slab depth.

### 3.13.4 Sealing Joints in Slabs on Ground

Isolation and control joints which are to receive finish flooring material must be sealed with joint sealing compound after concrete curing period. Slightly underfill groove with joint sealing compound to prevent extrusion of compound. Remove excess material as soon after sealing as possible.

Sealing is not required for isolation and control joints to be covered with finish flooring material. Groove must be left ready to receive filling material that is provided as part of finish floor covering work.

## 3.14 INSTALLATION OF ANCHORAGE DEVICES

### 3.14.1 General

Anchorage devices and embedded items required for other work that is attached to, or supported by, set and build in cast-in-place concrete as part of the work of this section, using setting drawings, instructions, and directions for work to be attached thereto.

### 3.14.2 Placing Anchorage Devices

Anchorage devices and embedded items must be positioned accurately and supported against displacement. Fill openings in anchorage devices such as slots and threaded holes with an approved, removable material to prevent entry of concrete into openings.

## 3.15 CONCRETE CONVEYING

### 3.15.1 Transfer of Concrete At Project Site

Handle concrete from point of delivery and transfer to concrete conveying equipment and to locations of final deposit as rapidly as practical by methods which prevent segregation and loss of concrete mix materials.

### 3.15.2 Mechanical Equipment for Conveying Concrete

Equipment must ensure a continuous flow of concrete at delivery end, as approved. Provide runways for wheeled concrete-conveying equipment from concrete delivery point to locations of final deposit. Interior surfaces of concrete conveying equipment must be free of hardened concrete, debris, water, snow, ice, and other deleterious substances.

-- End of Section --

## SECTION 03 30 53

MISCELLANEOUS CAST-IN-PLACE CONCRETE FOR CIVIL WORK  
04/08

## PART 1 GENERAL

## 1.1 SUMMARY

Perform all work in accordance with ACI MCP SET Parts 2 and 3.

## 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.

## ACI INTERNATIONAL (ACI)

ACI MCP SET (2012) Manual of Concrete Practice

## ASTM INTERNATIONAL (ASTM)

ASTM A185/A185M (2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

ASTM A615/A615M (2009b) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM C1064/C1064M (2011) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

ASTM C143/C143M (2010a) Standard Test Method for Slump of Hydraulic-Cement Concrete

ASTM C150/C150M (2015) Standard Specification for Portland Cement

ASTM C171 (2007) Standard Specification for Sheet Materials for Curing Concrete

ASTM C172/C172M (2010) Standard Practice for Sampling Freshly Mixed Concrete

ASTM C173/C173M (2010b) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

ASTM C231/C231M (2010) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C260/C260M (2010a) Standard Specification for Air-Entraining Admixtures for Concrete

|                 |  |
|-----------------|--|
| ASTM C309       | (2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete                  |
| ASTM C31/C31M   | (2010) Standard Practice for Making and Curing Concrete Test Specimens in the Field                      |
| ASTM C33/C33M   | (2013) Standard Specification for Concrete Aggregates  |
| ASTM C39/C39M   | (2011) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens                   |
| ASTM C494/C494M | (2011) Standard Specification for Chemical Admixtures for Concrete                                       |
| ASTM C618       | (2008a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete |
| ASTM C685/C685M | (2011) Concrete Made by Volumetric Batching and Continuous Mixing  |
| ASTM C920       | (2011) Standard Specification for Elastomeric Joint Sealants   |
| ASTM C94/C94M   | (2015) Standard Specification for Ready-Mixed Concrete   |
| ASTM C989/C989M | (2011) Standard Specification for Slag Cement for Use in Concrete and Mortars                            |
| ASTM D1752      | (2004a; R 2008) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion       |
| ASTM D75/D75M   | (2009) Standard Practice for Sampling Aggregates   |
| ASTM E96/E96M   | (2014) Standard Test Methods for Water Vapor Transmission of Materials                                   |

U.S. ARMY CORPS OF ENGINEERS (USACE)

|               |  |
|---------------|--|
| COE CRD-C 400 | (1963) Requirements for Water for Use in Mixing or Curing Concrete |
|---------------|--|

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

|            |   |
|------------|---|
| 40 CFR 247 | Comprehensive Procurement Guideline for Products Containing Recovered Materials |
|------------|---|

### 1.3 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 three specimens from each sample; two to be tested at 28 days (90 days if pozzolan is used) for acceptance, and one will be tested at 7 days for information.

#### 1.3.1 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,  $f'_c$ , and no individual acceptance test result falls below  $f'_c$  by more than 500 psi.

#### 1.3.2 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 Part 4 of ACI MCP SET.

#### 1.3.3 Concrete Mixture Proportions

Concrete mixture proportions are the responsibility of the Contractor. Mixture proportions shall 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 cubic 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. Specified compressive strength  $f'_c$  shall be 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 MCP SET Part 3. The air content shall be between 4.5 and 7.5 percent with a slump between 2 and 5 inches. The maximum water cement 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.

#### 1.4 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  
Joint Sealants - Field Molded Sealants  
Batching and Mixing Equipment  
Conveying and Placing Concrete  
Formwork  
Forms  
Ready-Mix Concrete  
Mix Design Data  
Air-Entraining Admixtures  
Fly Ash  
Accessories  
Curing Compound

#### SD-06 Test Reports

Aggregates  
Concrete Mixture Proportions  
Compressive Strength Testing  
Slump

#### SD-07 Certificates

Cementitious Materials  
CPG for recycled materials or appropriate Waiver Form  
Aggregates

## PART 2 PRODUCTS

### 2.1 MATERIALS

Submit manufacturer's literature from suppliers which demonstrates compliance with applicable specifications for the specified materials.

#### 2.1.1 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:

##### 2.1.1.1 Portland Cement

ASTM C150/C150M, Type I, except that the tricalcium aluminate of the Type III or IIIA cement shall be limited to 5 percent.

##### 2.1.1.2 Pozzolan

Provide pozzolan that conforms to ASTM C618, Class C or F, including requirements of Tables 1A and 2A.

#### 2.1.2 Aggregates

Fine and coarse aggregates shall meet the quality and grading requirements of ASTM C33/C33M Class Designations 4M or better. 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.

### 2.1.3 Admixtures

Admixtures to be used, when required or approved, shall comply 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.

#### 2.1.3.1 Air-Entraining Admixture

Provide air-entraining admixture that meets the requirements of ASTM C260/C260M.

#### 2.1.3.2 Water-Reducing or Retarding Admixture

Provide water-reducing or retarding admixture meeting the requirements of ASTM C494/C494M, Type A, B, or D.

### 2.1.4 Water

Use fresh, clean, potable water for mixing and curing, free from injurious amounts of oil, acid, salt, or alkali, except that unpotable water may be used if it meets the requirements of COE CRD-C 400.

### 2.1.5 Reinforcing Steel

Provide reinforcing bars conforming to the requirements of ASTM A615/A615M, Grade 60. Welded steel wire fabric shall conform to the requirements of ASTM A185/A185M. Details of reinforcement not shown shall be in accordance with ACI MCP SET Part 3, Chapters 7 and 12.

### 2.1.6 Expansion Joint Filler Strips, Premolded

Expansion joint filler strips, premolded shall be sponge rubber conforming to ASTM D1752, Type I.

### 2.1.7 Joint Sealants - Field Molded Sealants

Joint sealants - field molded sealants shall conform to ASTM C920, Type M, Grade NS, Class 25, use NT for vertical joints and Type M, Grade P, Class 25, use T for horizontal joints. Provide polyethylene tape, coated paper, metal foil, or similar type bond breaker materials. The backup material needs to be compressible, nonshrink, nonreactive with the sealant, and a nonabsorptive material such as extruded butyl or polychloroprene foam rubber. Immediately prior to installation of field-molded sealants, clean the joint of all debris and further cleaned using water, chemical solvents, or other means as recommended by the sealant manufacturer or directed.

### 2.1.8 Formwork

The design and engineering of the formwork as well as its construction, will be the responsibility of the Contractor. Submit formwork design prior to the first concrete placement.



### 2.1.9 Form Coatings

Coat forms, for exposed surfaces, with a nonstaining form oil to be applied shortly before concrete is placed.

### 2.1.10 Vapor Barrier

Provide polyethylene vapor barrier sheeting with a minimum thickness of 6 mils or other equivalent material having a vapor permeance rating not exceeding 0.5 perms as determined in accordance with ASTM E96/E96M.

### 2.1.11 Curing Materials

Provide curing materials conforming to the following requirements.

#### 2.1.11.1 Impervious Sheet Materials

Impervious sheet materials, ASTM C171, type optional, except polyethylene film, if used, shall be white opaque.

#### 2.1.11.2 Membrane-Forming Curing Compound

ASTM C309, Type 1-D or 2, Class A.

## 2.2 READY-MIX CONCRETE

- a. Concrete shall be ready-mix concrete with mix design data conforming to ACI MCP SET Part 2. Bill of Lading for each ready-mix concrete delivery shall be in accordance with ASTM C94/C94M.
- b. Non-exposed concrete elements: 3000 psi minimum compressive strength.
- c. Direct-exposed concrete elements (including air-conditioned rooms): 5000 psi minimum compressive strength as determined in 28 calendar days.
- d. Slump: 1 to 4 inch according to ASTM C143/C143M and ACI MCP SET Part 1.
- e. Portland Cement conforming to ASTM C150/C150M, Type I.
- f. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.
- g. Air-Entraining Admixtures conforming to ASTM C260/C260M. Exterior concrete exposed to freezing needs to be air-entrained 5 to 6 percent by volume.
- h. Water-reducing admixtures, retarding admixtures, accelerating admixtures, water-reducing and accelerating admixtures, and water-reducing and retarding admixtures shall conform to ASTM C494/C494M.
- i. Fly Ash used as an supplementary cementitious material shall conform to ASTM C618, Class C with 4 percent maximum loss on ignition and 35 percent maximum cement replacement by weight.
- j. Ground granulated blast furnace slag used as an supplementary cementitious material shall conform to ASTM C989/C989M, Grade 120 with

between 25 to 50 percent maximum cement replacement by weight.

## 2.3 STEEL REINFORCEMENT

### 2.3.1 Deformed Steel Bars

Provide steel bars conforming to ASTM A615/A615M, Grade 60 ksi ACI MCP SET Parts 2 and 3.

### 2.3.2 Welded Wire Fabric

Provide welded wire fabric conforming to ASTM A185/A185M.

## 2.4 FORMS

Forms shall be of wood, steel, or other approved material and conform to ACI MCP SET, Parts 2 and 3.

Provide form release conforming to ACI MCP SET, Part 4.

## 2.5 ACCESSORIES

### 2.5.1 Curing Compound

Provide curing compound conforming to ASTM C309.

## PART 3 EXECUTION

### 3.1 PREPARATION

Prepare construction joints to expose coarse aggregate. The surface shall 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. Earth foundations shall be satisfactorily compacted. Ensure spare vibrators are available. The entire preparation shall be accepted by the Government prior to placing.

#### 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. Embedded items shall 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. All equipment needed to place, consolidate, protect, and cure the concrete shall be at the placement site and in good operating condition.

#### 3.1.2 Formwork Installation

Forms shall 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

Concrete made by volumetric batching and continuous mixing shall conform to ASTM C685/C685M.

### 3.2 CONVEYING AND PLACING CONCRETE

Concrete placement is not permitted when weather conditions prevent proper placement and consolidation without approval. When concrete is mixed and/or transported by a truck mixer, deliver the concrete to the site of the work completing the discharge within 1-1/2 hours or 45 minutes when the placing temperature is 86 degrees F or greater unless a retarding admixture is used. Convey concrete from the mixer to the forms as rapidly as practicable by methods which prevent segregation or loss of ingredients. Concrete shall be in place and consolidated within 15 minutes after discharge from the mixer. Deposit concrete as close as possible to its final position in the forms and regulate it so that it may be effectively consolidated in horizontal layers 18 inches or less in thickness with a minimum of lateral movement. Carry on the placement at such a rate that the formation of cold joints will be prevented. Submit Methods and equipment for transporting, handling, depositing, and consolidating the concrete prior to the first concrete placement. Perform conveying and placing concrete in conformance with the following:

#### 3.2.1 Consolidation

Consolidate each layer of concrete by rodding, spading, or internal vibrating equipment. Systematically accomplish internal vibration by inserting the vibrator through the fresh concrete in the layer below at a uniform spacing over the entire area of placement. The distance between insertions shall be approximately 1.5 times the radius of action of the vibrator and overlay the adjacent, just-vibrated area by approximately 4 inches. Ensure that the vibrator penetrates rapidly to the bottom of the layer and at least 6 inches into the layer below, if such a layer exists. Hold vibrator stationary until the concrete is consolidated and then withdraw it slowly at the rate of about 3 inches per second.

#### 3.2.2 Cold-Weather Requirements

No concrete is to be mixed or placed when the ambient temperature is below 36 degrees F or if the ambient temperature is below 41 degrees F and falling. Provide suitable covering and other means as approved for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing and at a temperature above freezing for the remainder of the curing period. Do not mix salt, chemicals, or other foreign materials with the concrete to prevent freezing. Remove and replace concrete damaged by freezing at the expense of the Contractor.

#### 3.2.3 Hot-Weather Requirements

When the rate of evaporation of surface moisture, as determined by use of Figure 1 of ACI MCP SET Part 2, is expected to exceed 0.2 psf per hour,

provisions for windbreaks, shading, fog spraying, or covering with a light-colored material shall be made in advance of placement, and such protective measures taken as quickly as finishing operations will allow.

### 3.3 FORM REMOVAL

Do not remove forms before 24 hours after concrete placement, except as otherwise specifically authorized. Do not remove supporting forms and shoring until the concrete has cured for at least 5 days. When conditions require longer curing periods, forms shall remain in place.

### 3.4 FINISHING

#### 3.4.1 Temperature Requirement

Do not finish or repair concrete when either the concrete or the ambient temperature is below 50 degrees F.

#### 3.4.2 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. 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 shall be reamed or chipped and filled 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. The cement used in mortar or concrete for repairs to all surfaces permanently exposed to view shall be a blend of portland cement and white cement so that the final color when cured is the same as adjacent concrete.

#### 3.4.3 Finishing Unformed Surfaces

Float finish all unformed surfaces, that are not to be covered by additional concrete or backfill, to elevations shown, unless otherwise specified. Surfaces to receive additional concrete or backfill shall be brought to the elevations shown and left as a true and regular surface. Slope exterior surfaces for drainage unless otherwise shown. Carefully make joints with a jointing tool. Finish unformed surfaces to a tolerance of 3/8 inch for a float finish as determined by a 10 foot straightedge placed on surfaces shown on the drawings to be level or having a constant slope. Do not perform finishing while there is excess moisture or bleeding water on the surface. No water or cement is to be added to the surface during finishing.

##### 3.4.3.1 Float Finish

Provide float finished surfaces, screeded and darbied or bullfloated to eliminate the ridges and to fill in the voids left by the screed. In addition, the darby or bullfloat shall fill all surface voids and only slightly embed the coarse aggregate below the surface of the fresh concrete. When the water sheen disappears and the concrete supports a person's weight without deep imprint, complete floating. Floating shall embed large aggregates just beneath the surface, remove slight imperfections, humps, and voids to produce a plane surface, compact the concrete, and consolidate mortar at the surface.

#### 3.4.3.2 Broom Finish

Apply a broom finish to all slabs. Screed and float the concrete to required finish plane with no coarse aggregate visible. After surface moisture disappears, broom or brush the surface with a broom or fiber bristle brush in a direction transverse to that of the main traffic or as directed.

#### 3.4.3.3 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(es) deep with a jointing tool after the surface has been finished.

### 3.5 CURING AND PROTECTION

Beginning immediately after placement, and continuing for at least 7 days, cure and protect all concrete from premature drying, extremes in temperature, rapid temperature change, freezing, mechanical damage, and exposure to rain or flowing water. Provide all materials and equipment needed for adequate curing and protection at the site of the placement prior to the start of concrete placement. Accomplish moisture preservation of moisture for concrete surfaces not in contact with forms by one of the following methods:

- a. Continuous sprinkling or ponding.
- b. Application of absorptive mats or fabrics kept continuously wet.
- c. Application of sand kept continuously wet.
- d. Application of impervious sheet material conforming to ASTM C171.
- e. Application of membrane-forming curing compound conforming to ASTM C309, Type 1-D, on surfaces permanently exposed to view. Accomplish Type 2 on other surfaces in accordance with manufacturer's instructions.

Accomplish the preservation of moisture for concrete surfaces placed against wooden forms by keeping the forms continuously wet for 7 days. If forms are removed prior to end of the required curing period, use other curing methods for the balance of the curing period. Do not perform protection removal if the temperature of the air in contact with the concrete may drop more than 60 degrees F within a 24 hour period.

### 3.6 TESTS AND INSPECTIONS

#### 3.6.1 Field Testing Technicians

The individuals who sample and test concrete, as required in this specification, shall 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.

### 3.6.2 Inspection Details and Frequency of Testing

#### 3.6.2.1 Preparations for Placing

Inspect foundation or construction joints, forms, and embedded items in sufficient time prior to each concrete placement by the Contractor to certify that it is ready to receive concrete.

#### 3.6.2.2 Air Content

Check air content at least once during each shift that concrete is placed. Obtain samples in accordance with ASTM C172/C172M and tested in accordance with ASTM C231/C231M.

#### 3.6.2.3 Slump

Check slump once during each shift that concrete is produced. Obtain samples in accordance with ASTM C172/C172M and tested in accordance with ASTM C143/C143M.

#### 3.6.2.4 Consolidation and Protection

Ensure that the concrete is properly consolidated, finished, protected, and cured.

### 3.6.3 Action Required

#### 3.6.3.1 Placing

Do not permit placing to begin until the availability of an adequate number of acceptable vibrators, which are in working order and have competent operators, has been verified. Do not continue placing if any pile is inadequately consolidated.

#### 3.6.3.2 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.

#### 3.6.3.3 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. The adjustments are to be made so that the water-cement ratio does not exceed that specified in the submitted concrete mixture proportion.

### 3.6.4 Reports

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 3 days after the end of each weekly reporting period. See Section 01 45 00.00 10 QUALITY CONTROL.

## 3.7 FORM WORK

Form work shall conform to ACI MCP SET Parts 2 through 5.

### 3.7.1 Preparation of Form Surfaces

Forms shall be true to line and grade, mortar-tight, and sufficiently rigid to prevent objectionable deformation under load. Form surfaces for permanently exposed faces shall be smooth, free from irregularities, dents, sags, or holes. Chamfer exposed joints and exposed edges. Arrange internal ties so that when the forms are removed, the form ties are not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structure.

### 3.7.2 Form Coating

Coat forms, for exposed surfaces, with a nonstaining form release coating applied shortly before concrete is placed. Forms for unexposed surfaces may be wetted in lieu of coating immediately before the placing of concrete, except that in freezing weather form release coating shall be used.

### 3.7.3 Removal of Forms

Remove forms carefully to prevent damage to the concrete. Do not remove forms before the expiration of the minimum time indicated below:

|   |           |
|---|-----------|
| Arches, beams and deck-type slabs           | 144 hours |
| Columns and walls (lifts 15 feet and under) | 24 hours  |
| Columns and walls (lifts over 15 feet)      | 48 hours  |

## 3.8 STEEL REINFORCING

Reinforcement shall 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.

### 3.8.1 Fabrication

Shop fabricate steel reinforcement in accordance with ACI MCP SET Parts 2 and 3. Shop details and bending shall be in accordance with ACI MCP SET Parts 2 and 3.

### 3.8.2 Splicing

Perform splices in accordance with ACI MCP SET Parts 2 and 3.

### 3.8.3 Supports

Secure reinforcement in place by the use of metal or concrete supports, spacers, or ties.

## 3.9 EMBEDDED ITEMS

Before placing concrete, take care to determine that all embedded items are firmly and securely fastened in place. Provide embedded items free of oil and other foreign matter, such as loose coatings of rust, paint and scale. Embedding of wood in concrete is permitted only when specifically authorized or directed.

3.10 FIELD TESTING

- a. Provide samples and test concrete for quality control during placement. Sampling of fresh concrete for testing shall be in accordance with ASTM C172/C172M.
- b. Test concrete for compressive strength at 7 and 28 days for each design mix. Concrete test specimens shall conform 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.
- 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.
- e. Determine temperature of concrete at time of placement in accordance with ASTM C1064/C1064M.

-- End of Section --



## SECTION 03 45 33

## PRECAST STRUCTURAL CONCRETE

04/08

## PART 1 GENERAL

## 1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO HB-17 (2002; Errata 2003; Errata 2005, 17th Edition) Standard Specifications for Highway Bridges

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 304R (2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete

ACI 305R (2010) Specification for Hot Weather Concreting

ACI 306.1 (1990; R 2002) Standard Specification for Cold Weather Concreting

ACI 309R (2005) Guide for Consolidation of Concrete

ACI 318 (2011) Building Code Requirements for Structural Concrete and Commentary

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995; R 2004) Basic Hardboard

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2010) Structural Welding Code - Steel

AWS D1.4/D1.4M (2011) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A185/A185M (2007) Standard Specification for Steel

|                   |  |
|-------------------|--|
|                   | Welded Wire Reinforcement, Plain, for Concrete   |
| ASTM A27/A27M     | (2010) Standard Specification for Steel Castings, Carbon, for General Application                              |
| ASTM A307         | (2014) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength                    |
| ASTM A325         | (2010) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength  |
| ASTM A36/A36M     | (2008) Standard Specification for Carbon Structural Steel  |
| ASTM A47/A47M     | (1999; R 2014) Standard Specification for Ferritic Malleable Iron Castings                                     |
| ASTM A496/A496M   | (2007) Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement                             |
| ASTM A497/A497M   | (2007) Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete                      |
| ASTM A563         | (2015) Standard Specification for Carbon and Alloy Steel Nuts  |
| ASTM A615/A615M   | (2009b) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement             |
| ASTM A706/A706M   | (2009b) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement          |
| ASTM A780/A780M   | (2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings               |
| ASTM A82/A82M     | (2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement                                |
| ASTM A996/A996M   | (2009b) Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement          |
| ASTM C1107/C1107M | (2011) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)                             |
| ASTM C1202        | (2010) Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration |
| ASTM C1218/C1218M | (1999; R 2008) Standard Specification for Water-Soluble Chloride in Mortar and Concrete                        |

|                 |  |
|-----------------|--|
| ASTM C1260      | (2007) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)            |
| ASTM C150/C150M | (2015) Standard Specification for Portland Cement  |
| ASTM C260/C260M | (2010a) Standard Specification for Air-Entraining Admixtures for Concrete                                |
| ASTM C33/C33M   | (2013) Standard Specification for Concrete Aggregates  |
| ASTM C494/C494M | (2011) Standard Specification for Chemical Admixtures for Concrete                                       |
| ASTM C618       | (2008a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete |
| ASTM C94/C94M   | (2015) Standard Specification for Ready-Mixed Concrete   |
| ASTM C989       | (2010) Standard Specification for Slag Cement for Use in Concrete and Mortars                            |
| ASTM F 436      | (2011) Hardened Steel Washers  |
| ASTM F 844      | (2007a) Washers, Steel, Plain (Flat), Unhardened for General Use   |

#### PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)

|             |  |
|-------------|--|
| PCI MNL-116 | (1999) Manual for Quality Control for Plants and Production of Structural Precast Concrete Products, 4th Edition |
| PCI MNL-120 | (2010) PCI Design Handbook - Precast and Prestressed Concrete, 6th Edition                                       |

## 1.2 SYSTEM DESCRIPTION

The work includes the provision of precast non-prestressed concrete herein referred to as precast members . Precast members shall be the product of a manufacturer specializing in the production of precast concrete members.

### 1.2.1 Design Requirements

Design precast members in accordance with ACI 318 and the PCI MNL-120. Design precast members (including connections) for the design load conditions and spans indicated, and handling and erection stresses, and for additional loads imposed by openings and supports of the work of other trades. Design precast members for handling without cracking in accordance with the PCI MNL-120. Concrete toppings shall not be used in establishing the design strength of the precast members.

## 1.2.1.1 Loads

Loadings for members and connections shall include all dead load, live load, applicable lateral loads such as wind and earthquake, applicable construction loads such as handling, erection loads, and other applicable loads.

## 1.2.1.2 Drawing and Design Calculation Information

Submit drawings and design calculations indicating complete information for the fabrication, handling, and erection of the precast member. Drawings shall not be reproductions of contract drawings. Design calculations, drawings of precast members (including connections) shall be made by a registered professional engineer experienced in the design of precast concrete members and register in the state where the project is located, and submitted for approval prior to fabrication. The drawings shall indicate, as a minimum, the following information:

## a. Plans, elevations and other drawing views showing the following:

- (1) Member piece marks locating and defining products furnished by the manufacturer.
- (2) Headers for openings.
- (3) Location and size of openings .
- (4) Relationships to adjacent material.
- (5) Joints and openings between members and between members and other construction.
- (6) Location of field installed anchors.
- (7) Erection sequences and handling requirements
- (9) Lifting and erection inserts

## b. Elevations, sections and other details for each member showing the following:

- (1) Connections between members and connections between members and other construction.
- (2) Connections for work of other trades and cast-in items and their relation to other trades.
- (3) Dimensioned size and shape for each member with quantities, position and other details of reinforcing steel, anchors, inserts and other embedded items.
- (4) Lifting, erection and other handling devices and inserts.
- (5) Surface finishes of each member.
- (6) Estimated cambers

## d. Strength properties for concrete, steel and other materials.

- e. Methods for storage and transportation.
- f. Description of loose, cast-in and field hardware.
- g. All dead, live, handling, erection and other applicable loads used in the design.

### 1.3 MODIFICATION TO REFERENCE

In the ACI publications, the advisory provisions shall be considered to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears; reference to the "Building Official," the "Structural Engineer" and the "Architect/Engineer" shall be interpreted to mean the Contracting Officer.

### 1.4 SUBMITTALS

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

#### SD-02 Shop Drawings

Drawings of precast members;

#### SD-03 Product Data

Anchorage and lifting inserts and devices

Bearing pads

#### SD-04 Samples

Surface finish

Submit two 12 by 12 by 2 inch thick sample panels representative of the color and finish for each type of precast member requiring a finish Grade A surface finish.

#### SD-05 Design Data

Precast concrete members design calculations;

Concrete mix design;

#### SD-06 Test Reports

Contractor-furnished mix design;

Submit copies of laboratory test reports showing that the mix has been successfully tested to produce concrete with the properties specified and that mix will be suitable for the job conditions. The laboratory test reports shall include mill test and all other test for cement, silica fume, aggregates, and admixtures. Provide maximum nominal aggregate size, gradation analysis, percentage retained and passing sieve, and a graph of percentage retained versus sieve size. Test reports shall be submitted along with the concrete mix design. Obtain approval before concrete placement.

Cement

Pozzolan

Air-Entraining Admixture

Aggregates

Submit test results for aggregates in accordance with ASTM C1260 for potential alkali-silica reactions.

#### SD-07 Certificates

Quality control procedures

Submit quality control procedures established in accordance with PCI MNL-116 by the precast manufacturer.

Construction Records;

Construction records of the manufacturing, handling, and erection of the precast prestressed concrete members shall be submitted.

#### SD-11 Closeout Submittals

Concrete batch ticket information

### 1.5 QUALITY ASSURANCE

#### 1.5.1 Qualifications

##### 1.5.1.1 Manufacturer Qualifications

PCI MNL-116. Plants shall be certified by the PCI Plant Certification Program for Category C1 work. At the Contracting Officer's option, PCI Plant quality control program records shall be available for review.

PCI MNL-116. Where panels are manufactured by specialists in plants not currently enrolled in the PCI "Quality Control Program," provide a product quality control system in accordance with PCI MNL-116 and perform concrete and aggregate quality control testing using an approved, independent commercial testing laboratory. Submit test results to the Contracting Officer.

##### 1.5.1.2 Designer Qualifications

The designer shall be a registered professional engineer in the state where the project is located experienced in the design of precast concrete.

##### 1.5.1.3 Erector Qualifications

The erector shall be regularly engaged for at least three years in the erection of precast structural concrete similar to the requirements of this project.

#### 1.5.1.4 Welding Qualifications

Provide AWS D1.1/D1.1M qualified welders who are currently certified at contract award date and have maintained their certificates over the past year.

#### 1.5.2 Regulatory Requirements

Provide precast members in conformance with ACI 318 and AWS D1.4/D1.4M.

#### 1.5.3 Concrete Mix Design

Thirty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, fly ash, pozzolans, silica fume, ground slag, and admixtures, and applicable reference specification. Provide mix proportion data using at least three different water-cement ratios for each class and type of concrete required. If source material changes, resubmit mix proportion data using revised source material. No material shall be provided unless proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Contracting Officer. The submittal shall clearly indicate where each mix design will be used when more than one mix design is submitted. Submit additional data regarding concrete aggregates if the source of aggregates changes.

#### 1.5.4 Certificates: Record Requirement

ASTM C94/C94M. Submit mandatory batch ticket information for each load of ready-mixed concrete.

### 1.6 DELIVERY, STORAGE, AND HANDLING

#### 1.6.1 Transportation

##### 1.6.1.1 Transporting Members

In transporting members by truck, railroad car, or barge, provision shall be made for supporting the members as described above, except battens can be continuous over more than one stack of units, with adequate bracing to ensure their maintaining the vertical position and damping of dangerous vibrations. Trucks with double bolsters are satisfactory provided the members are fully seated on the outer bolsters at not more than 3 feet from the depth of the member from the end and the inner bolster is not more than 8 feet from the end of the member or the designated pickup point. Adequate padding material shall be provided between tie chains or cables to preclude chipping of concrete.

##### 1.6.1.2 Lateral Deflection or Vibration

Any noticeable indication of lateral deflection or vibration during transportation shall be corrected by rigid bracing between members or by means of lateral trussing.

#### 1.6.2 Storage

##### 1.6.2.1 Storage Areas

Storage areas for precast members shall be stabilized, and suitable

foundations shall be provided, so differential settlement or twisting of members will not occur.

#### 1.6.2.2 Stacked members

Stacked members shall be separated and supported by battens placed across the full width of each bearing point. Battens shall be arranged in vertical planes at a distance not greater than the depth of the member from designated pickup points. Battens shall not be continuous over more than one stack of precast units. Stacking of members shall be such that lifting devices will be accessible and undamaged. The upper members of a stacked tier shall not be used as storage areas for shorter members or equipment.

#### 1.6.3 Handling of Members

The location of pickup points for handling of the members and details of the pickup devices shall be shown in shop drawings. Members shall be handled only by means of approved devices at designated locations. Members shall be maintained in an upright position at all times and picked up and supported as shown in approved shop drawings.

### PART 2 PRODUCTS

#### 2.1 CONTRACTOR-FURNISHED MIX DESIGN

ACI 318. The minimum compressive strength of concrete at 28 days shall be 5000 psi , unless otherwise indicated. Add air-entraining admixtures at the mixer to produce between 4 and 6 percent air by volume.

#### 2.2 MATERIALS

##### 2.2.1 Cement

ASTM C150/C150M, Type I, II, or III with a maximum alkali content of 0.40 percent If no satisfactory test results are available (made within the past six months) to prove that the cement alkali content is less than 0.40 percent, then it shall be assumed that the cement contains greater than 0.40 percent alkali. Cement certificates shall include test results in accordance with ASTM C150/C150M, including equivalent alkalies indicated in the optional chemical requirements. For exposed concrete, use one manufacturer for each type of cement, ground slag, fly ash, and pozzolan.

##### 2.2.1.1 Fly Ash and Pozzolan

ASTM C618, Type N, F, or C, except that the maximum calcium oxide content shall be 8.0 percent, the maximum available alkalies shall be 1.5 percent, and the maximum allowable loss on ignition shall be 6 percent for Type N and F. Class C shall not be used with reactive aggregates.

##### 2.2.1.2 Ground Iron Blast-Furnace Slag

ASTM C989, Grade 100 or 120.

##### 2.2.2 Water

Water shall be fresh, clean, and potable; free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete, ACI 318.



### 2.2.3 Aggregates

#### 2.2.3.1 Aggregates Selection

ASTM C33/C33M, Size 57 , except as modified herein. Obtain aggregates for exposed concrete surfaces from one source. Aggregates shall not contain any substance which may be deleteriously reactive with the alkalies in the cement, nor in an amount sufficient to cause excessive expansion of concrete. Prior to fabrication, submit certified test reports for the following tests specified in ASTM C33/C33M:

- a. Grading
- b. Amount of material finer than No. 200 sieve
- c. Organic impurities
- d. Soundness
- e. Clay lumps and friable particles
- f. Coal and lignite
- g. Weight of slag
- h. Abrasion of coarse aggregate
- i. Fineness modulus
- j. Reactive aggregates
- k. Freezing and thawing

#### 2.2.3.2 Alkali-Silica Reactivity

Evaluate and test fine and coarse aggregates to be used in all concrete for alkali-aggregate reactivity in accordance with ASTM C1260. Test both coarse aggregate size groups if from different sources. Evaluate the fine and coarse aggregates separately and in combination, which matches the Contractor's proposed mix design proportioning, utilizing the modified version of ASTM C1260. Test results of the combination must have a measured expansion equal to or less than 0.08 percent at 16 days after casting. Modify ASTM C1260 as follows to included one of the following options:

- a. Utilize the Contractor's proposed low alkali portland cement and Class F fly ash or Class N pozzolan in combination with the proposed aggregate percentage for the test proportioning. Use Class F fly ash or Class N pozzolan in the range of 25 percent to 40 percent of the total cementitious material by mass. Determine the quantity that will meet all the requirements of these specifications and that will lower the expansion equal to or less than 0.08 percent at 16 days after casting. Class C fly ash shall not be used with reactive aggregates.
- b. Utilize the Contractor's proposed low alkali portland cement and ground granulated blast furnace (GGBF) slag in combination with the proposed aggregate percentage for the test proportioning. Use GGBF slag in the range of 40 percent to 50 percent of the total cementitious material by mass. Determine the quantity that will meet all the

requirements of these specifications and that will lower the expansion equal to or less than 0.08 percent at 16 days.

c. Utilize the Contractor's proposed low alkali portland cement and a lithium nitrate admixture. The lithium nitrate admixture may be used in combination with either Class "F" fly ash, Class N pozzolan, or ground granulated blast furnace (GGBF) slag, at a dosage rate as recommended by the manufacturer.

If any of the above options does not lower the expansion to less than 0.08 percent at 16 days after casting, reject the aggregate(s) and submit new aggregate sources for retesting. Submit the results of testing to the Contracting Officer for evaluation and acceptance.

#### 2.2.4 Grout

##### 2.2.4.1 Nonshrink Grout

ASTM C1107/C1107M.

##### 2.2.4.2 Cementitious Grout

Shall be a mixture of portland cement, sand, and water. Proportion one part cement to approximately 2.5 parts sand, with the amount of water based on placement method. Provide air entrainment for grout exposed to the weather.

#### 2.2.5 Admixtures

##### 2.2.5.1 Air-Entraining

ASTM C260/C260M.

##### 2.2.5.2 Accelerating

ASTM C494/C494M, Type C or E.

##### 2.2.5.3 Water Reducing

ASTM C494/C494M, Type A, E, or F.

#### 2.2.6 Reinforcement

##### 2.2.6.1 Reinforcing Bars

ASTM A615/A615M, Grade 60; ASTM A706/A706M, Grade 60; or ASTM A996/A996M, Grade 60.

##### 2.2.6.2 Wire

ASTM A82/A82M or ASTM A496/A496M.

##### 2.2.6.3 Welded Wire Fabric

ASTM A185/A185M or ASTM A497/A497M.

### 2.2.7 Metal Accessories

Provide ASTM A123/A123M or ASTM A153/A153M galvanized.

#### 2.2.7.1 Inserts

ASTM A47/A47M, Grade 32510 or 35018, or ASTM A27/A27M Grade U-60-30.

#### 2.2.7.2 Structural Steel

ASTM A36/A36M.

#### 2.2.7.3 Bolts

ASTM A307; ASTM A325.

#### 2.2.7.4 Nuts

ASTM A563.

#### 2.2.7.5 Washers

ASTM F 844 washers for ASTM A307 bolts, and ASTM F 436 washers for ASTM A325 bolts.

### 2.2.8 Bearing Pads

#### 2.2.8.1 Elastomeric

AASHTO HB-17, for plain neoprene bearings.

#### 2.2.8.2 Hardboard (Interior Only)

AHA A135.4, class as specified by the precast manufacturer.

### 2.2.9 Grout

#### 2.2.9.1 Cementitious Grout

Shall be a mixture of portland cement, sand, and water. Proportion one part cement to approximately 2.5 parts sand, with the amount of water based on placement method. Provide air entrainment for grout exposed to the weather.

#### 2.2.9.2 Nonshrink Grout

Nonshrink grout shall conform to ASTM C1107/C1107M and shall be a commercial formulation suitable for the application proposed.

### 2.3 PRODUCTION QUALITY CONTROL PROCEDURES

PCI MNL-116 unless specified otherwise.

#### 2.3.1 Forms

Brace forms to prevent deformation. Forms shall produce a smooth, dense surface. Chamfer exposed edges of columns and beams 3/4 inch, unless otherwise indicated. Provide threaded or snap-off type form ties.

### 2.3.2 Reinforcement Placement

ACI 318 for placement and splicing. Reinforcement may be preassembled before placement in forms. Provide exposed connecting bars, or other approved connection methods, between precast and cast-in-place construction. Remove any excess mortar that adheres to the exposed connections.

### 2.3.3 Concrete

#### 2.3.3.1 Concrete Mixing

ASTM C94/C94M. Mixing operations shall produce batch-to-batch uniformity of strength, consistency, and appearance.

#### 2.3.3.2 Concrete Placing

ACI 304R, ACI 305R for hot weather concreting , ACI 306.1 for cold weather concreting, and ACI 309R, unless otherwise specified.

#### 2.3.3.3 Concrete Curing

Commence curing immediately following the initial set and completion of surface finishing. Provide curing procedures to keep the temperature of the concrete between 50 and 190 degrees F. When accelerated curing is used, apply heat at controlled rate and uniformly along the casting beds. Monitor temperatures at various points in a product line in different casts.

### 2.3.4 Surface Finish

Repairs located in a bearing area shall be approved by the Contracting Officer prior to repairs. Precast members containing hairline cracks which are visible and are less than 0.01 inches in width, may be accepted, except that cracks larger than 0.005 inches in width for surfaces exposed to the weather shall be repaired. Defects that involve more than 36 square inches of concrete shall be grounds for rejection. Any precast member that is structurally impaired or contains honeycombed section deep enough to expose stressing tendons or reinforcing shall be rejected. Defects shall be repaired or rejected as specified in paragraph "Defects."

#### 2.3.4.1 Unformed Surfaces

Provide a steel troweled finish.

#### 2.3.4.2 Formed Surfaces

PCI MNL-116 (Appendix A - Commentary), Chapter 3, for grades of surface finishes.

a. Unexposed Surfaces: Provide a standard grade surface finish.

b. Exposed Surfaces: Provide a finish Grade B surface finish.

#### 2.3.4.3 Architectural Finish

Provide a finish Grade A surface finish to those members indicated.

### 2.3.5 Acceptance/Rejection of Defects

#### 2.3.5.1 Minor Defects

All honeycombed areas, chipped corners, air pockets over 1/4 inch in diameter, and other minor defects involve less than 36 square inches of concrete shall be repaired. Form offsets of fins over 1/8 inch shall be ground smooth. All unsound concrete shall be removed from defective areas prior to repairing. All surfaces permanently exposed to view shall be repaired by a blend of portland cement and white cement properly proportioned so that the final color when cured will be the same as adjacent concrete.

#### 2.3.5.2 Major Defects

Major defects are those which involve more than 36 square inches of concrete or expose stressing tendons or reinforcing steel. If one or more major defects appear in a member, it shall be rejected. Cracks of a width of more than 0.01 inch shall be cause for rejection of the member.

### 2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

#### 2.4.1 Chloride Ion Concentration Test

Sampling and determination of water soluble chloride ion content in accordance with ASTM C1218/C1218M. Maximum water soluble chloride ion concentrations in hardened concrete at ages from 28 to 42 days contributed from the ingredients including water, aggregates, cementitious materials, and admixtures shall not exceed 0.06 percent by weight of cement.

#### 2.4.2 Chloride Ion Penetration Test

To ensure the durability of concrete in marine environment, concrete shall be proportioned to have the chloride ion penetration test in accordance with ASTM C1202, and be below 1500 coulombs for concrete specimens tested at 28 days.

#### 2.4.3 Factory Inspection

At the option of the Contracting Officer, precast units may be inspected by the Contracting Officer prior to being transported to the job site. The Contractor shall give notice 14 days prior to the time the units will be available for plant inspection. Neither the exercise nor waiver of inspection at the plant will affect the Government's right to enforce contractual provisions after units are transported or erected.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Prior to erection, and again after installation, precast members shall be checked for damage, such as cracking, spalling, and honeycombing. As directed by the Contracting Officer, precast members that do not meet the surface finish requirements specified in Part 2 in paragraph entitled "Surface Finish" shall be repaired, or removed and replaced with new precast members.

### 3.2 ERECTION

Precast members shall be erected after the concrete has attained the specified compressive strength, unless otherwise approved by the precast manufacturer. Erect in accordance with the approved shop drawings. PCI MNL-116 and PCI MNL-120 (Chapter 8), for tolerances. Provide a 1:500 tolerance, if no tolerance is specified. Brace precast members, unless design calculations submitted with the shop drawings indicate bracing is not required. Follow the manufacturer's recommendations for maximum construction loads. Place precast members level, plumb, square, and true within tolerances. Align member ends.

### 3.3 BEARING SURFACES

Shall be flat, free of irregularities, and properly sized. Size bearing surfaces to provide for the indicated clearances between the precast member and adjacent precast members or adjoining field placed surfaces. Correct bearing surface irregularities with nonshrink grout. Provide bearing pads where indicated or required. Do not use hardboard bearing pads in exterior locations. Place precast members at right angles to the bearing surface, unless indicated otherwise, and draw-up tight without forcing or distortion, with sides plumb.

### 3.4 ANCHORAGE

Provide anchorage for fastening work in place. Conceal fasteners where practicable. Make threaded connections up tight and nick threads to prevent loosening.

### 3.5 WELDING

AWS D1.4/D1.4M for welding connections and reinforcing splices. Protect the concrete and other reinforcing from heat during welding. Weld continuously along the entire area of contact. Grind smooth visible welds in the finished installation. Welding of epoxy-coated reinforcing is not allowed.

### 3.6 OPENINGS

Holes or cuts requiring reinforcing to be cut, which are not indicated on the approved shop drawing, shall only be made with the approval of the Contracting Officer and the precast manufacturer. Drill holes less than 12 inches in diameter with a diamond tipped core drill.

### 3.7 GALVANIZING REPAIR

Repair damage to galvanized coatings using ASTM A780/A780M zinc rich paint for galvanized surfaces damaged by handling, transporting, cutting, welding, bolting, or acid washing. Do not heat surfaces to which repair paint has been applied.

### 3.8 GROUTING

Clean and fill keyways between precast members, and other indicated areas, solidly with nonshrink grout or cementitious grout. Provide reinforcing where indicated. Remove excess grout before hardening.

### 3.9 SEALANTS

Provide as indicated and as specified in Section 07 92 00 JOINT SEALANTS.

### 3.10 CONSTRUCTION RECORDS

Complete construction records shall be kept of the manufacturing, handling, and erection of the precast-prestressed concrete members. Records shall be kept for, but not limited to, the following items:

- a. Specifications of material used in the manufacture of the members.
- b. Time-temperature history of the concrete members from casting to the transfer of the prestress force.
- c. Records of the tendon stressing operation including initial prestress force, measured elongation, how it was measured, and how the tendons were stressed and destressed.
- d. Records of inspection of the members before and after the prestress force is transferred to the members.
- e. Records of the inspection of the members each time they are moved.
- f. Records of any defects in the member and any corrective measures taken.

-- End of Section --

## SECTION 04 20 00

MASONRY  
02/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ACI INTERNATIONAL (ACI)

ACI 530/530.1 (2008; Errata 2008; Errata 2009) Building Code Requirements and Specification for Masonry Structures and Related Commentaries

## ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M (2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A167 (2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A615/A615M (2009b) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM A641/A641M (2009a) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

ASTM A82/A82M (2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement

ASTM B 370 (2009) Standard Specification for Copper Sheet and Strip for Building Construction

ASTM C 1019 (2011) Standard Test Method for Sampling and Testing Grout

ASTM C 1072 (2010) Standard Test Method for Measurement of Masonry Flexural Bond Strength

ASTM C 129 (2006) Standard Specification for Nonloadbearing Concrete Masonry Units

ASTM C 140 (2011) Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units



|                   |   |
|-------------------|---|
| ASTM C 144        | (2004) Standard Specification for Aggregate for Masonry Mortar                                      |
| ASTM C 150/C 150M | (2009) Standard Specification for Portland Cement   |
| ASTM C 207        | (2006) Standard Specification for Hydrated Lime for Masonry Purposes                                |
| ASTM C 216        | (2010) Facing Brick (Solid Masonry Units Made from Clay or Shale)                                   |
| ASTM C 270        | (2010) Standard Specification for Mortar for Unit Masonry   |
| ASTM C 476        | (2010) Standard Specification for Grout for Masonry   |
| ASTM C 494/C 494M | (2010a) Standard Specification for Chemical Admixtures for Concrete                                 |
| ASTM C 593        | (2006) Fly Ash and Other Pozzolans for Use with Lime for Soil Stabilization                         |
| ASTM C 641        | (2009) Staining Materials in Lightweight Concrete Aggregates  |
| ASTM C 67         | (2009) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile                |
| ASTM C 780        | (2010) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry |
| ASTM C 90         | (2011) Loadbearing Concrete Masonry Units   |
| ASTM C 91         | (2005) Masonry Cement   |
| ASTM C 94/C 94M   | (2015) Standard Specification for Ready-Mixed Concrete  |
| ASTM C 989        | (2010) Standard Specification for Slag Cement for Use in Concrete and Mortars                       |
| ASTM D 2000       | (2008) Standard Classification System for Rubber Products in Automotive Applications                |
| ASTM D 2240       | (2005; R 2010) Standard Test Method for Rubber Property - Durometer Hardness                        |
| ASTM D 2287       | (1996; R 2010) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds        |
| ASTM E 119        | (2011) Standard Test Methods for Fire Tests of Building Construction and Materials                  |

## INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC

(2012) International Building Code

## 1.2 SYSTEM DESCRIPTION

## 1.2.1 Design Requirements

## 1.2.1.1 Seismic Requirement

In addition to design requirements of ICC IBC, provide additional seismic reinforcement as detailed on the drawings.

Bond beams are required as indicated on the drawings.

## 1.2.2 Additional Requirements

- a. Provide bracing and scaffolding necessary for masonry work. Design bracing to resist wind pressure as required by local code.

## 1.3 SUBMITTALS

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

## SD-03 Product Data

Clay or Shale Brick  
Cement  
Insulation  
Cold Weather Installation

## SD-04 Samples

Concrete Masonry Units (CMU)  
Clay or Shale Brick  
Anchors, Ties, and Bar Positioners  
Expansion-Joint Materials

## SD-06 Test Reports

Fire-rated CMU

## SD-07 Certificates

Clay or Shale Brick  
Concrete Masonry Units (CMU)  
Joint Reinforcement  
Masonry Cement  
Insulation  
Admixtures for Masonry Mortar  
Admixtures for Grout  
Insulation

## SD-08 Manufacturer's Instructions

Masonry Cement

#### 1.4 QUALITY ASSURANCE

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered, stored, handled, and protected to avoid chipping, breakage, and contact with soil or contaminating material. Store and prepare materials in already disturbed areas to minimize project site disturbance and size of project site.

##### 1.5.1 Masonry Units

Cover and protect moisture-controlled concrete masonry units and cementitious materials from precipitation. Conform to all handling and storage requirements of ASTM C 90. Mark prefabricated lintels on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

##### 1.5.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

##### 1.5.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Store sand and aggregates in a manner to prevent contamination or segregation.

#### 1.6 PROJECT/SITE CONDITIONS

Conform to ACI 530/530.1 for hot and cold weather masonry erection.

##### 1.6.1 Hot Weather Installation

Take the following precautions if masonry is erected when the ambient air temperature is more than 99 degrees F in the shade and the relative humidity is less than 50 percent or the ambient air temperature exceeds 90 degrees F and the wind velocity is more than 8 mph. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 4 feet ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

##### 1.6.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 40 degrees F or temperature of masonry units is below 40 degrees F, submit a written statement of proposed cold weather construction procedures for approval.

## PART 2 PRODUCTS

### 2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval. Submit sample of colored mortar with applicable masonry unit and color samples of three stretcher units and one unit for each type of special shape. Units shall show the full range of color and texture. Submit test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project. Submit certificates of compliance stating that the materials meet the specified requirements.

### 2.2 CLAY OR SHALE BRICK

Submit brick samples as specified. Color range and texture of clay or shale brick shall match the existing brick masonry and shall conform to the approved sample. Clay or shale brick units shall be delivered factory-blended to provide a uniform appearance and color range in the completed wall.

#### 2.2.1 Solid Clay or Shale Brick

Solid clay or shale brick shall conform to ASTM C 216, Type FBS. Brick size shall be modular and the nominal size of the brick used shall be 3-5/8 inches thick, 2-1/4 inches high, and 7 5/8 inches long.

### 2.3 CONCRETE MASONRY UNITS (CMU)

Cement shall have a low alkali content and be of one brand. Units shall be of modular dimensions and air, water, or steam cured. Exposed surfaces of units shall be smooth and of uniform texture.

- a. Hollow Load-Bearing Units: ASTM C 90, made with lightweight aggregate. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls.
- b. Hollow Non-Load-Bearing Units: ASTM C 129, made with lightweight aggregate. Load-bearing units may be provided in lieu of non-load-bearing units.
- c. Solid Load-Bearing Units: ASTM C 90, lightweight units.

#### 2.3.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification. Use industrial waste by-products (air-cooled slag, cinders, or bottom ash), ground waste glass and concrete, granulated slag, and expanded slag in aggregates. Slag shall comply with ASTM C 989; Grade 80.

#### 2.3.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header,

lintel, and bond beam units and special shapes and sizes to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners except at door, window, and louver jambs. Radius of the bullnose shall be 1 inch. Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

### 2.3.3 Fire-Rated CMU

Concrete masonry units used in fire-rated construction shown on the drawings shall be of minimum equivalent thickness for the fire rating indicated and the corresponding type of aggregates indicated in TABLE I. Units containing more than one of the aggregates listed in TABLE I will be rated on the aggregate requiring the greater minimum equivalent thickness to produce the required fire rating. Construction shall conform to ASTM E 119.

TABLE I  
FIRE-RATED CONCRETE MASONRY UNITS

See note (a) below

| Aggregate Type                                   | Minimum equivalent thickness<br>inches for fire rating of: |         |         |
|--|--|---------|---------|
|  | 4 hours  | 3 hours | 2 hours |
| Pumice   | 4.7  | 4.0     | 3.0     |
| Expanded slag                                    | 5.0  | 4.2     | 3.3     |
| Expanded clay, shale,<br>or slate                | 5.7  | 4.8     | 3.7     |
| Limestone, scoria, cinders<br>or unexpanded slag | 5.9  | 5.0     | 4.0     |
| Calcareous gravel                                | 6.2  | 5.3     | 4.2     |
| Siliceous gravel                                 | 6.7  | 5.7     | 4.5     |

Minimum equivalent thickness shall equal net volume as determined in conformance with ASTM C 140 divided by the product of the actual length and height of the face shell of the unit in inches. Where walls are to receive plaster or be faced with brick, or otherwise form an assembly; the thickness of plaster or brick or other material in the assembly will be included in determining the equivalent thickness. Submit calculation results.

### 2.4 MORTAR FOR STRUCTURAL MASONRY

ASTM C 270, Type S. Use Type I portland cement. Do not use admixtures containing chlorides. When structural reinforcement is incorporated, maximum air-content shall be 12 percent in cement-lime mortar and 18 percent in masonry cement mortar. Use up to 40 percent Class F fly ash with type IP cement in cement-lime mortar. Fly ash shall comply with ASTM C 593.

## 2.5 MASONRY MORTAR

Type S mortar shall conform to ASTM C 270. Mortar Type S shall conform to the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate.

When masonry cement ASTM C 91 is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Verification of masonry cement performance shall be based on ASTM C 780 and ASTM C 1072. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

### 2.5.1 Admixtures for Masonry Mortar

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C. Submit the required certifications.

### 2.5.2 Hydrated Lime and Alternates

Hydrated lime shall conform to ASTM C 207, Type S.

### 2.5.3 Cement

Portland cement shall conform to ASTM C 150/C 150M, Type I,. Masonry cement shall conform to ASTM C 91, Type S. Containers shall bear complete instructions for proportioning and mixing to obtain the required types of mortar. Incorporate to the maximum extent, without conflicting with other requirements of this section, up to 40 percent fly ash, up to 70 percent slag, up to 10 percent cenospheres, and up to 10 percent silica fume. When masonry cement is used, submit the manufacturer's printed instructions on proportions of water and aggregates and on mixing to obtain the type of mortar required. Additives shall conform to requirements in Section 03 30 00 CAST-IN-PLACE CONCRETE.

### 2.5.4 Sand and Water

Sand shall conform to ASTM C 144. Water shall be clean, potable, and free from substances which could adversely affect the mortar.

## 2.6 GROUT AND READY-MIXED GROUT

Grout shall conform to ASTM C 476, fine. Cement used in grout shall have a low alkali content. Grout slump shall be between 8 and 10 inches. Minimum grout strength shall be 2000 psi in 28 days, as tested by ASTM C 1019. Use grout subject to the limitations of Table III. Do not change proportions and do not use materials with different physical or chemical characteristics in grout for the work unless additional evidence is furnished that the grout meets the specified requirements. Ready-Mixed grout shall conform to ASTM C 94/C 94M.

### 2.6.1 Admixtures for Grout

In cold weather, a non-chloride based accelerating admixture may be used subject to approval; accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C. In general, air-entrainment, anti-freeze or chloride admixtures shall not be used except as approved by the Contracting

Officer. Submit required certifications.

## 2.6.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

## 2.7 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A153/A153M, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A82/A82M. Wire ties or anchors in exterior walls shall conform to ASTM A641/A641M. Joint reinforcement in interior walls, and in exterior or interior walls exposed to moist environment shall conform to ASTM A641/A641M; coordinate with paragraph JOINT REINFORCEMENT below. Anchors and ties shall be sized to provide a minimum of 5/8 inch mortar cover from either face. Submit two anchors, ties and bar positioners of each type used, as samples.

### 2.7.1 Wall Ties

Provide wall ties rectangular-shaped or Z-shaped fabricated of 3/16 inch diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 4 inches wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 3/16 inch diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 1/2 inch eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 1/16 inch. The pintle and eye elements shall be formed so that both can be in the same plane.

### 2.7.2 Adjustable Anchors

Adjustable anchors shall be 3/16 inch diameter steel wire, triangular-shaped. Anchors attached to steel shall be 5/16 inch diameter steel bars placed to provide 1/16 inch play between flexible anchors and structural steel members. Spacers shall be welded to rods and columns. Equivalent welded-on steel anchor rods or shapes standard with the flexible-anchor manufacturer may be furnished when approved. Welds shall be cleaned and given one coat of zinc-rich touch up paint.

### 2.7.3 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

## 2.8 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A82/A82M, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A153/A153M, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 5/8 inch

cover from either face. The distance between crosswires shall not exceed 16 inches. Joint reinforcement for straight runs shall be furnished in flat sections not less than 10 feet long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features. Submit one piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

## 2.9 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A615/A615M, Grade 60.

## 2.10 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D 2000 or polyvinyl chloride conforming to ASTM D 2287. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than 5/8 inch thick and 3/8 inch thick flanges, with a tolerance of plus or minus 1/16 inch. The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of minus 30 degrees F after five hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with ASTM D 2240.

## 2.11 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07 92 00 JOINT SEALANTS, and shall be penetrating with a maximum volatile organic compound (VOC) content of 600 grams/liter. Submit one piece of each type of material used.

## 2.12 THROUGH WALL FLASHING

Provide one of the following types except that the material shall be one which is not adversely affected by dampproofing material.

- a. Copper or Stainless Steel Flashing: Copper, ASTM B 370, minimum 16 ounce weight; stainless steel, ASTM A167, Type 301, 302, 304, or 316, 0.015 inch thick, No. 2D finish. Flashing shall extend beyond the face of the wall 1/4 inch, and turn down at a 45 degree angle to form a drip. Where the flashing is not continuous, such as over and under openings in the wall and on each side of vertical expansion joints, the ends of the flashing should be extended beyond the jamb lines on both sides and turned up into the head of the head joint at least 1 inch at each end to form a dam. Flashing shall be lapped a minimum of 6 inches at joints and shall be sealed with a 12 inch width, 40 mil total thickness self adhesive, cold applied tape consisting of 32 mils of rubberized asphalt integrally bonded to a 8 mil high density, cross laminated polyethylene film.



## PART 3 EXECUTION

## 3.1 PREPARATION

Prior to start of work, masonry inspector shall verify the applicable conditions as set forth in ACI 530/530.1, inspection. The Contracting Officer will serve as inspector or will select a masonry inspector.

## 3.1.1 Protection

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

- a. Air Temperature 40 to 32 Degrees F. Sand or mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F
- b. Air Temperature 32 to 25 Degrees F. Sand and mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing.
- c. Air Temperature 25 to 20 Degrees F. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 15 mph.
- d. Air Temperature 20 Degrees F and below. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Enclosure and auxiliary heat shall be provided to maintain air temperature above 32 degrees F. Temperature of units when laid shall not be less than 20 degrees F.

## 3.1.2 Completed Masonry and Masonry Not Being Worked On

- a. Mean daily air temperature 40 to 32 degrees F. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.
- b. Mean daily air temperature 32 to 25 degrees F. Masonry shall be completely covered with weather-resistant membrane for 24 hours.
- c. Mean Daily Air Temperature 25 to 20 degrees F. Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.
- d. Mean Daily Temperature 20 degrees F and Below. Masonry temperature shall be maintained above 32 degrees F for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

## 3.1.3 Stains

Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

### 3.1.4 Loads

Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed. Provide temporary bracing as required.

### 3.1.5 Surfaces

Clean surfaces on which masonry is to be placed of laitance, dust, dirt, oil, organic matter, or other foreign materials and slightly roughen to provide a surface texture with a depth of at least 1/8 inch. Sandblast, if necessary, to remove laitance from pores and to expose the aggregate.

## 3.2 LAYING MASONRY UNITS

- a. Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching. Masonry units shall be laid in running bond pattern. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus 1/2 inch. Each unit shall be adjusted to its final position while mortar is still soft and plastic.
- b. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be selected from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb.
- c. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below.
- d. In double wythe construction, the inner wythe may be brought up not more than 16 inches ahead of the outer wythe. Collar joints shall be filled with mortar or grout during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by more than 8 inches.

### 3.2.1 Forms and Shores

Provide bracing and scaffolding as required. Design bracing to resist wind pressure as required by local codes. Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

### 3.2.2 Reinforced Concrete Masonry Units Walls

Where vertical reinforcement occurs, fill cores solid with grout. Lay units in such a manner as to preserve the unobstructed vertical continuity of cores to be filled. Embed the adjacent webs in mortar to prevent leakage of grout. Remove mortar fins protruding from joints before placing grout. Minimum clear dimensions of vertical cores shall be 2 by 3 inches. Position reinforcing accurately as indicated before placing grout. As masonry work progresses, secure vertical reinforcing in place at vertical intervals not to exceed 160 bar diameters. Use puddling rod or vibrator to consolidate the grout. Minimum clear distance between masonry and vertical reinforcement shall be not less than 1/2 inch. Unless indicated or specified otherwise, form splices by lapping bars not less than 40 bar diameters and wire tying them together.

### 3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

### 3.2.4 Clay or Shale Brick Units

Lay brick facing with the better face exposed. Lay brick in running bond with each course bonded at corners, unless otherwise indicated. Lay molded brick with the frog side down. Brick that is cored, recessed, or has other deformations may be used in sills, treads, soldier courses, except where deformations will be exposed to view.

#### 3.2.4.1 Wetting of Units

Wetting of clay, shale brick, or hollow brick units having an initial rate of absorption of more than 1 gram per minute per square inch of bed surface shall be in conformance with ASTM C 67. The method of wetting shall ensure that each unit is nearly saturated but surface dry when laid. Test clay or shale brick daily on the job, prior to laying, as follows: Using a wax pencil, draw a circle the size of a quarter on five randomly selected bricks. Apply 20 drops of water with a medicine dropper to the surface within the circle on each brick. If the average time that the water is completely absorbed in the five bricks is less than 1-1/2 minutes, wet bricks represented by the five bricks tested.

#### 3.2.4.2 Solid Units

Completely fill bed, head, and collar joints with mortar.

## 3.2.4.3 Hollow Units

Lay hollow units as specified for concrete masonry units.

## 3.2.4.4 Brick-Faced Walls

For brick-faced walls bond the two wythes in every sixth brick course with continuous horizontal joint reinforcement.

- a. Collar Joints: Fill collar joints solid with mortar as each course of brick is laid. Do not disturb units in place.
- b. Brick Sills: Lay brick on edge, slope, and project not less than 1/2 inch beyond the face of the wall to form a wash and drip. Fill all joints solidly with mortar and tool.

## 3.2.4.5 Cavity Walls

Provide a continuous cavity as indicated. Securely tie the two wythes together with horizontal joint reinforcement. Bevel mortar beds away from cavity to prevent projection into cavity when bricks are shoved in place. Keep cavities clear and clean of mortar droppings. At the bottom of cavity walls, in the course immediately above the through-wall flashing, temporarily omit one brick every 4 feet. With a hose and clean water, wash all mortar droppings and debris out of the cavity through the temporary openings at least twice each day masonry is laid, and more often when required to keep the cavities clean. Fill in the openings with bricks and mortar after the wall is complete and the cavity has been inspected and found clean. Provide weep holes of open head joints spaced 24 inches o.c. wherever the cavity is interrupted at base of wall and vertical obstructions (e.g. lintels).

## 3.2.5 Tolerances

Lay masonry plumb, true to line, with courses level. Keep bond pattern plumb throughout. Square corners unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, lay masonry within the following tolerances (plus or minus unless otherwise noted):

TABLE II

## TOLERANCES

Variation from the plumb in the lines  
and surfaces of columns, walls and arises

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|                           |          |
|---------------------------|----------|
| In adjacent masonry units | 1/8 inch |
| In 10 feet                | 1/4 inch |
| In 20 feet                | 3/8 inch |
| In 40 feet or more        | 1/2 inch |

Variations from the plumb for external corners,  
expansion joints, and other conspicuous lines

---

|                    |          |
|--------------------|----------|
| In 20 feet         | 1/4 inch |
| In 40 feet or more | 1/2 inch |

## TOLERANCES

Variations from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines

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|                    |          |
|--------------------|----------|
| In 20 feet         | 1/4 inch |
| In 40 feet or more | 1/2 inch |

Variation from level for bed joints and top surfaces of bearing walls

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|                    |          |
|--------------------|----------|
| In 10 feet         | 1/4 inch |
| In 40 feet or more | 1/2 inch |

Variations from horizontal lines

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|                    |          |
|--------------------|----------|
| In 10 feet         | 1/4 inch |
| In 20 feet         | 3/8 inch |
| In 40 feet or more | 1/2 inch |

Variations in cross sectional dimensions of columns and in thickness of walls

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|       |          |
|-------|----------|
| Minus | 1/4 inch |
| Plus  | 1/2 inch |

## 3.2.6 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

## 3.2.7 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

## 3.2.7.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed

joints.

#### 3.2.7.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

#### 3.2.7.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

#### 3.2.8 Joint Widths

Joint widths shall be as follows:

##### 3.2.8.1 Concrete Masonry Units

Concrete masonry units shall have 3/8 inch joints.

##### 3.2.8.2 Brick

Brick joint widths shall be the difference between the actual and nominal dimensions of the brick in either height or length. Brick expansion joint widths shall be as shown.

#### 3.2.9 Embedded Items

Fill spaces around built-in items with mortar. Point openings around flush-mount electrical outlet boxes in wet locations with mortar. Embed anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in as the masonry work progresses. Fully embed anchors, ties and joint reinforcement in the mortar. Fill cells receiving anchor bolts and cells of the first course below bearing plates with grout.

#### 3.2.10 Unfinished Work

Step back unfinished work for joining with new work. Toothing may be resorted to only when specifically approved. Remove loose mortar and thoroughly clean the exposed joints before laying new work.

#### 3.2.11 Masonry Wall Intersections

Masonry bond each course at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

#### 3.2.12 Partitions

Partitions shall be continuous from floor to underside of floor or roof deck where shown. Openings in firewall shall be filled as indicated or approved. An isolation joint shall be placed in the intersection between

partitions and structural or exterior walls as shown. Interior partitions having 4 inch nominal thick units shall be tied to intersecting partitions of 4 inch units, 5 inches into partitions of 6 inch units, and 7 inches into partitions of 8 inch or thicker units. Cells within vertical plane of ties shall be filled solid with grout for full height of partition or solid masonry units may be used. Interior partitions having masonry walls over 4 inches thick shall be tied together with joint reinforcement. Partitions containing joint reinforcement shall be provided with prefabricated pieces at corners and intersections or partitions.

### 3.3 ANCHORED VENEER CONSTRUCTION

Completely separate the inner and outer wythes by a continuous airspace as indicated. Lay up both the inner and the outer wythes together except when adjustable joint reinforcement assemblies are approved for use. When both wythes are not brought up together, through-wall flashings shall be protected from damage until they are fully enclosed in the wall. The airspace between the wythes shall be kept clear and free of mortar droppings by temporary wood strips laid on the wall ties and carefully lifted out before placing the next row of ties. A coarse gravel or drainage material shall be placed behind the weep holes in the cavity to a minimum depth of 4 inches of coarse aggregate or 10 inches of drainage material to keep mortar droppings from plugging the weep holes.

### 3.4 WEEP HOLES

Wherever through-wall flashing occurs, provide weep holes to drain flashing to exterior at acceptable locations as indicated on drawings. Weep holes shall be open head joints at 24 inches o.c. Weep holes shall be provided not more than 24 inches on centers in mortar joints of the exterior wythe above wall flashing, over foundations, bond beams, and any other horizontal interruptions of the cavity. Weep holes shall be perfectly horizontal or slightly canted downward to encourage water drainage outward and not inward. Weep holes shall be kept free of mortar and other obstructions.

### 3.5 COMPOSITE WALLS

Tie masonry wythes together with joint reinforcement or with unit wall ties. Anchor or tie the facing wythe to the backup at a maximum spacing of 16 inches on center vertically and 24 inches on center horizontally. Unit ties shall be spaced not over 24 inches on centers horizontally, in courses not over 16 inches apart vertically, staggered in alternate courses. Ties shall be laid not closer than 5/8 inch to either masonry face. Ties shall not extend through control joints. Collar joints between masonry facing and masonry backup shall be filled solidly with grout.

### 3.6 MORTAR MIX

Mix mortar in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measure ingredients for mortar by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Mix water with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Retemper mortar that has stiffened because of loss of water through evaporation by adding water to restore the proper consistency and workability. Discard mortar that has reached its initial set or that has not been used within 2.5 hours after mixing.

### 3.7 REINFORCING STEEL

Clean reinforcement of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 2 inches of tops of walls.

#### 3.7.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 1/2 inch shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

#### 3.7.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

### 3.8 JOINT REINFORCEMENT INSTALLATION

Joint reinforcement shall be installed at 16 inches on center or as indicated. Reinforcement shall be lapped not less than 6 inches. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 5/8 inch cover to either face of the unit.

### 3.9 PLACING GROUT

Fill cells containing reinforcing bars with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

#### 3.9.1 Vertical Grout Barriers for Fully Grouted Walls

Provide grout barriers not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

#### 3.9.2 Horizontal Grout Barriers

Embed grout barriers in mortar below cells of hollow units receiving grout.



### 3.9.3 Grout Holes and Cleanouts

#### 3.9.3.1 Grout Holes

Provide grouting holes in slabs, spandrel beams, and other in-place overhead construction. Locate holes over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Provide additional openings spaced not more than 16 inches on centers where grouting of all hollow unit masonry is indicated. Openings shall not be less than 4 inches in diameter or 3 by 4 inches in horizontal dimensions. Upon completion of grouting operations, plug and finish grouting holes to match surrounding surfaces.

#### 3.9.3.2 Cleanouts for Hollow Unit Masonry Construction

Provide cleanout holes at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet. Where all cells are to be grouted, construct cleanout courses using bond beam units in an inverted position to permit cleaning of all cells. Provide cleanout holes at a maximum spacing of 32 inches where all cells are to be filled with grout. Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 3 by 4 inch openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

### 3.9.4 Grouting Equipment

#### 3.9.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Operate pumps to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, remove waste materials and debris from the equipment, and dispose of outside the masonry.

#### 3.9.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. Maintain at least one spare vibrator at the site at all times. Apply vibrators at uniformly spaced points not further apart than the visible effectiveness of the machine. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation.

### 3.9.5 Grout Placement

Lay masonry to the top of a pour before placing grout. Do not place grout in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as

indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

#### 3.9.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

#### 3.9.5.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 1/4 inch into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 4 feet in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 12 to 18 inches into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

## POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

| Maximum<br>Grout Pour<br>Height<br>(feet) (4) | Grout<br>Type | Grouting<br>Procedure | Minimum Dimensions of the<br>Total Clear Areas Within Grout<br>Spaces and Cells (in.) (1,2) |                        |
|---|---------------|-----------------------|---|------------------------|
|   |               |                       | Multiwythe<br>Masonry (3)   | Hollow-unit<br>Masonry |
| 1   | Fine          | Low Lift              | 3/4   | 1-1/2 x 2              |
| 5   | Fine          | Low Lift              | 2   | 2 x 3                  |
| 8   | Fine          | High Lift             | 2   | 2 x 3                  |
| 12  | Fine          | High Lift             | 2-1/2   | 2-1/2 x 3              |
| 24  | Fine          | High Lift             | 3   | 3 x 3                  |
| 1   | Coarse        | Low Lift              | 1-1/2   | 1-1/2 x 3              |
| 5   | Coarse        | Low Lift              | 2   | 2-1/2 x 3              |
| 8   | Coarse        | High Lift             | 2   | 3 x 3                  |
| 12  | Coarse        | High Lift             | 2-1/2   | 3 x 3                  |
| 24  | Coarse        | High Lift             | 3   | 3 x 4                  |

## Notes:

- (1) The actual grout space or cell dimension shall be larger than the sum of the following items:
  - a) The required minimum dimensions of total clear areas given in the table above;
  - b) The width of any mortar projections within the space;
  - c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.
- (2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.
- (3) For grouting spaces between masonry wythes.
- (4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

## 3.10 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 1/2 inch shall be maintained between reinforcement and interior faces of units.

## 3.11 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using special control-joint units or sash jamb units with control joint key in accordance with the details shown on the drawings. Sash jamb units

shall have a 3/4 by 3/4 inch groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of 3/4 inch; backer rod and sealant shall be installed in accordance with Section 07 92 00 JOINT SEALANTS. Exposed interior control joints shall be raked to a depth of 1/4 inch. Concealed control joints shall be flush cut.

### 3.12 JOINTS SHOWN ON THE DRAWINGS

- a. Brick expansion joints
- b. Concrete masonry veneer joints
- c. will be located, detailed, and constructed as shown on the drawings. Keep joints free of mortar and other debris.

### 3.13 LINTELS

#### 3.13.1 Masonry Lintels

Construct masonry lintels with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 24 inches, whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 1/2 inch above the bottom inside surface of the lintel unit.

#### 3.13.2 Steel Lintels

Construct steel lintels as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel lintels shall have a minimum bearing length of 8 inches unless otherwise indicated on the drawings.

### 3.14 INSULATION

Anchored veneer walls shall be insulated, where shown, by installing board-type insulation on the cavity side of the inner wythe. Board type insulation shall be applied directly to the masonry or thru-wall flashing with adhesive. Insulation shall be neatly fitted between obstructions without impaling of insulation on ties or anchors. The insulation shall be applied in parallel courses with vertical joints breaking midway over the course below and shall be applied in moderate contact with adjoining units without forcing, and shall be cut to fit neatly against adjoining surfaces.

### 3.15 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, completely remove mortar and grout daubs or splashings from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which

have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

### 3.15.1 Dry-Brushing

- a. Exposed concrete masonry unit
- b. shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

### 3.15.2 Clay or Shale Brick Surfaces

Clean exposed clay or shale brick masonry surfaces as necessary to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. After cleaning, examine the sample panel of similar material for discoloration or stain as a result of cleaning. If the sample panel is discolored or stained, change the method of cleaning to ensure that the masonry surfaces in the structure will not be adversely affected. The exposed masonry surfaces shall be water-soaked and then cleaned with a solution proportioned 1/2 cup trisodium phosphate and 1/2 cup laundry detergent to one gallon of water or cleaned with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay products manufacturer. The solution shall be applied with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence shall be removed in conformance with the brick manufacturer's recommendations.

### 3.16 PROTECTION

Protect facing materials against staining. Cover top of walls with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

-- End of Section --

## SECTION 05 12 00

## STRUCTURAL STEEL

**10/07**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

|          |  |
|----------|--|
| AISC 303 | (2005) Code of Standard Practice for Steel Buildings and Bridges                             |
| AISC 317 | (1992; Reprint 1999) ASD Manual of Steel Construction, Vol II: Connections                   |
| AISC 325 | (2011) Steel Construction Manual   |
| AISC 326 | (2002) Detailing for Steel Construction  |
| AISC 348 | (2000) Structural Joints Using ASTM A325 or A490 Bolts                                       |
| AISC 350 | (2005) Load and Resistance Factor Design (LRFD) Specification for Structural Steel Buildings |
| AISC 360 | (2005) Specification for Structural Steel Buildings, with Commentary                         |
| AISC 810 | (1997) Erection Bracing of Low-Rise Structural Steel Frames/Fisher and West                  |
| AISC FCD | (1995a) Quality Certification Program Description  |

## AMERICAN WELDING SOCIETY (AWS)

|                |   |
|----------------|---|
| AWS A2.4       | (2007) Standard Symbols for Welding, Brazing and Nondestructive Examination |
| AWS D1.1/D1.1M | (2010) Structural Welding Code - Steel                                      |

## ASME INTERNATIONAL (ASME)

|            |  |
|------------|--|
| ASME B46.1 | (2002) Surface Texture (Surface Roughness, Waviness and Lay) |
|------------|--|

## ASTM INTERNATIONAL (ASTM)

|                   |   |
|-------------------|---|
| ASTM A 123/A 123M | (2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
|-------------------|---|

|                   |   |
|-------------------|---|
| ASTM A 143/A 143M | (2007) Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement |
| ASTM A 153/A 153M | (2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware   |
| ASTM A 276        | (2006) Standard Specification for Stainless Steel Bars and Shapes   |
| ASTM A 307        | (2014) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength   |
| ASTM A 325        | (2007a) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength  |
| ASTM A 36/A 36M   | (2008) Standard Specification for Carbon Structural Steel   |
| ASTM A 490        | (2006) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength   |
| ASTM A 500/A 500M | (2009) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes                                     |
| ASTM A 501        | (2007) Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing   |
| ASTM A 53/A 53M   | (2007) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless   |
| ASTM A 563        | (2015) Standard Specification for Carbon and Alloy Steel Nuts   |
| ASTM A 572/A 572M | (2007) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel   |
| ASTM A 6/A 6M     | (2007) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling                                 |
| ASTM A 780        | (2001; R 2006) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings  |
| ASTM A 992/A 992M | (2006a) Standard Specification for Structural Steel Shapes  |

|                     |  |
|---------------------|--|
| ASTM C 1107/C 1107M | (2007a) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)                |
| ASTM C 827          | (2001a; R 2005) Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures |
| ASTM F 436          | (2011) Hardened Steel Washers  |
| ASTM F 844          | (2007a) Washers, Steel, Plain (Flat), Unhardened for General Use                                   |
| ASTM F 959          | (2007a) Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners       |

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

|               |   |
|---------------|---|
| SSPC PA 1     | (2000; E 2004) Shop, Field, and Maintenance Painting of Steel   |
| SSPC PS 13.01 | (1982; E 2004) Epoxy-Polyamide Painting System  |
| SSPC Paint 25 | (1997; E 2004) Paint Specification No. 25Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel Type I and Type II |
| SSPC SP 3     | (1982; E 2004) Power Tool Cleaning  |
| SSPC SP 6     | (2000; E 2004) Commercial Blast Cleaning  |

1.2 SYSTEM DESCRIPTION

Provide the structural steel system, including shop primer , complete and ready for use. Structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing shall be provided in accordance with AISC 325 and AISC 317 except as modified in this contract.

1.3 MODIFICATIONS TO REFERENCES

Conform to AISC 325, AISC 317, AISC 360, AISC 303, AISC 348, and AISC 325, except as modified in this section.

Conform to AISC 325, AISC 350, AISC 303, AISC 348, and AISC 325, except as modified in this section.

1.4 SUBMITTALS

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

SD-02 Shop Drawings

Erection Plan, including description of temporary supports



Fabrication drawings including description of connections

SD-03 Product Data

Shop primer

Welding electrodes and rods

Load indicator washers

Non-Shrink Grout

Include test report for Class B primer.

SD-06 Test Reports

Class B coating

Bolts, nuts, and washers

Supply the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

SD-07 Certificates

Steel

Bolts, nuts, and washers

Galvanizing

AISC Quality Certification

Welding procedures and qualifications

1.5 AISC QUALITY CERTIFICATION

Work shall be fabricated in an AISC certified Category Sbd fabrication plant.

1.6 QUALITY ASSURANCE

1.6.1 Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 326, AISC 325 and AISC 317. Fabrication drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS A2.4 standard welding symbols. Member substitutions of details shown on the contract drawings shall be clearly highlighted on the fabrication drawings. Explain the reasons for any deviations from the contract drawings.

## 1.6.2 Certifications

### 1.6.2.1 Erection Plan

Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing, and a detailed sequence of welding, including each welding procedure required.

### 1.6.2.2 Welding Procedures and Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests.

Conform to all requirements specified in AWS D1.1/D1.1M.

## PART 2 PRODUCTS

### 2.1 STEEL

#### 2.1.1 Structural Steel

ASTM A 36/A 36M.

#### 2.1.2 High-Strength Structural Steel

##### 2.1.2.1 Low-Alloy Steel

ASTM A 572/A 572M , Grade 50. ASTM A 992/A 992M Grade 50.

#### 2.1.3 Structural Shapes for Use in Building Framing

Wide flange shapes, ASTM A 992/A 992M.

#### 2.1.4 Structural Steel Tubing

ASTM A 500/A 500M, Grade B ; ASTM A 501; ASTM A 618/A 618M, Grade 36.

#### 2.1.5 Steel Pipe

ASTM A 53/A 53M, Type E or S, Grade B, weight class STD (Standard) .

### 2.2 BOLTS, NUTS, AND WASHERS

Provide the following unless indicated otherwise.

#### 2.2.1 Structural Steel

##### 2.2.1.1 Bolts

ASTM A 307, Grade A; ASTM A 325, Type 1, . The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications.

2.2.1.2 Nuts

ASTM A 563, Grade and Style for applicable ASTM bolt standard recommended.

2.2.1.3 Washers

ASTM F 844 washers for ASTM A 307 bolts, and ASTM F 436 washers for ASTM A 325 and ASTM A 490 bolts.

2.2.2 High-Strength Structural Steel

2.2.2.1 Bolts

ASTM A 325, Type 1 ASTM A 490, Type 1 or 2.

2.2.2.2 Nuts

ASTM A 563, Grade and Style as specified in the applicable ASTM bolt standard.

2.2.2.3 Washers

ASTM F 436, plain carbon steel.

2.2.3 Foundation Anchorage

2.2.3.1 Anchor Bolts

ASTM A 307. Stainless steel Type 304 conforming to ASTM A 276.

2.2.3.2 Anchor Nuts

ASTM A 563, Grade A, hex style.

2.2.3.3 Anchor Washers

ASTM F 844.

2.2.4 Load Indicator Washers

ASTM F 959.

2.3 STRUCTURAL STEEL ACCESSORIES

2.3.1 Welding Electrodes and Rods

AWS D1.1/D1.1M.

2.3.2 Non-Shrink Grout

ASTM C 1107/C 1107M, with no ASTM C 827 shrinkage. Grout shall be nonmetallic.

2.3.3 Welded Shear Stud Connectors

AWS D1.1/D1.1M.

## 2.4 SHOP PRIMER

SSPC Paint 25, (alkyd primer) or SSPC PS 13.01 epoxy-polyamide, green primer (Form 150) type 1, except provide a Class B coating in accordance with AISC 325 and AISC 317 for slip critical joints. Primer shall conform to Federal, State, and local VOC regulations. If flash rusting occurs, re-clean the surface prior to application of primer.

## 2.5 GALVANIZING

ASTM A 123/A 123M or ASTM A 153/A 153M, as applicable, unless specified otherwise galvanize after fabrication where practicable.

## 2.6 FABRICATION

### 2.6.1 Markings

Prior to erection, members shall be identified by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections shall be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate match markings in areas that will decrease member strength or cause stress concentrations.

### 2.6.2 Shop Primer

Shop prime structural steel, except as modified herein, in accordance with SSPC PA 1. Do not prime steel surfaces embedded in concrete, galvanized surfaces, surfaces to receive sprayed-on fireproofing, or surfaces within 0.5 inch of the toe of the welds prior to welding (except surfaces on which metal decking is to be welded). Slip critical surfaces shall be primed with a Class B coating. Prior to assembly, prime surfaces which will be concealed or inaccessible after assembly. Do not apply primer in foggy or rainy weather; when the ambient temperature is below 45 degrees F or over 95 degrees F; or when the primer may be exposed to temperatures below 40 degrees F within 48 hours after application, unless approved otherwise by the Contracting Officer.

#### 2.6.2.1 Cleaning

SSPC SP 6, except steel exposed in spaces above ceilings, attic spaces, furred spaces, and chases that will be hidden to view in finished construction may be cleaned to SSPC SP 3 when recommended by the shop primer manufacturer. Maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

#### 2.6.2.2 Primer

Apply primer to a minimum dry film thickness of 2.0 mil except provide the Class B coating for slip critical joints in accordance with the coating manufacturer's recommendations. Repair damaged primed surfaces with an additional coat of primer.

## 2.7 DRAINAGE HOLES

Adequate drainage holes shall be drilled to eliminate water traps. Hole diameter shall be 1/2 inch and location shall be indicated on the detail drawings. Hole size and location shall not affect the structural integrity.

## PART 3 EXECUTION

### 3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC 325. Fabrication and assembly shall be done in the shop to the greatest extent possible. The fabricating plant shall be certified under the AISC FCD for Category Sbd structural steelwork.

Compression joints depending on contact bearing shall have a surface roughness not in excess of 500 micro inch as determined by ASME B46.1, and ends shall be square within the tolerances for milled ends specified in ASTM A 6/A 6M.

Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, surfaces to be fireproofed, and contact surfaces of friction-type high-strength bolted connections shall be prepared for painting in accordance with endorsement "P" of AISC FCD and primed with the specified paint.

Shop splices of members between field splices will be permitted only where indicated on the Contract Drawings. Splices not indicated require the approval of the Contracting Officer.

### 3.2 ERECTION

- a. Erection of structural steel, except as indicated in item b. below, shall be in accordance with the applicable provisions of AISC 325. Erection plan shall be reviewed, stamped and sealed by a licensed structural engineer.
- b. For low-rise structural steel buildings (60 feet tall or less and a maximum of 2 stories), the erection plan shall conform to AISC 303 and the structure shall be erected in accordance with AISC 810.

Provide for drainage in structural steel. After final positioning of steel members, provide full bearing under base plates and bearing plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions.

#### 3.2.1 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

### 3.3 CONNECTIONS

Except as modified in this section, connections not detailed shall be designed in accordance with AISC 360. Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Punch, subpunch and ream, or drill bolt holes perpendicular to the surface of the member. Holes shall not be cut or enlarged by burning. Bolts, nuts, and washers shall be clean of dirt and rust, and lubricated immediately prior to installation.

#### 3.3.1 Common Grade Bolts

ASTM A 307 bolts shall be tightened to a "snug tight" fit. "Snug tight" is

the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

### 3.3.2 High-Strength Bolts

ASTM A 325 and ASTM A 490 bolts shall be fully tensioned to 70 percent of their minimum tensile strength. Bolts shall be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, bolts shall then be fully tensioned, progressing from the most rigid part of a connection to the free edges.

#### 3.3.2.1 Installation of Load Indicator Washers (LIW)

ASTM F 959. Where possible, the LIW shall be installed under the bolt head and the nut shall be tightened. If the LIW is installed adjacent to the turned element, provide a flat ASTM F 436 washer between the LIW and nut when the nut is turned for tightening, and between the LIW and bolt head when the bolt head is turned for tightening. In addition to the LIW, provide flat ASTM F 436 washers under both the bolt head and nut when ASTM A 490 bolts are used.

### 3.4 GAS CUTTING

Use of gas-cutting torch in the field for correcting fabrication errors will not be permitted on any major member in the structural framing. Use of a gas cutting torch will be permitted on minor members not under stress only after approval has been obtained from the Contracting Officers.

### 3.5 WELDING

AWS D1.1/D1.1M. Grind exposed welds smooth as indicated. Provide AWS D1.1/D1.1M qualified welders, welding operators, and tackers.

The Contractor shall develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Prequalified procedures may be submitted for information only; however, procedures that are not prequalified shall be submitted for approval.

#### 3.5.1 Removal of Temporary Welds, Run-Off Plates, and Backing Strips

Remove only from finished areas.

### 3.6 SHOP PRIMER REPAIR

Repair shop primer in accordance with the paint manufacturer's recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

#### 3.6.1 Field Priming

Field priming of steel exposed to the weather, or located in building areas without HVAC for control of relative humidity. After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

### 3.7 GALVANIZING REPAIR

Provide as indicated or specified. Galvanize after fabrication where practicable. Repair damage to galvanized coatings using ASTM A 780 zinc rich paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces to which repair paint has been applied.

### 3.8 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing. The Contracting Officer shall be notified in writing of defective welds, bolts, nuts, and washers within 7 working days of the date of weld inspection.

#### 3.8.1 Welds

##### 3.8.1.1 Visual Inspection

AWS D1.1/D1.1M. Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification inspections. Welding inspectors shall visually inspect and mark welds, including fillet weld end returns.

#### 3.8.2 Load Indicator Washers

##### 3.8.2.1 Load Indicator Washer Compression

Load indicator washers shall be tested in place to verify that they have been compressed sufficiently to provide the 0.015 inch gap when the load indicator washer is placed under the bolt head and the nut is tightened, and to provide the 0.005 inch gap when the load indicator washer is placed under the turned element, as required by ASTM F 959.

#### 3.8.3 High-Strength Bolts

##### 3.8.3.1 Testing Bolt, Nut, and Washer Assemblies

Test a minimum of 3 bolt, nut, and washer assemblies from each mill certificate batch in a tension measuring device at the job site prior to the beginning of bolting start-up. Demonstrate that the bolts and nuts, when used together, can develop tension not less than the provisions specified in AISC 348 , Table 4, depending on bolt size and grade. The bolt tension shall be developed by tightening the nut. A representative of the manufacturer or supplier shall be present to ensure that the fasteners are properly used, and to demonstrate that the fastener assemblies supplied satisfy the specified requirements.

##### 3.8.3.2 Inspection

Inspection procedures shall be in accordance with AISC 348 , Section 9. Confirm and report to the Contracting Officer that the materials meet the project specification and that they are properly stored. Confirm that the faying surfaces have been properly prepared before the connections are assembled. Observe the specified job site testing and calibration, and confirm that the procedure to be used provides the required tension. Monitor the work to ensure the testing procedures are routinely followed on joints that are specified to be fully tensioned.

Inspection by the Government will include proper preparation, size, gaging location, and acceptability of welds; identification marking; operation and current characteristics of welding sets in use; and calibration of torque wrenches for high-strength bolts.

#### 3.8.3.3 Testing

The Government has the option to perform nondestructive tests on 5 percent of the installed bolts to verify compliance with pre-load bolt tension requirements. The nondestructive testing will be done in-place using an ultrasonic measuring device or any other device capable of determining in-place pre-load bolt tension. The test locations shall be selected by the Contracting Officer. If more than 10 percent of the bolts tested contain defects identified by testing, then all bolts used from the batch from which the tested bolts were taken, shall be tested. Retest new bolts after installation.

#### 3.8.4 Testing for Embrittlement

ASTM A 143/A 143M for steel products hot-dip galvanized after fabrication.

-- End of Section --



## SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS  
05/10

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ALUMINUM ASSOCIATION (AA)

- AA 46 (1978) Standards for Anodized Architectural Aluminum
- AA DAF-45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

- AISC 303 (2005) Code of Standard Practice for Steel Buildings and Bridges

## AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

- ASSE/SAFE A10.3 (2006) Operations - Safety Requirements for Powder Actuated Fastening Systems

## AMERICAN WELDING SOCIETY (AWS)

- AWS D1.1/D1.1M (2010) Structural Welding Code - Steel

## ASME INTERNATIONAL (ASME)

- ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)
- ASME B18.2.2 (2010) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
- ASME B18.21.1 (2009) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)
- ASME B18.22.1 (1965; R 2008) Plain Washers
- ASME B18.6.2 (1998; R 2005) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws: Inch Series
- ASME B18.6.3 (2010) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)

## ASTM INTERNATIONAL (ASTM)

|                   |  |
|-------------------|--|
| ASTM A 123/A 123M | (2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products  |
| ASTM A 153/A 153M | (2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware  |
| ASTM A 307        | (2014) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength  |
| ASTM A 36/A 36M   | (2008) Standard Specification for Carbon Structural Steel  |
| ASTM A 47/A 47M   | (1999; R 2014) Standard Specification for Ferritic Malleable Iron Castings   |
| ASTM A 500/A 500M | (2009) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes                    |
| ASTM A 53/A 53M   | (2007) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless                                    |
| ASTM A 653/A 653M | (2009a) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| ASTM A 687        | (1993) Standard Specification for High-Strength Nonheaded Steel Bolts and Studs  |
| ASTM A 780/A 780M | (2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings   |
| ASTM A 924/A 924M | (2009a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process                          |
| ASTM B 108/B 108M | (2008) Standard Specification for Aluminum-Alloy Permanent Mold Castings   |
| ASTM B 209        | (2007) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate  |
| ASTM B 221        | (2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes                             |
| ASTM B 26/B 26M   | (2009) Standard Specification for Aluminum-Alloy Sand Castings   |

ASTM C 1513 (2004; E 2009; R 2009) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections

ASTM D 1187 (1997; R 2002e1) Asphalt-Base Emulsions for Use as Protective Coatings for Metal

ASTM F 609 (2005) Standard Test Method for Using a Horizontal Pull Slipmeter (HPS)

MASTER PAINTERS INSTITUTE (MPI)

MPI 79 (Oct 2009) Alkyd Anti-Corrosive Metal Primer

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3 (1982; E 2004) Power Tool Cleaning

SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning

## 1.2 SUBMITTALS

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

### SD-02 Shop Drawings

RETROFIT STAIR TREADS  
Column Cover  
Access doors and panels, installation drawings

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in AISC 303.

Submit templates, erection and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the building construction.

### SD-03 Product Data

RETROFIT STAIR TREADS  
Column Cover  
Access doors and panels

## 1.3 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

## 1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Structural Carbon Steel

ASTM A 36/A 36M.

#### 2.1.2 Structural Tubing

ASTM A 500/A 500M.

#### 2.1.3 Steel Pipe

ASTM A 53/A 53M, Type E or S, Grade B.

#### 2.1.4 Fittings for Steel Pipe

Standard malleable iron fittings ASTM A 47/A 47M.

#### 2.1.5 Anchor Bolts

ASTM A 307. Where exposed, shall be of the same material, color, and finish as the metal to which applied.

##### 2.1.5.1 Expansion Anchors and Adhesive Anchors

Provide sizes as shown on the Drawings.

##### 2.1.5.2 Lag Screws and Bolts

ASME B18.2.1, type and grade best suited for the purpose.

##### 2.1.5.3 Toggle Bolts

ASME B18.2.1.

##### 2.1.5.4 Bolts, Nuts, Studs and Rivets

ASME B18.2.2 and ASTM A 687 or ASTM A 307.

##### 2.1.5.5 Powder Actuated Fasteners

Follow safety provisions of ASSE/SAFE A10.3.

##### 2.1.5.6 Screws

ASME B18.2.1, ASME B18.6.2, ASME B18.6.3 and ASTM C 1513.

##### 2.1.5.7 Washers

Provide plain washers to conform to ASME B18.22.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers to conform to ASME B18.21.1.

#### 2.1.6 Aluminum Alloy Products

Conform to ASTM B 209 for sheet plate, ASTM B 221 for extrusions and ASTM B 26/B 26M or ASTM B 108/B 108M for castings, as applicable. Provide

aluminum extrusions at least 1/8 inch thick and aluminum plate or sheet at least 0.050 inch thick.

## 2.2 FABRICATION FINISHES

### 2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A 123/A 123M, ASTM A 153/A 153M, ASTM A 653/A 653M or ASTM A 924/A 924M, G90, as applicable.

### 2.2.2 Galvanize

Anchor bolts, steel lintels, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

### 2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A 780/A 780M or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

### 2.2.4 Shop Cleaning and Painting

#### 2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with SSPC SP 6/NACE No.3. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with SSPC SP 3 in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete shall be free of dirt and grease. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints, but coat with rust preventative applied in the shop.

#### 2.2.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions. On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 1.0 mil. Tint additional prime coat with a small amount of tinting pigment.

### 2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

### 2.2.6 Aluminum Surfaces

#### 2.2.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks,

and other defects which will affect uniform appearance of finished surfaces.

#### 2.2.6.2 Aluminum Finishes

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA DAF-45, or AA 46. Unless otherwise specified, provide all other aluminum items with a standard mill finish. Provide a coating thickness not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF-45. Provide a polished satin finish on items to be anodized.

#### 2.3 ACCESS DOORS AND PANELS

Provide flush type access doors and panels unless otherwise indicated. Fabricate frames for access doors of steel not lighter than 14 gage with welded joints and anchorage for securing into construction. Provide access doors of not lighter than 14 gage steel, with stiffened edges and welded attachments. Provide access doors hinged to frame and with pin-tumbler cylinder locks with appropriate cams in lieu of screwdriver-operated latches. All access doors and panels shall have locks that are keyed the same so that all door and panel locks can be opened by one key. The lock shall be keyed alike to the Mechanical Room locksets. The ceiling access panel shall be sized to permit maintenance personnel access to the equipment for servicing and maintenance, but no smaller than sizes indicated on the Drawings. Provide exposed metal surface with a baked enamel finish.

Provide ceiling access panels for terminal air blenders.

#### 2.4 RETROFIT STAIR TREADS

The tread base shall be extruded aluminum alloy 6063-T6, heat treated for high strength. The abrasive filler material is a blend of carborundum and aluminum oxide bonded and locked into the channels provided in the underside. Treads will have a coefficient of friction 1.02 dry, 0.98 wet per ASTM F 609. Treads shall be furnished with drilled and countersunk holes.

#### 2.5 MISCELLANEOUS PLATES AND SHAPES

Provide for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings and frames. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as indicated and as required to support wall loads over openings. Provide with connections and fasteners. Construct to have at least 8 inches bearing on masonry at each end.

Provide angles and plates, ASTM A 36/A 36M, for embedment as indicated. Galvanize embedded items exposed to the elements according to ASTM A 123/A 123M.

#### 2.6 Column Cover

Provide removable column cover, 12 inch diameter, 14 gauge thickness, #4 brushed stainless steel finish. Column covers are to be self-aligning, positive interlock column cover system without exposed fasteners or supports. Column covers shall be fabricated in single length, in two

vertically divided sections attached with demountable interlock assembly. All fasteners are to be concealed. Provide angles and mounting clips to permit installation to steel columns. Provide 1 1/4 inch high reveal ring trim as indicated on the Drawings.

### PART 3 EXECUTION

#### 3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners shall be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Form joints exposed to the weather shall be formed to exclude water. Items listed below require additional procedures.

#### 3.2 WORKMANSHIP

Provide miscellaneous metalwork that is well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections of work in place and ground smooth. Provide a smooth finish on exposed surfaces of work in place and unless otherwise approved, flush exposed riveting. Mill joints where tight fits are required. Corner joints shall be coped or mitered, well formed, and in true alignment. Accurately set work to established lines and elevations and securely fastened in place. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

#### 3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

#### 3.4 BUILT-IN WORK

Form for anchorage metal work built-in with concrete or masonry, or provide with suitable anchoring devices as indicated or as required. Furnish metal work in ample time for securing in place as the work progresses.

#### 3.5 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

### 3.6 FINISHES

#### 3.6.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to MPI 79 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D 1187, asphalt-base emulsion.

#### 3.7 ACCESS PANELS

Provide a removable access panel not less than 12 by 12 inches directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would otherwise not be accessible. The panel shall be sized to permit maintenance personnel access to the equipment for servicing and maintenance.

-- End of Section --



## SECTION 05 52 00

## METAL RAILINGS

02/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 314 (1990; R 2008) Standard Specification for  
Steel Anchor Bolts

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2010) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts  
and Screws (Inch Series)

ASME B18.21.1 (2009) Washers: Helical Spring-Lock, Tooth  
Lock, and Plain Washers (Inch Series)

ASME B18.6.1 (1981; R 2008) Wood Screws (Inch Series)

ASME B18.6.3 (2010) Machine Screws, Tapping Screws, and  
Machine Drive Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2013) Standard Specification for Zinc  
(Hot-Dip Galvanized) Coatings on Iron and  
Steel Products

ASTM A153/A153M (2009) Standard Specification for Zinc  
Coating (Hot-Dip) on Iron and Steel  
Hardware

ASTM A283/A283M (2003; R 2007) Standard Specification for  
Low and Intermediate Tensile Strength  
Carbon Steel Plates

ASTM A307 (2014) Standard Specification for Carbon  
Steel Bolts and Studs, 60 000 PSI Tensile  
Strength

ASTM A325 (2010) Standard Specification for  
Structural Bolts, Steel, Heat Treated,  
120/105 ksi Minimum Tensile Strength

|                 |   |
|-----------------|---|
| ASTM A36/A36M   | (2008) Standard Specification for Carbon Structural Steel   |
| ASTM A449       | (2010) Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use |
| ASTM A500/A500M | (2010a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes                        |
| ASTM A53/A53M   | (2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless   |
| ASTM C514       | (2004; R 2009e1) Standard Specification for Nails for the Application of Gypsum Board   |
| ASTM C636/C636M | (2008) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels                           |
| ASTM E488       | (1996; R 2003) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements   |

## NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

|               |                            |
|---------------|----------------------------|
| NAAMM AMP 521 | (2001) Pipe Railing Manual |
|---------------|----------------------------|

## 1.2 ADMINISTRATIVE REQUIREMENTS

## 1.2.1 Pre-Installation Meetings

Submit fabrication drawings to the Contracting Officer for the following items:

- a. Steel Railings and Handrails

## 1.3 SUBMITTALS

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

## SD-02 Shop Drawings

Fabrication Drawings

Iron and Steel Hardware

Steel Shapes, Plates, Bars and Strips

## SD-03 Product Data

Structural Steel Plates, Shapes, and Bars

Structural Steel Tubing

Masonry Anchorage Devices

Protective Coating

Steel Guardrails and Handrails;

SD-07 Certificates

Welder Qualification

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Welder Qualification

Submit certified welder qualification by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. In addition be performed 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 each test weld must pass. 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 SYSTEM DESCRIPTION

Provide complete, detailed fabrication and installation drawings for all iron and steel hardware, and for all steel shapes, plates, bars and strips used in accordance with the design specifications referenced in this section.

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.

#### 2.2 GENERAL FABRICATION

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 if required.

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.

## 2.3 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.

## 2.4 STRUCTURAL STEEL TUBING

Provide structural steel tubing, hot-formed, welded or seamless, conforming to ASTM A500/A500M, Grade B, unless otherwise noted.

## 2.5 STEEL PIPE

Provide pipe conforming to ASTM A53/A53M, type as selected, Grade B; standard weight (Schedule 40).

## 2.6 MASONRY ANCHORAGE DEVICES

Provide masonry anchorage devices consisting of expansion shields complying with AASHTO M 314, ASTM E488 and ASTM C514 as follows:

Provide lead expansion shields for machine screws and bolts 1/4 inch and smaller; head-out embedded nut type, single unit class, Group I, Type 1, Class 1.

Provide 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.

Provide bolt anchor expansion shields for lag bolts; zinc-alloy, long shield anchors class, Group II, Type 1, Class 1.

Provide bolt anchor expansion shields for bolts; closed-end bottom bearing class, Group II, Type 2, Class 1.

Provide tumble-wing type toggle bolts conforming to ASTM A325, ASTM A449

and ASTM C636/C636M, type, class, and style as required.

## 2.7 FASTENERS

Provide galvanized zinc-coated fasteners in accordance with ASTM A153/A153M used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items. Provide standard hexagon-head bolts, conforming to ASTM A307, Grade A.

Provide square-head lag bolts conforming to ASME B18.2.1.

Provide cadmium-plated steel machine screws conforming to ASME B18.6.3.

Provide flat-head carbon steel wood screws conforming to ASME B18.6.1.

Provide plain round, general-assembly-grade, carbon steel washers conforming to ASME B18.21.1.

## 2.8 PROTECTIVE COATING

Provide hot dipped galvanized steelwork as indicated in accordance with ASTM A123/A123M. Hot-dipped galvanizing shall be G-90. Guardrails and handrails shall be hot-dipped galvanized. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

## 2.9 STEEL GUARDRAILS AND HANDRAILS

Design guardrails and handrails to resist a concentrated load of 250 lbs in any direction at any point of the top of the rail or 20 lbs per foot applied horizontally to top of the rail, whichever is more severe. NAAMM AMP 521, provide the same size rail and post.

### 2.9.1 Steel Handrails and Guardrails

Provide steel handrails and guardrails, steel pipe conforming to ASTM A53/A53M and structural tubing conforming to ASTM A500/A500M, Grade A or B of equivalent strength. Provide steel railings of hot-dip galvanized.

- a. Fabrication: Joint posts, rail, and corners by the following method:

- (1) 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.

Provide galvanized railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components.

## PART 3 EXECUTION

### 3.1 PREPARATION

Adjust guardrails and handrails prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Space posts on guardrails as indicated on the drawings. Plumb posts in

each direction. Secure posts and rail ends to building construction as follows:

Anchor posts in concrete by means of non-shrink grout.

Secure handrails to walls by means of wall brackets and wall return fitting at handrail ends. Provide brackets of malleable iron castings, with not less than 3-inch projection from the finish wall surface to the center of the pipe drilled to receive one 3/8-inch bolt. Locate brackets not more than 60 inches on center. Provide wall return fittings of cast iron castings, flush-type, with the same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to building construction as follows:

For concrete and solid masonry anchorage, use bolt anchor expansion shields and lag bolts.

### 3.2 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 --

## SECTION 06 20 00

## FINISH CARPENTRY

**02/12**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

ALSC PS 20 (2010) American Softwood Lumber Standard

## AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA M2 (2011) Standard for Inspection of Treated Wood Products

AWPA M4 (2011) Standard for the Care of Preservative-Treated Wood Products

AWPA P5 (2014) Standard for Waterborne Preservatives

## APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA L870 (2010) Voluntary Product Standard, PS 1-09, Structural Plywood

## ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI AWS (2009) Architectural Woodwork Standards

## ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

ASME B18.2.2 (2010) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B18.6.1 (1981; R 2008) Wood Screws (Inch Series)

## ASTM INTERNATIONAL (ASTM)

ASTM F547 (2006; R 2012) Nails for Use with Wood and Wood-Base Materials

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.9 (2010) Cabinet Hardware

HARDWOOD PLYWOOD AND VENEER ASSOCIATION (HPVA)

HPVA HP-1 (2009) American National Standard for  
Hardwood and Decorative Plywood

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003 (2002) Standard Grading Rules for Southern  
Pine Lumber

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

WDMA I.S.4 (2013) Preservative Treatment for Millwork

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMPMA)

WMPMA WM 6 (1987) Industry Standard for Non-Pressure  
Treating of Wood Millwork

1.2 SUBMITTALS

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

SD-02 Shop Drawings

Detail Drawings - cabinets, vanities, wardrobes

1.3 DETAIL DRAWINGS - cabinets, vanities, wardrobes

The Contractor shall submit detail drawings showing fabricated items and  
special mill and woodwork items. Drawings shall indicate materials and  
details of construction, methods of fastening, erection, and installation.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver lumber, plywood, trim, and millwork to job site in an undamaged  
condition. Stack materials to ensure ventilation and drainage. Protect  
against dampness before and after delivery. Store materials under cover in  
a well-ventilated enclosure and protect against extreme changes in  
temperature and humidity. Do not store products in building until wet  
trade materials are dry.

1.5 QUALITY ASSURANCE

1.5.1 Lumber

Identify each piece or each bundle of lumber, millwork, and trim by the  
grade mark of a recognized association or independent inspection agency  
that is certified by the Board of Review, American Lumber Standards  
Committee, to grade the species.

1.5.2 Plywood

Each sheet of plywood shall bear the mark of a recognized association or  
independent inspection agency that maintains continuing control over  
quality of the plywood. Mark shall identify plywood by species group or  
span rating, and shall show exposure durability classification, grade, and



compliance with APA L870.

#### 1.5.3 Pressure-Treated Lumber and Plywood

Each treated piece shall be inspected in accordance with AWP A M2.

#### 1.5.4 Nonpressure-Treated Woodwork and Millwork

Mark, stamp, or label, indicating compliance with WDMA I.S.4.

#### 1.5.5 Fire-Retardant Treated Lumber

Each piece to bear Underwriters Laboratories label or the label of another nationally recognized independent testing laboratory.

### PART 2 PRODUCTS

#### 2.1 WOOD

##### 2.1.1 Sizes and Patterns of Wood Products

Yard and board lumber sizes shall conform to ALSC PS 20. Provide shaped lumber and millwork in the patterns indicated and standard patterns of the association covering the species. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the applicable standard.

##### 2.1.2 Trim, Finish, and Frames

Provide species and grades listed for materials to be paint finished. Provide materials that are to be stain, natural, or transparent finished one grade higher than that listed. Provide species indicated for materials to be transparent finished. Run trim, except window stools and aprons with hollow backs.

| <u>TABLE OF GRADES FOR WOOD TO RECEIVE PAINT FINISH</u> |                |   |
|---|----------------|---|
| <u>Grading Rules</u>                                    | <u>Species</u> | <u>Exterior and Interior Trim, Finish, and Frames</u> |
|   |                |   |

| <u>TABLE OF GRADES FOR WOOD TO RECEIVE PAINT FINISH</u> |                |   |
|---|----------------|---|
| <u>Grading Rules</u>                                    | <u>Species</u> | <u>Exterior and Interior Trim, Finish, and Frames</u> |
|   |                |   |
| SPIB 1003 standard grading rules                        | Southern Pine  | C & Btr   |
|   |                |   |
|   |                |   |
|   |                |   |
|   |                |   |
|   |                |   |
|   |                |   |
|   |                |   |

### 2.1.3 Hardwood Plywood

HPVA HP-1, Type II (Interior) Good (1) Grade, hardwood veneer core construction, face veneers of birch, of thickness indicated.

### 2.1.4 Shoe Mold

Clear red or white oak, 1/2 by 5/8 inch unless otherwise indicated.

## 2.2 COUNTER TOPS

### 2.2.1 Solid Surface

For solid surface counter tops refer to section 06 61 16, SOLID POLYMER (SOLID SURFACING) FABRICATIONS.

## 2.3 MOISTURE CONTENT OF WOOD PRODUCTS

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products at time of delivery to the job site, and when installed, shall be as follows:

- a. Interior Finish Lumber, Trim, and Millwork 1-1/4 Inches Nominal or Less in Thickness: 6 percent on 85 percent of the pieces and 8 percent on remainder.
- b. Exterior Treated and Untreated Finish Lumber and Trim 4 inches Nominal or Less in Thickness: 19 percent.

## 2.4 PRESERVATIVE TREATMENT OF WOOD PRODUCTS

### 2.4.1 Nonpressure Treatment

Treat woodwork and millwork, such as exterior trim, door trim, and window trim, in accordance with WDMA I.S.4, with either 2 percent copper napthenate, 3 percent zinc napthenate, or 1.8 percent copper-8-quinolinolate. Provide a liberal brushcoat of preservative treatment to field cuts and holes.

### 2.4.2 Pressure Treatment

Lumber and plywood used on the exterior of buildings or in contact with masonry or concrete shall be treated with water-borne preservative listed in AWPAs P5 as applicable, and inspected in accordance with AWPAs M2. Identify treatment on each piece of material by the quality mark of an agency accredited by the Board of Review of the American Lumber Standards Committee. Plywood shall be treated to a reflection level as follows:

Exterior wood molding and millwork within 18 inches of soil, in contact with water or concrete shall be preservative-treated in accordance with WMMPA WM 6. Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPAs M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil.

## 2.5 HARDWARE

Provide sizes, types, and spacings of manufactured building materials recommended by the product manufacturer except as otherwise indicated or specified.

### 2.5.1 Wood Screws

ASME B18.6.1.

### 2.5.2 Bolts, Nuts, Lag Screws, and Studs

ASME B18.2.1 and ASME B18.2.2.

### 2.5.3 Nails

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to

extend 1-1/2 inches into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

#### 2.5.4 Adjustable Shelf Standards

ANSI/BHMA A156.9, Type BO4071, with shelf rests Type BO4081.

#### 2.5.5 Vertical Slotted Shelf Standards

ANSI/BHMA A156.9, Type BO4102, with shelf brackets Type BO4112.

#### 2.5.6 Closet Hanger Rods

Chromium-plated steel rods, not less than 1 inch diameter by 18 gage. Rods may be adjustable with integral mounting brackets if smaller tube is 1 inch by 18 gage. Provide intermediate support bracket for rods more than 48 inches long.

### 2.6 FABRICATION

#### 2.6.1 Quality Standards (QS)

The terms "Premium," "Custom," and "Economy" refer to the quality grades defined in AWI AWS. Items not specified to be of a specific grade shall be Custom grade. The AWI QS is superseded by all contract document requirements indicated or stated herein.

#### 2.6.2 Cabinets

Wall and base cabinets and vanity cabinets shall be of the same construction and appearances. Fabricate with solid ends and frame fronts, or with frames all around. Frames shall be not less than 3/4 by 1-1/2 inches. Ends, bottom, back, partitions, and doors shall be plywood. Mortise and tenon, dovetail, or dowel and glue joints to produce a rigid unit. Doors, frames, and solid exposed ends shall be 3/4 inch thick; bottom, partitions, and framed ends 3/4 inch minimum; shelves 5/8 inch minimum; back 1/4 inch minimum.

##### 2.6.2.1 Cabinet Hardware

ANSI/BHMA A156.9. Provide cabinet hardware including two self-closing hinges for each door, two side-mounted metal drawer slides for each drawer and pulls for all doors and drawers as follows. Hardware exposed to view shall be satin chromium plated. All cabinet hardware shall comply with the following requirements:

- a. Provide concealed Euro-Style, back mounted hinges with opening to 165 degrees with self-closing feature at less than 90 degrees to its closed position.
- b. Drawer slides shall have a static rating capacity of 100 lbs. The slides shall have a self closing/stay-closed action, zinc or epoxy coated steel finish, ball bearing rollers, and positive stop with lift out design.
- c. Drawer pulls shall be wire type pulls with center-to-center dimension not less than 3-1/2 inches and cross sectional diameter of 5/16 inch. The handle projection shall be not less than 1-5/16 inches.

- d. Drawer catch shall be heavy duty magnetic catch.

#### 2.6.2.2 Finish

Provide a natural factory finish on wood surfaces after fabrication. Finish shall be fabricator's standard natural finish, except that it shall be equivalent to one coat of sealer and one coat of spar varnish on all surfaces and a second coat of spar varnish on surfaces exposed to view. Sand lightly and wipe clean between coats.

#### 2.6.3 Casework With Transparent Finish (CTF)

##### 2.6.3.1 AWI Quality Grade (CTF)

Custom grade.

##### 2.6.3.2 Construction (CTF)

Details shall conform to reveal overlay exposed face frame design.

##### 2.6.3.3 Exposed Parts

Birch specie, rotary cut.

##### 2.6.3.4 Semi-Exposed Parts

As specified in the AWI AWS for the grade selected.

#### 2.6.4 Casework With High Pressure Laminate Finish (CHPL)

##### 2.6.4.1 AWI Quality Grade (CHPL)

Custom grade.

##### 2.6.4.2 Construction (CHPL)

Details shall conform to flush overlay design.

##### 2.6.4.3 Exposed Surfaces

High pressure laminate, as selected from manufacturer's standard finishes. See the Drawings for color selection.

##### 2.6.4.4 Semi-Exposed Surfaces

As specified in the AWI AWS for the grade selected. The interior of the cabinet shall be thermoset decorative overlay (melamine). The back side of doors and all edges shall be clad with high pressure laminate finish which shall be the same laminate used on the exposed part of the door.

### PART 3 EXECUTION

#### 3.1 FINISH WORK

Provide sizes, materials, and designs as indicated and as specified. Apply primer to finish work before installing. Where practicable, shop assemble and finish items of built-up millwork. Joints shall be tight and constructed in a manner to conceal shrinkage. Miter trim and moldings at

exterior angles and cope at interior angles and at returns. Material shall show no warp after installation. Install millwork and trim in maximum practical lengths. Fasten finish work with finish nails. Provide blind nailing where practicable. Set face nails for putty stopping.

### 3.2 CLOTHES HANGER RODS

Provide clothes hanger rods where indicated and in closets having hook strips. Set rods parallel with front edges of shelves and support by sockets at each end and by intermediate brackets spaced not more than 4 feet o.c.

### 3.3 MISCELLANEOUS

#### 3.3.1 Counters

Construct as indicated. Conceal fastenings where practicable, fit counter neatly, install in a rigid and substantial manner, and scribe to adjoining surfaces. Provide counter sections in longest lengths practicable; keep joints in tops to a minimum; and where joints are necessary, provide tight hairline joints drawn up with concealed-type heavy pull-up bolts. Glue joints with water-resistant glue and, in addition, make rigid and substantial with screws, bolts, or other approved fastenings.

#### 3.3.2 Cabinets

Install level, plumb, and tight against adjacent walls. Secure cabinets to walls with concealed toggle bolts, and secure top to cabinet with concealed screws. Make cut-outs for fixtures to templates supplied by fixture manufacturer. Carefully locate cut-outs for pipes so that edges of holes will be covered by escutcheons.

-- End of Section --

## SECTION 06 61 16

SOLID POLYMER AND NATURAL QUARTZ (SOLID SURFACING) FABRICATIONS  
08/10

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

|                 |  |
|-----------------|--|
| ASTM C1026      | (2013) Standard Test Method for Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling  |
| ASTM C1028      | (2007; E 2010) Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method |
| ASTM C170/C170M | (2015) Standard Test Method for Compressive Strength of Dimension Stone  |
| ASTM C482       | (2014) Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste   |
| ASTM C484       | (2014) Standard Test Method for Thermal Shock Resistance of Glazed Ceramic Tile  |
| ASTM C501       | (1984; R 2009) Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser   |
| ASTM C97/C97M   | (2015) Absorption and Bulk Specific Gravity of Dimension Stone   |
| ASTM D 2583     | (2007) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor   |
| ASTM D 570      | (1998; R 2010e1) Standard Test Method for Water Absorption of Plastics   |
| ASTM D 638      | (2010) Standard Test Method for Tensile Properties of Plastics   |
| ASTM D696       | (2008; E 2013) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer          |

|  |  |
|--|--|
| ASTM E84   | (2015a) Standard Test Method for Surface Burning Characteristics of Building Materials |
| ASTM G 21  | (2009) Determining Resistance of Synthetic Polymeric Materials to Fungi                |
| INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO) |  |
| IAPMO Z124.3   | (2005) Plastic Lavatories  |
| IAPMO Z124.6   | (1997) Plastic Sinks   |
| NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)                   |  |
| ANSI/NEMA LD 3   | (2005) Standard for High-Pressure Decorative Laminates                                 |
| NSF INTERNATIONAL (NSF)  |  |
| NSF/ANSI 51  | (2009e) Food Equipment Materials   |
| TILE COUNCIL OF NORTH AMERICA (TCNA)                                   |  |
| TCA Hdbk   | (2010) Handbook for Ceramic Tile Installation  |

## 1.2 SYSTEM DESCRIPTION

- a. Work under this section includes countertops and other items utilizing solid polymer (solid surfacing) fabrication as shown on the drawings and as described in this specification. Do not change source of supply for materials after work has started, if the appearance of finished work would be affected.
- b. In most instances, installation of solid polymer fabricated components and assemblies will require strong, correctly located structural support provided by other trades. To provide a stable, sound, secure installation, close coordination is required between the solid polymer fabricator/installer and other trades to ensure that necessary structural wall support, cabinet counter top structural support, proper clearances, and other supporting components are provided for the installation of wall panels, countertops, shelving, and all other solid polymer fabrications to the degree and extent recommended by the solid polymer manufacturer.
- c. Appropriate staging areas for solid polymer fabrications. Allow variation in component size and location of openings of plus or minus 1/8 inch.

## 1.3 SUBMITTALS

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  
Shower Wall Panel System

## SD-06 Test Reports

Solid polymer material

## SD-07 Certificates

Fabrications  
Qualifications

## SD-10 Operation and Maintenance Data

Clean-up

## 1.4 QUALITY ASSURANCE

## 1.4.1 Qualifications

To ensure warranty coverage, solid polymer fabricators shall be certified to fabricate by the solid polymer material manufacturer being utilized. Mark all fabrications with the fabricator's certification label affixed in an inconspicuous location. Fabricators shall have a minimum of 5 years of experience working with solid polymer materials. Submit solid polymer manufacturer's certification attesting to fabricator qualification approval.

## 1.4.2 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 6 by 6 inch sample of each color and pattern for approval. Samples shall indicate full range of color and pattern variation. Approved samples shall be retained as a standard for this work. Submit test report results from an independent testing laboratory attesting that the submitted solid polymer material meets or exceeds each of the specified performance requirements.

## 2.1.1 Cast, 100 Percent Acrylic Polymer Solid Surfacing Material (SS-1)

Cast, 100 percent acrylic solid polymer material shall be composed of acrylic polymer, mineral fillers, and pigments and shall meet the following minimum performance requirements:

| PROPERTY                            | REQUIREMENT<br>(min. or max.)    | TEST PROCEDURE      |
|-------------------------------------|----------------------------------|---------------------|
| Tensile Strength                    | 5000 psi (min.)                  | ASTM D 638          |
| Hardness                            | 51-Barcol<br>Impressor (min.)    | ASTM D 2583         |
| Thermal Expansion                   | .000023 in/in/F (max.)           | ASTM D696           |
| Boiling water<br>Surface Resistance | No Change                        | ANSI/NEMA LD 3-3.05 |
| High Temperature<br>Resistance      | No Change                        | ANSI/NEMA LD 3-3.06 |
| Impact Resistance<br>(Ball drop)    |                                  | ANSI/NEMA LD 3-2000 |
| 1/4" sheet                          | 36", 1/2 lb<br>ball, no failure  |                     |
| 1/2" sheet                          | 140", 1/2 lb<br>ball, no failure |                     |
| 3/4" sheet                          | 200", 1/2 lb<br>ball, no failure |                     |
| Mold & Mildew<br>Growth             | No growth                        | ASTM G 21           |
| Bacteria Growth                     | No Growth                        | ASTM G 21           |
| Liquid<br>Absorption                |                                  |                     |

| PROPERTY            | REQUIREMENT<br>(min. or max.) | TEST PROCEDURE |
|---------------------|-------------------------------|----------------|
| (Weight in 24 hrs.) | 0.8% max.                     | ASTM D 570     |
| Flammability        |                               | ASTM E84       |
| Flame Spread        | 25 max.                       |                |
| Smoke Developed     | 30 max                        |                |
| Sanitation          | "Food Contact" approval       | NSF/ANSI 51    |

#### 2.1.2 Cast, 100 Percent Acrylic Polymer Solid Surfacing Material (SS-2)

Cast, 100 percent acrylic solid polymer material shall be composed of acrylic polymer, mineral fillers, and pigments and shall meet the following minimum performance requirements:

| PROPERTY                                    | REQUIREMENT<br>(min. or max.)    | TEST PROCEDURE      |
|---|----------------------------------|---------------------|
| Tensile Strength                            | 4000 psi (min.)                  | ASTM D 638          |
| Hardness                                    | 51-Barcol<br>Impressor (min.)    | ASTM D 2583         |
| Thermal Expansion                           | .000198 in/in/F (max.)           | ASTM D696           |
| Boiling water<br>Surface Resistance         | No Change                        | ANSI/NEMA LD 3-3.05 |
| High Temperature<br>Resistance              | No Change                        | ANSI/NEMA LD 3-3.06 |
| Impact Resistance<br>(Ball drop)            |                                  | ANSI/NEMA LD 3-303  |
| 1/4" sheet                                  | 36", 1/2 lb<br>ball, no failure  |                     |
| 1/2" sheet                                  | 140", 1/2 lb<br>ball, no failure |                     |
| 3/4" sheet                                  | 200", 1/2 lb<br>ball, no failure |                     |
| Mold & Mildew<br>Growth                     | No growth                        | ASTM G 21           |
| Bacteria Growth                             | No Growth                        | ASTM G 21           |
| Liquid<br>Absorption<br>(Weight in 24 hrs.) | 0.1% max.                        | ASTM D 570          |
| Flammability                                |                                  | ASTM E84            |
| Flame Spread                                | 25 max.                          |                     |
| Smoke Developed                             | 30 max                           |                     |

| PROPERTY   | REQUIREMENT<br>(min. or max.) | TEST PROCEDURE |
|------------|-------------------------------|----------------|
| Sanitation | "Food Contact" approval       | NSF/ANSI 51    |

### 2.1.3 Material Patterns and Colors

Patterns and colors for all solid polymer components and fabrications shall be those indicated on the project drawings. Pattern and color shall occur, and shall be consistent in appearance, throughout the entire depth (thickness) of the solid polymer material.

### 2.1.4 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 4 inches high unless indicated otherwise on the drawings. Backsplashes and end splashes shall be provided for all counter tops and at locations indicated on the drawings. Backsplashes shall be shop fabricated and be permanently attached.

#### 2.3.3.1 Permanently Attached Backsplash

Permanently attached backsplashes shall be attached straight with seam adhesive to form a 90 degree transition.

#### 2.3.3.2 End Splashes

End splashes shall be provided loose for installation at the jobsite after horizontal surfaces to which they are to be attached have been installed.

### 2.3.4 Counter and Vanity Tops

Fabricate all solid surfacing, solid polymer counter top and vanity top components from 1/2 inch thick material. Edge details, dimensions, locations, and quantities shall be as indicated on the Drawings. Counter tops shall be complete with 4 inch high permanently attached, 90 degree transition at all locations. Attach 2 inch wide reinforcing strip of polymer material under each horizontal counter top seam. Submit a minimum 1 foot wide by 6 inch deep, full size sample for each type of counter top shown on the project drawings. The sample shall include the edge profile and backsplash as detailed on the project drawings. Solid polymer material

shall be of a pattern and color as indicated on the drawings. Sample shall include at least one seam. Approved sample shall be retained as standard for this work.

#### 2.3.4.1 Vanity Tops With Bowls

- a. Solid polymer bowls shall be a solid polymer manufacturer's standard, pre-molded product specifically designed for attachment (undermount) to solid polymer counter tops.

#### 2.3.5 Solid Polymer Vanity Bowls

Solid polymer vanity bowls shall be a standard product of the solid polymer manufacturer, designed specifically to be attached to (undermount) solid polymer vanity tops. Bowls shall be of the same polymer composition as the adjoining counter top. Bowl design shall support a seam adhesive undermount installation method. The bowl and countertop shall align for a flush mount with inconspicuous seams. Bowl dimensions shall be 18" side-to-side, 11" front-to-side, and 5-1/2" depth.

#### 2.3.6 Shower Wall Panel System

Tub/shower wall enclosures shall provide a system of solid polymer components to include: panels, corner trim, and panel edge trim. Dimensions of all components shall be as indicated on the drawings. Panels shall be formed from manufacturer's standard 1/4 inch thick sheet product. Panels shall be full width and height with seams occurring only at the inside corners of the enclosure. Panels shall have a smooth, honed finish.

#### 2.4 Natural Quartz Countertop (QTZ-1)

Provide a pure natural quartz surface for the countertop where indicated on the drawings. The countertop shall be a thickness of 2 cm and shall have a polished finish.

#### Product Performance Data

| Test                              | Typical Result               | Method            |
|-----------------------------------|------------------------------|-------------------|
| Moisture Absorption               | 0.02%                        | ASTM C97/C97MASTM |
| C97                               |                              |                   |
| Compressive Strength              | 24,750 psi                   | ASTM C170/C170M   |
| Abrasion Resistance               | 139                          | ASTM C501         |
| Bond Strength                     | 164 psi                      | ASTM C482         |
| Thermal Shock                     | Passes-5 cycles              | ASTM C484         |
| Coefficient of Thermal Expansion  | 1.2x10 <sup>-5</sup> inch/°F | ASTM D696         |
| Resistance to Freeze Thaw Cycling | Unaffected-15 cycles         | ASTM C1026        |
| Coefficient of Friction           | .75 dry / .51 wet            | ASTM C1028        |
| Pull Method                       |                              |                   |
| Surface Burning Characteristics   | Class A                      | ASTM E84          |
| Stain Resistance                  | Unaffected                   |                   |

### 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. Solid polymer sinks and bowls shall be installed using a color-matched seam adhesive. Plumbing connections to sinks and lavatories shall be made in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

#### 3.1.1.1 Wall Panels & Panel Systems

Installation of wall panels and system components to substrates shall be a adhesive which is required by the panel manufacturer. Depending on the condition (flatness) of the existing wall surface, if required, provide additional adhesive to ensure contact between the substrate and the wall panel. Provide a water or oil-based primer/sealer on the substrate as required by the panel manufacturer. Use seam adhesive to adhere all solid polymer components to each other with the exception of expansion joints and inside corners. All inside corners and expansion joints between solid polymer components shall be joined with silicone sealant. All joints between solid polymer components and non-solid polymer surfaces shall be sealed with a clear silicone sealant.

#### 3.1.2 Silicone Sealant

Use a clear, silicone sealant or caulk to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures. Sealant bead shall be smooth and uniform in appearance and shall be the minimum size necessary to bridge any gaps between the solid surfacing material and the adjacent surface. Bead shall be continuous and run the entire length of the joint being sealed.

#### 3.1.3 Plumbing

Make plumbing connections to sinks and lavatories in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

#### 3.2 CLEAN-UP

Components shall be cleaned after installation and covered to protect against damage during completion of the remaining project items. Components damaged after installation by other trades will be repaired or replaced at the General Contractor's cost. Component supplier will provide a repair/replace cost estimate to the General Contractor who shall approve estimate before repairs are made. Submit a minimum of six copies of maintenance data indicating manufacturer's care, repair and cleaning instructions. Maintenance video shall be provided, if available. Maintenance kit for matte finishes shall be submitted.

-- End of Section --

## SECTION 07 11 13

## BITUMINOUS DAMPPROOFING

08/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

|                   |  |
|-------------------|--|
| ASTM D 1227       | (1995; R 2007) Emulsified Asphalt Used as a Protective Coating for Roofing |
| ASTM D 4263       | (1983; R 2005) Indicating Moisture in Concrete by the Plastic Sheet Method |
| ASTM D 4479       | (2007) Asphalt Roof Coatings - Asbestos-Free                               |
| ASTM D1187/D1187M | (2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal     |
| ASTM D41/D41M     | (2011) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing     |

## 1.2 SUBMITTALS

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

SD-07 Certificates

Materials

## 1.3 DELIVERY AND STORAGE

Deliver materials in sealed containers bearing manufacturer's original labels. Labels shall include date of manufacture, contents of each container, performance standards that apply to the contents and recommended shelf life.

## PART 2 PRODUCTS

## 2.1 ASPHALT PRIMER

ASTM D41/D41M.

## 2.2 FIBROUS ASPHALT

ASTM D 4479, Type I for horizontal surfaces, Type II for vertical surfaces.



## 2.3 EMULSION-BASED ASPHALT DAMPPROOFING

### 2.3.1 Non-Fibrated Emulsion-Based Asphalt

Non-fibrated emulsion-based asphalt dampproofing shall be cold-applied type conforming to ASTM D1187/D1187M Type II or ASTM D 1227 Type III, manufactured of refined asphalt, emulsifiers and selected clay. Asphalt shall contain a minimum 58 percent solids by weight, 55 percent solids by volume.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Clean masonry surfaces to receive dampproofing of foreign matter and loose particles. Apply dampproofing to clean dry surfaces. Moisture test in accordance with ASTM D 4263. If test indicates moisture, allow a minimum of 7 additional days after test completion for curing. If moisture still exists, redo test until substrate is dry.

### 3.2 Protection of Surrounding Areas

Before starting the dampproofing work, the surrounding areas and surfaces shall be protected from spillage and migration of dampproofing material onto other work.

### 3.3 APPLICATION

Prime surfaces to receive fibrous asphaltic dampproofing unless recommended otherwise by dampproofing materials manufacturer. Apply dampproofing after priming coat is dry, but prior to any deterioration of primed surface, and when ambient temperature is above 40 degrees F.

#### 3.3.1 Cold-Application Method

##### 3.3.1.1 Emulsion-Based Asphalt

Emulsion-based asphalt dampproofing work shall not be performed in temperatures below 40 degrees F. Emulsions shall have a smooth and uniform consistency at time of application. Dampproofing materials shall be applied in accordance with manufacturer's published instructions to produce a smooth uniform dry film of not less than 12 mils thick without voids or defects. Dull or porous spots shall be recoated. Dampproofing materials shall seal tightly around pipes and other items projecting through dampproofing. Rates of application shall be as follows:

- a. Primer: 1/2 gallon per 100 square feet, cold-applied.
- b. Fibrated Dampproofing: 2 gallons per 100 square feet, cold-applied with spray, brush or trowel.
- c. Non-fibrated Dampproofing: 2 gallons per 100 square feet, cold-applied with spray, brush or trowel.

-- End of Section --

## SECTION 07 19 00

## WATER REPELLENTS

05/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 501.1 (2005) Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure

## AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 259 (2002; R 2006) Standard Method of Test for Resistance of Concrete to Chloride Ion Penetration

AASHTO T 260 (1997; R 2009) Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials

## ASTM INTERNATIONAL (ASTM)

ASTM C 140 (2011) Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units

ASTM C 672/C 672M (2003) Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals

ASTM D 2369 (2010) Volatile Content of Coatings

ASTM D 3278 (1996; R 2004e1) Flash Point of Liquids by Small Scale Closed-Cup Apparatus

ASTM E 514/E 514M (2009) Standard Test Method for Water Penetration and Leakage Through Masonry

ASTM E 96/E 96M (2010) Standard Test Methods for Water Vapor Transmission of Materials

ASTM G 154 (2006) Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

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

29 CFR 1910.1000 Air Contaminants

## 1.2 SUBMITTALS

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

### SD-03 Product Data

Water repellents

### SD-06 Test Reports

Water absorption

Accelerated weathering

Resistance to chloride ion penetration

Moisture vapor transmission

Scaling resistance

Water Penetration and Leakage

### SD-07 Certificates

Manufacturer's qualifications

Applicator's qualifications

Evidence of acceptable variation

Warranty

### SD-08 Manufacturer's Instructions

Application instructions

Provide manufacturer's instructions including preparation, application, recommended equipment to be used, safety measures, and protection of completed application.

Manufacturer's material safety data sheets

## 1.3 QUALITY ASSURANCE

### 1.3.1 Qualifications

- a. Manufacturer's qualifications: Minimum five years record of successful in-service experience of water repellent treatments manufactured for concrete, and brick masonry application.
- b. Applicator's qualifications: Minimum five years successful experience in projects of similar scope using specified or similar treatment materials and manufacturer's approval for application.

### 1.3.2 Performance Requirements

- a. Water absorption: ASTM C 140. Comparison of treated and untreated specimens.

- b. Moisture vapor transmission: ASTM E 96/E 96M. Comparison of treated and untreated specimens.
- c. Water penetration and leakage through masonry: ASTM E 514/E 514M.

#### 1.3.3 Evidence of Acceptable Variation

If a product proposed for use does not conform to requirements of the referenced specification, submit for approval to the Contracting Officer, evidence that the proposed product is either equal to or better than the product specified. Include the following:

- a. Identification of the proposed substitution;
- b. Reason why the substitution is necessary;
- c. A comparative analysis of the specified product and the proposed substitution, including tabulations of the composition of pigment and vehicle;
- d. The difference between the specified product and the proposed substitution; and
- e. Other information necessary for an accurate comparison of the proposed substitution and the specified product.

#### 1.4 SAMPLE TEST PANEL

The approved Sample Test Panel will serve as the standard of quality for all other water repellent coating work. Do not proceed with application until the sample panel has been approved by the Contracting Officer.

##### 1.4.1 Sample Test Panel

Prior to commencing work, including bulk purchase and delivery of material, apply water repellent treatment to a minimum 4 feet high by 4 feet long concrete, and brick masonry section on the Building.

#### 1.5 REGULATORY REQUIREMENTS

##### 1.5.1 Environmental Protection

In addition to requirements specified in Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS for environmental protection, provide coating materials that conform to the restrictions of the Local Air Pollution Control jurisdiction. Notify the Contracting Officer of any water repellent coating specified herein which fails to conform to the local Air Quality Management District Rules at the location of the Project. In localities where the specified coating is prohibited, the Contracting Officer may direct the substitution of an acceptable coating.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials in original sealed containers, clearly marked with the manufacturer's name, brand name, type of material, batch number, percent solids by weight and volume, and date of manufacturer. Store materials off the ground, in a dry area where the temperature will be not less than 50 degrees F nor more than 85 degrees F.

## 1.7 SAFETY METHODS

Apply coating materials using safety methods and equipment in accordance with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS, and the following:

### 1.7.1 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

- a. The coating manufacturer when using solvents or other chemicals. Use impermeable gloves, chemical goggles or face shield, and other recommended protective clothing and equipment to avoid exposure of skin, eyes, and respiratory system. Conduct work in a manner to minimize exposure of building occupants and the general public.
- b. 29 CFR 1910.1000.
- c. Threshold Limit Values (R) of the American Conference of Governmental Industrial Hygienists.
- d. Manufacturer's material safety data sheets.

## 1.8 ENVIRONMENTAL CONDITIONS

### 1.8.1 Weather and Substrate Conditions

Do not proceed with application of water repellents under any of the following conditions, except with written recommendations of manufacturer.

- a. Ambient temperature is less than 40 degrees F.
- b. Substrate faces have cured less than one month.
- c. Rain or temperature below 40 degrees F are predicted for a period of 24 hours before or after treatment.
- d. Earlier than three days after surfaces are wet.
- e. Substrate is frozen or surface temperature is less than 40 degrees F and falling.

### 1.8.2 Moisture Condition

Determine moisture content of substrate meets manufacturer's requirements prior to application of water repellent material.

## 1.9 SEQUENCING AND SCHEDULING

### 1.9.1 Masonry Surfaces

Do not start water repellent coating until cleaning operations have been completed.

### 1.9.2 Concrete Surfaces

Do not start water repellent coating until all patching, pointing and cleaning operations have been completed and concrete has cured a minimum of

30 days under normal weather conditions.

### 1.9.3 Sealants

Do not apply water repellents until the sealants for joints adjacent to surfaces receiving water repellent treatment have been installed and cured.

- a. Water repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.
- b. Provide manufacturers' test results of compatibility.

### 1.10 INSPECTIONS

Notify the manufacturer's representative a minimum of 72 hours prior to scheduled application of water repellents for field inspection. Inspect surfaces and obtain approval in writing from the manufacturer's representative prior to any application of any water repellent coating.

### 1.11 SURFACES TO BE COATED

Coat all exterior concrete, and brick masonry surfaces. This includes all edges and returns adjacent to windows and door frames and free standing walls.

### 1.12 WARRANTY

Provide a warranty, issued jointly by the manufacturer and the applicator of the water repellent treatment against moisture penetration through the treated structurally sound surface for a period of five years. Warranty to provide the material, labor, and equipment necessary to remedy the problem. At the satisfactory completion of the work, complete the warranty sign, notarize, and submit to the Contracting Officer.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Water repellent solution shall be a clear, non-yellowing, deep-penetrating, VOC compliant solution. Material shall not stain or discolor and shall produce a mechanical and chemical interlocking bond with the substrate to the depth of the penetration.

### 2.2 WATER REPELLENTS

#### 2.2.1 Siloxanes

Penetrating water repellent. Alkylalkoxysiloxanes that are oligomeric with alcohol, ethanol, mineral spirits, or water.

- a. Solids by weight: ASTM D 2369, 7.5 to 16.0 percent.
- b. Volatile Organic Content (VOC) after blending: Less than 175 grams per liter.
- c. Density, activated: 8.4 pounds per gallon, plus or minus one percent.

- d. Flash point, ASTM D 3278: Greater than 212 degrees F.

### 2.2.2 VOC-Complying Water Repellents

Products certified by the manufacturer that they comply with local regulations controlling use of volatile organic compounds (VOC's).

## 2.3 PERFORMANCE CRITERIA

### 2.3.1 Siloxanes

- a. Dry time for recoat, if necessary: One to two hours depending on weather conditions.
- b. Penetration: 3/8 inch, depending on substrate.
- c. Water penetration and leakage through masonry, ASTM E 514/E 514M, percentage reduction of leakage: 97.0 percent minimum.
- d. Moisture vapor transmission, ASTM E 96/E 96M: 47.5 perms or 82 percent maximum compared to untreated sample.
- e. Resistance to accelerated weathering, ASTM G 154. Testing 2,500 hours: No loss in repellency.
- f. Resistance to chloride ion penetration, AASHTO T 259 and AASHTO T 260.
- g. Scaling resistance, ASTM C 672/C 672M, non-air-entrained concrete: Zero rating, no scaling, 100 cycles treated concrete.

## 3.1 EXAMINATION

Examine concrete and brick masonry surfaces to be treated to ensure that:

- a. All visible cracks, voids or holes have been repaired.
- b. All mortar joints in masonry are tight and sound, have not been re-set or misaligned and show no cracks or spalling.
- c. Moisture contents of walls does not exceed 15 percent when measured on an electronic moisture register, calibrated for the appropriate substrate.
- d. Concrete surfaces are free of form release agents, curing compounds and other compounds that would prevent full penetration of the water repellent material.

Do not start water repellent treatment work until all deficiencies have been corrected, examined and found acceptable to the Contracting Officer and the water repellent treatment manufacturer. Do not apply treatment to damp, dirty, dusty or otherwise unsuitable surfaces. Comply with the manufacturer's recommendations for suitability of surface.

## 3.2 PREPARATION

### 3.2.1 Surface Preparation

Prepare substrates in accordance with water repellent treatment manufacturer's recommendation. Clean surfaces of dust, dirt,

efflorescence, alkaline, and foreign matter detrimental to proper application of water repellent treatment.

### 3.2.2 Protection

Provide masking or protective covering for materials which could be damaged by water repellent treatment.

- a. Protect glass, glazed products, and prefinished products from contact with water repellent treatment.
- b. Protect landscape materials with breathing type drop cloths: plastic covers are not acceptable.

### 3.2.3 Compatibility

- a. Confirm treatment compatibility with each type of joint sealer within or adjacent to surfaces receiving water repellent treatment in accordance with manufacturer's recommendations.
- b. When recommended by joint sealer manufacturer, apply treatment after application and cure of joint sealers. Coordinate treatment with joint sealers.

## 3.3 MIXING

Mix water repellent material thoroughly in accordance with the manufacturer's recommendations. Mix, in quantities required for that days work, all containers prior to application. Mix each container the same length of time.

## 3.4 APPLICATION

In strict accordance with the manufacturers written requirements. Do not start application without the manufacturer's representative being present or his written acceptance of the surface to be treated.

### 3.4.1 Water Repellent Treatment

#### 3.4.1.1 Spray Application

Spray apply water repellent material to exterior concrete and brick masonry surfaces using low-pressure airless spray equipment in strict accordance with manufacturer's printed application instructions and precautions. Maintain copies at the job site. Apply flood coat in an overlapping pattern allowing approximately 8 to 10 inch rundown on the vertical surface. Maintain a wet edge at all overlaps, both vertical and horizontal. Hold gun maximum 18 inches from wall.

#### 3.4.1.2 Brush or Roller Application

Brush or roller apply water repellent material only at locations where overspray would affect adjacent materials and where not practical for spray applications.

#### 3.4.1.3 Rate of Application

Apply materials to exterior surfaces at the coverages recommended by the manufacturer and as determined from sample panel test. Increase or decrease



application rates depending upon the surface texture and porosity of the substrate so as to achieve even appearance and total water repellency.

#### 3.4.1.4 Appearance

If unevenness in appearance, lines of work termination or scaffold lines exist, or detectable changes from the approved sample panel occur, the Contracting Officer may require additional treatment at no additional cost to the Government. Apply any required additional treatment to a natural break off point.

### 3.5 CLEANING

Clean all runs, drips, and overspray from adjacent surfaces while the water repellent treatment is still wet in a manner recommended by the manufacturer.

### 3.6 FIELD QUALITY CONTROL

Do not remove drums containing water repellent material from the job site until completion of all water repellent treatment and until so authorized by the Contracting Officer.

#### 3.6.1 Field Testing

AAMA 501.1. At a time not less than twenty days after completion of the water repellent coating application, subject a representative wall area of the building to the Navy Hose Stream Field Test similar to AAMA 501.1 hose test to simulated rainfall for a period of three hours. Use a minimum 5/8 inch diameter hose and a fixed lawn sprinkler spray head which will direct a full flow of water against the wall. Place the sprinkler head so that the water will strike the wall downward at a 45 degree angle to the wall. If the inside of the wall shows any trace of moisture during or following the test, apply another coat of water repellent, at the manufacturer's recommended coverage rate to the entire building. Repeat testing and re-coating process until no moisture shows on the inside wall face. Accomplish any required work retesting and re-coating at no additional cost to the Government.

#### 3.6.2 Site Inspection

Inspect treatment in progress by manufacturer's representative to verify compliance with manufacturer instructions and recommendations.

-- End of Section --

## SECTION 07 21 13

## BOARD AND BLOCK INSULATION

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.

## ASTM INTERNATIONAL (ASTM)

|                 |  |
|-----------------|--|
| ASTM C 203      | (2005a) Breaking Load and Flexural Properties of Block-Type Thermal Insulation                           |
| ASTM C 272      | (2001; R 2007) Water Absorption of Core Materials for Structural Sandwich Constructions                  |
| ASTM C 578      | (2015) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation                         |
| ASTM C 930      | (2005) Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories |
| ASTM D 1621     | (2010) Compressive Properties of Rigid Cellular Plastics   |
| ASTM E 136      | (2011) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C                                 |
| ASTM E 84       | (2015a) Standard Test Method for Surface Burning Characteristics of Building Materials                   |
| ASTM E 96/E 96M | (2010) Standard Test Methods for Water Vapor Transmission of Materials                                   |

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

|          |  |
|----------|--|
| NFPA 211 | (2010) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances   |
| NFPA 31  | (2011) Standard for the Installation of Oil-Burning Equipment  |
| NFPA 54  | (2012) National Fuel Gas Code  |
| NFPA 70  | (2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code |

## 1.2 SUBMITTALS

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

### SD-03 Product Data

Block or board insulation

Accessories

### SD-08 Manufacturer's Instructions

Block or Board Insulation

Adhesive

## 1.3 DELIVERY, STORAGE, AND HANDLING

### 1.3.1 Delivery

Deliver materials to the 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 Other Safety Considerations

Consider safety concerns and measures as outlined in ASTM C 930.

## PART 2 PRODUCTS

### 2.1 BLOCK OR BOARD INSULATION

Provide only thermal insulating materials recommended by manufacturer for type of application indicated. Provide board or block thermal insulation conforming to the following standards and the physical properties listed below:

- a. Extruded Preformed Cellular Polystyrene: ASTM C 578

#### 2.1.1 Thermal Resistance

As indicated.

### 2.1.2 Fire Protection Requirement

- a. Flame spread index of 5 or less when tested in accordance with ASTM E 84.
- b. Smoke developed index of 150 or less when tested in accordance with ASTM E 84.

### 2.1.3 Other Material Properties

Provide thermal insulating materials with the following properties:

- a. Rigid cellular plastics: Compressive Resistance at Yield: Not less than 15 pounds per square inch (psi) when measured according to ASTM D 1621.
- b. Flexural strength: Not less than 40 psi when measured according to ASTM C 203.
- c. Water Vapor Permeance: Not more than 1.1 perms or less when measured according to ASTM E 96/E 96M, desiccant method, in the thickness required to provide the specified thermal resistance, including facings, if any.
- d. Water Absorption: Not more than 0.1 percent by total immersion, by volume, when measured according to ASTM C 272.

### 2.1.4 Prohibited Materials

Do not provide materials containing more than one percent of asbestos.

## 2.2 DAMPPROOFING

### 2.2.1 Dampproofing for Masonry Cavity Walls

Bituminous material is specified in Section 07 11 13 BITUMINOUS DAMPPROOFING.

## 2.3 ACCESSORIES

### 2.3.1 Adhesive

As recommended by insulation manufacturer.

### 2.3.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

## PART 3 EXECUTION

### 3.1 EXISTING CONDITIONS

Before installing insulation, ensure that all 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 installing perimeter or under slab insulation, check that the fill is flat, smooth, dry, and well tamped. If moisture or other conditions are found that do not allow the proper installation of the insulation, do not proceed but notify the Contracting Officer of such conditions.

### 3.2 PREPARATION

#### 3.2.1 Blocking Around Heat Producing Devices

Unless using insulation board that passes ASTM E 136 in addition to the requirements in Part 2, install non-combustible blocking around heat producing devices to provide the following clearances:

- a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 24 inches above fixture.
- b. Vents and vent connectors used for venting products of combustion, flues, and chimneys other than masonry chimneys: minimum clearances as required by NFPA 211.
- c. Gas Fired Appliances: Clearances as required in NFPA 54.
- d. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking is not required if chimneys or flues are certified by the Manufacturer for use in contact with insulating materials.

### 3.3 INSTALLATION

#### 3.3.1 Insulation Board

Install and handle insulation in accordance with the manufacturer's installation instructions. Keep material dry and free of extraneous materials. Observe safe work practices.

#### 3.3.2 Electrical Wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

#### 3.3.3 Cold Climate Requirement

Place insulation to the outside of pipes.

#### 3.3.4 Continuity of Insulation

Butt tightly against adjoining boards, studs, rafters, joists, sill plates, headers and obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joint, roof, and floor. Avoid creating any thermal bridges or voids.

### 3.4 INSTALLATION ON WALLS

#### 3.4.1 Installation on Masonry Walls

Apply board directly to masonry with adhesive or fasteners as recommended by the insulation manufacturer. Fit between obstructions without impaling board on ties or anchors. Apply in parallel courses with joints breaking midway over course below. Put ends in moderate contact with adjoining insulation without forcing. Cut and shape as required to fit around wall penetrations, projections or openings to accommodate conduit or other

services. Seal around cut-outs with sealant. Install board in wall cavities so that it leaves at least a nominal one inch free air space outside of the insulation to allow for cavity drainage.

#### 3.4.2 Adhesive Attachment to Concrete and Masonry Walls

Apply adhesive to wall and completely cover wall with insulation.

c. As recommended by the insulation manufacturer.

#### 3.5 PERIMETER AND UNDER SLAB INSULATION

##### 3.5.1 Manufacturer's Instructions

Install, attach, tape edges, provide vapor retarder and other requirements such as protection against vermin, insects, damage during construction as recommended in manufacturer's instructions.

##### 3.5.2 Insulation on Vertical Surfaces

Install thermal insulation as indicated.

-- End of Section --

## SECTION 07 60 00

## FLASHING AND SHEET METAL

08/08

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

|                 |  |
|-----------------|--|
| ASTM A 167      | (2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip |
| ASTM A792/A792M | (2010) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process         |
| ASTM B 32       | (2008) Standard Specification for Solder Metal   |
| ASTM D 41       | (2005) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing                                       |
| ASTM D 4586     | (2007) Asphalt Roof Cement, Asbestos-Free  |

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

|             |  |
|-------------|--|
| SMACNA 1793 | (2012) Architectural Sheet Metal Manual, 7th Edition |
|-------------|--|

## 1.2 GENERAL REQUIREMENTS

Finished sheet metalwork will form a weathertight construction without waves, warps, buckles, fastening stresses or distortion, which allows for expansion and contraction. Sheet metal mechanic is responsible for cutting, fitting, drilling, and other operations in connection with sheet metal 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 roofing operations.

## 1.3 SUBMITTALS

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

SD-02 Shop Drawings

Gutters

## Downspouts

### Counter-flashing

Indicate thicknesses, dimensions, fastenings and 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.

### SD-11 Closeout Submittals

#### Quality Control Plan

Submit for sheet metal work in accordance with paragraph entitled "Field Quality Control."

## 1.4 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 immediately before installation.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Do not use lead, lead-coated metal, or galvanized steel. Conform to the requirements specified and to the thicknesses and configurations established in SMACNA Arch. Manual for the materials.

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 Steel Sheet, Aluminum-Zinc-Coated

ASTM A792/A792M AZ50.

##### 2.1.1.1 Finish

Exposed exterior items of aluminum-zinc-coated steel sheet must have a baked-on, factory-applied color coating of polyvinylidene fluoride or other equivalent fluorocarbon coating applied after metal substrates have been cleaned and pretreated. Provide finish coating dry-film thickness of 0.8 to 1.3 mils and color which matches the existing gutter/downspout color.



### 2.1.2 Stainless Steel

ASTM A 167, Type 302 or 304, 2D Finish, fully annealed, dead-soft temper.

### 2.1.3 Solder

ASTM B 32, 95-5 tin-antimony.

### 2.1.4 Bituminous Plastic Cement

ASTM D 4586, Type I.

### 2.1.5 Asphalt Primer

ASTM D 41.

### 2.1.6 Fasteners

Use the same metal or a metal compatible with the item fastened. Use stainless steel fasteners to fasten 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 Nailing

Confine nailing of sheet metal generally to sheet metal having a maximum width of 18 inch. Confine nailing of flashing to one edge only. Space nails evenly not over 3 inch on center and approximately 1/2 inch from edge unless otherwise specified or indicated. Face nailing will not be permitted. Where sheet metal is applied to other than wood surfaces, include in shop drawings, the locations for sleepers and nailing strips required to secure the work.

#### 3.1.3 Cleats

Provide continuous cleats for sheet metal as shown on the Drawings. Cleats shall be of the same material and thickness as the sheet metal being installed. Secure one end of the cleat with two nails and the cleat folded back over the nailheads. Lock the other end into the seam. Where the fastening is to be made to concrete or masonry, use screws and drive in expansion shields set in concrete or masonry. Prein cleats for soldered

seams.

#### 3.1.4 Bolts, Rivets, and Screws

Install bolts, rivets, and screws where indicated or required. Provide compatible washers where required to protect surface of sheet metal and to provide a watertight connection. Provide mechanically formed joints in aluminum sheets 0.040 inch or less in thickness.

#### 3.1.5 Seams

Straight and uniform in width and height with no solder showing on the face.

##### 3.1.5.1 Flat-lock Seams

Finish not less than 3/4 inch wide.

##### 3.1.5.2 Lap Seams

Finish soldered seams not less than one inch wide. Overlap seams not soldered, not less than 3 inch.

##### 3.1.5.3 Loose-Lock Expansion Seams

Not less than 3 inch wide; provide minimum one inch movement within the joint. Completely fill the joints with the specified sealant, applied at not less than 1/8 inch thick bed.

##### 3.1.5.4 Flat Seams

Make seams in the direction of the flow.

#### 3.1.6 Soldering

Where soldering is specified, apply to copper, terne-coated stainless steel, zinc-coated steel, and stainless steel items. Pretin edges of sheet metal before soldering is begun. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

##### 3.1.6.1 Edges

Scrape or wire-brush the edges of lead-coated material to be soldered to produce a bright surface. Flux brush the seams in before soldering. Treat with soldering acid flux the edges of stainless steel to be pretinned. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

#### 3.1.7 Protection from Contact with Dissimilar Materials

##### 3.1.7.1 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.

##### 3.1.7.2 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.

#### 3.1.1.7.3 Metal Surfaces

Paint surfaces in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

#### 3.1.1.7.4 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.

#### 3.1.1.8 Expansion and Contraction

Provide expansion and contraction joints at not more than 16 foot intervals.

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.

#### 3.1.1.9 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 and 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 inch 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 metals.

#### 3.1.1.10 Downspouts

Space supports for downspouts according to the manufacturer's recommendation for the masonry 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.

### 3.2 PAINTING

Field-paint sheet metal for separation of dissimilar materials.

### 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.

### 3.5 FIELD QUALITY CONTROL

Establish and maintain a Quality Control Plan for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Remove work that is not in compliance with the contract and replace or correct. Include quality control, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.
- b. Verification that specified material is provided and installed.
- c. Inspection of sheet metalwork, for proper size(s) and thickness(es), fastening and joining, and proper installation.

#### 3.5.1 Procedure

Submit for approval prior to start of roofing work. Include a checklist of points to be observed. Document the actual quality control observations and inspections. Furnish a copy of the documentation to the Contracting Officer at the end of each day.

| TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES |  |               |                            |  |  |
|--|--|---------------|----------------------------|--|--|
| Sheet Metal Items                                    |  | Alumi<br>inch | Stainles<br>Steel,<br>inch |  | Aluminum-Zinc-Coated<br>Steel, U.S. Std.<br>Gage |
|  |  |               |                            |  |  |
|  |  |               |                            |  |  |
|  |  |               |                            |  |  |
|  |  |               |                            |  |  |
| Downspouts and leaders                               |  |               |                            |  | 24   |

| TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES |   |                              |                            |  |  |
|--|---|------------------------------|----------------------------|--|--|
| Sheet Metal Items                                    |   | Alumi<br>inch                | Stainles<br>Steel,<br>inch |  | Aluminum-Zinc-Coated<br>Steel, U.S. Std.<br>Gage |
| Downspout clips and<br>anchors                       | - | .040<br>clip<br>.125<br>anch |                            |  |  |
| Downspout straps, 2-inch                             |   | .060                         |                            |  |  |
|  |   |                              |                            |  |  |
|  |   |                              |                            |  |  |
|  |   |                              |                            |  |  |
| <b>Flashings:</b>                                    |   |                              |                            |  |  |
|  |   |                              |                            |  |  |
| Counter-flashing                                     |   |                              |                            |  | 24   |
|  |   |                              |                            |  |  |
|  |   |                              |                            |  |  |
|  |   |                              |                            |  |  |
|  |   |                              |                            |  |  |
|  |   |                              |                            |  |  |
|  |   |                              |                            |  |  |
|  |   |                              |                            |  |  |
| Pipe vent sleeve (d)                                 |   |                              |                            |  |  |
|  |   |                              |                            |  |  |
|  |   |                              |                            |  |  |
|  |   |                              |                            |  |  |
|  |   |                              |                            |  |  |
| Trim: Sheets, smooth                                 |   |                              |                            |  | 24   |

| TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES   |  |                                   |                            |   |  |
|--|--|-----------------------------------|----------------------------|---|--|
| Sheet Metal Items  |  | Alumi<br>inch                     | Stainles<br>Steel,<br>inch |   | Aluminum-Zinc-Coated<br>Steel, U.S. Std.<br>Gage |
|  |  |                                   |                            |   |  |
| <b>Gutters:</b>  |  |                                   |                            |   |  |
| Gutter section   |  |                                   |                            |   | 24   |
| Continuous cleat   |  |                                   |                            |   | 24   |
| Hangers, dimensions  |  | 1<br>inch<br>by .0<br>inch<br>(c) |                            | - |  |
| Joint Cover plates (See<br>Table II)   |  |                                   |                            |   | 24   |
|  |  |                                   |                            |   |  |
|  |  |                                   |                            |   |  |
|  |  |                                   |                            |   |  |
|  |  |                                   |                            |   |  |
|  |  |                                   |                            |   |  |
|  |  |                                   |                            |   |  |
| (d) preformed pipe boot; ozone and ultraviolet resistant, square<br>base with fasteners. Boot top clamps are to be stainless steel.<br>Provide a 20 year warranty. |  |                                   |                            |   |  |

| TABLE II. SHEET METAL JOINTS |  |          |         |
|------------------------------|--|----------|---------|
| TYPE OF JOINT                |  |          |         |
| Item Designation             | Aluminum<br>Zinc-Coated Steel<br>and Stainless Steel | Aluminum | Remarks |
|                              |  |          |         |

| TABLE II. SHEET METAL JOINTS |  |          |  |
|------------------------------|--|----------|--|
| TYPE OF JOINT                |  |          |  |
| Item Designation             | Aluminum<br>Zinc-Coated Steel<br>and Stainless Steel | Aluminum | Remarks  |
| Flashings                    |  |          |  |
|                              |  |          |  |
| Cap                          | 3 inch lap   |          | Seal groove with<br>joint sealing<br>compound.     |
|                              |  |          |  |
|                              |  |          |  |
|                              |  |          |  |
|                              |  |          |  |
|                              |  |          |  |
| Smooth Sheets                |  |          |  |
| Extrusions                   | --   |          | Use sheet<br>flashing beneath<br>and a cover plate |
| Sheet, smooth                | Butt with 1/4 inch<br>space                          |          | Use sheet<br>flashing backup<br>plate.             |
|                              |  |          |  |
| Gutters                      | 1.5 inch lap,<br>riveted and<br>soldered             |          |  |

| TABLE II. SHEET METAL JOINTS |  |          |         |
|------------------------------|--|----------|---------|
| TYPE OF JOINT                |  |          |         |
| Item Designation             | Aluminum<br>Zinc-Coated Steel<br>and Stainless Steel | Aluminum | Remarks |
|                              |  |          |         |
|                              |  |          |         |
|                              |  |          |         |

-- End of Section --



## SECTION 07 84 00

FIRESTOPPING  
05/10

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

|                   |  |
|-------------------|--|
| ASTM E119         | (2012a) Standard Test Methods for Fire Tests of Building Construction and Materials  |
| ASTM E1399/E1399M | (1997; E 2013; R 2013) Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems                           |
| ASTM E1966        | (2007; R 2011) Fire-Resistive Joint Systems  |
| ASTM E2174        | (2014) Standard Practice for On-Site Inspection of Installed Fire Stops  |
| ASTM E2307        | (2010) Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus |
| ASTM E2393        | (2010a) Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers                             |
| ASTM E814         | (2013a) Standard Test Method for Fire Tests of Through-Penetration Fire Stops  |
| ASTM E84          | (2015a) Standard Test Method for Surface Burning Characteristics of Building Materials   |

## FM GLOBAL (FM)

|              |   |
|--------------|---|
| FM 4991      | (2013) Approval of Firestop Contractors   |
| FM APP GUIDE | (updated on-line) Approval Guide<br><a href="http://www.approvalguide.com/">http://www.approvalguide.com/</a> |

## INTERNATIONAL CODE COUNCIL (ICC)

|         |                                    |
|---------|------------------------------------|
| ICC IBC | (2012) International Building Code |
|---------|------------------------------------|

## UNDERWRITERS LABORATORIES (UL)

|                    |   |
|--------------------|---|
| UL 1479            | (2015) Fire Tests of Through-Penetration Firestops                                      |
| UL 2079            | (2004; Reprint Dec 2012) Tests for Fire Resistance of Building Joint Systems            |
| UL 723             | (2008; Reprint Aug 2013) Test for Surface Burning Characteristics of Building Materials |
| UL Fire Resistance | (2014) Fire Resistance Directory  |

## 1.2 SYSTEM DESCRIPTION

## 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.
- c. 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.

## 1.2.3 Submittals Requirements

- a. Submit detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resistance or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment, derived from

similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal shall indicate the firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are to receive firestopping, provide drawings that indicate location, "F" "T" and "L" ratings, and type of application.

- b. Submit certificates attesting that firestopping material complies with the specified requirements. For all intumescent firestop materials used in through penetration systems, manufacturer shall provide certification of compliance with UL 1479.
- c. Submit documentation of training and experience for Installer.
- d. Submit inspection report stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

### 1.3 SUBMITTALS

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

SD-02 Shop Drawings

Firestopping Materials

SD-06 Test Reports

Inspection

SD-07 Certificates

Inspector Qualifications

Firestopping Materials

Installer Qualifications

### 1.4 QUALITY ASSURANCE

#### 1.4.1 Installer

Engage an experienced Installer who is:

- a. FM Research approved in accordance with FM 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.

#### 1.4.2 Inspector Qualifications

The inspector shall have a minimum of two years experience in construction field inspections of firestopping systems, products, and assemblies. The inspector shall be completely independent of, and divested from, the installer, the manufacturer, and the supplier of any material or item being inspected. The inspector shall not be a competitor of the installer, the contractor, the manufacturer, or supplier of any material or item being inspected. Include in the qualifications submittal a notarized statement assuring compliance with the requirements stated herein.

#### 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 and temperatures in accordance with manufacturer requirements. Remove damaged or deteriorated materials from the site. Use materials within their indicated shelf life.

### PART 2 PRODUCTS

#### 2.1 FIRESTOPPING MATERIALS

Provide firestopping materials, supplied from a single domestic manufacturer, consisting of commercially manufactured, asbestos-free, nontoxic products FM APP GUIDE approved, or UL listed, for use with applicable construction and penetrating items, complying with the following minimum requirements:

##### 2.1.1 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:

#### 2.1.3.1.1 Penetrations of Fire Resistance Rated Walls and Partitions

F Rating = 1 hour.

#### 2.1.3.1.2 Penetrations of Fire Resistance Rated Floors, Floor-Ceiling Assemblies and the Ceiling Membrane of Roof-Ceiling Assemblies

F Rating = 1 hour, T Rating = 1 hour. Where the penetrating item is outside of a wall cavity the F rating must be equal to the fire resistance rating of the floor penetrated, and the T rating shall be in accordance with the requirements of ICC IBC.

#### 2.1.3.1.3 Penetrations of Fire and Smoke Resistance Rated Walls, Floors, Floor-Ceiling Assemblies, and the ceiling membrane of Roof-Ceiling Assemblies

F Rating = 1 hour, T Rating = 1 hour and L Rating = <10 cfm/sf (Where L rating is required).

#### 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 and curtain walls shall be as follows: construction joints in walls, 1 hour; construction joints in floors, 1 hour; gaps between floor slabs and curtain walls, 1 hour; gaps between top of the walls and the bottom of roof and floor decks, 1 hour, and provide L rating of <5 cfm/lf where required. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E119, ASTM E1966 or UL 2079 to meet the required fire resistance rating. Curtain wall joints shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E2307 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E1399/E1399M or UL 2079. All joints at the intersection of the top of a fire resistance rated wall and the underside of a fire-rated floor, floor ceiling, or roof ceiling assembly shall provide a minimum class II movement capability.

### 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 in accordance with Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM. Firestop installed with fire damper must be tested and approved for use in fire damper system.

#### 3.2.3 Data and Communication Cabling

Cabling for data and communication applications shall be sealed with re-enterable firestopping products or devices.

##### 3.2.3.1 Re-Enterable Devices

Firestopping devices shall be pre-manufactured modular devices, containing built-in self-sealing intumescent inserts. Firestopping devices shall allow for cable moves, additions or changes without the need to remove or replace any firestop materials. Devices must be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants; while maintaining "L" rating of <10 cfm/sf at 0 percent to 100 percent visual fill.

##### 3.2.3.2 Re-Sealable Products

Provide firestopping pre-manufactured modular products, containing self-sealing intumescent inserts. Firestopping products shall allow for cable moves, additions or changes. Devices shall be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants.

### 3.3 INSPECTION

#### 3.3.1 General Requirements

For Navy projects, install one of each type of penetration and have it inspected and accepted by the Mid-Atlantic Division, Naval Facilities Engineering Command, Fire Protection Engineer prior to the installation of the remainder of the penetrations. At this inspection, the manufacturer's technical representative of the firestopping material shall be present. The remainder of the firestopped areas shall not be covered or enclosed until inspection is complete and approved by the Contracting Officer. The inspector 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 E2393 and ASTM E2174 for firestop inspection, and document inspection results to be submitted.

-- End of Section --

## SECTION 07 92 00

## JOINT SEALANTS

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.

## ASTM INTERNATIONAL (ASTM)

ASTM C 920 (2011) Standard Specification for  
Elastomeric Joint Sealants

ASTM D 1056 (2007) Standard Specification for Flexible  
Cellular Materials - Sponge or Expanded  
Rubber

## 1.2 SUBMITTALS

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

## SD-03 Product Data

Sealants

Primers

Bond breakers

Backstops

Manufacturer's descriptive data including storage requirements,  
shelf life, curing time, instructions for mixing and application,  
and primer data (if required). Provide a copy of the Material  
Safety Data Sheet for each solvent, primer or sealant material.

## SD-07 Certificates

Sealant

Certificates of compliance stating that the materials conform to  
the specified requirements.

## 1.3 ENVIRONMENTAL CONDITIONS

Apply sealant when the ambient temperature is between 40 and 90 degrees F.

## 1.4 DELIVERY AND STORAGE

Deliver materials to the job site in unopened manufacturers' external  
shipping containers, with brand names, date of manufacture, color, and  
material designation clearly marked thereon. Label elastomeric sealant



containers to identify type, class, grade, and use. Carefully handle and store materials to prevent inclusion of foreign materials or subsection to sustained temperatures exceeding 90 degrees F or less than 0 degrees F.

## 1.5 QUALITY ASSURANCE

### 1.5.1 Compatibility with Substrate

Verify that each of the sealants are compatible for use with joint substrates.

### 1.5.2 Joint Tolerance

Provide joint tolerances in accordance with manufacturer's printed instructions.

### 1.5.3 Mock-Up

Project personnel is responsible for installing sealants in mock-up, using materials and techniques approved for use on the project.

## 1.6 SPECIAL WARRANTY

Guarantee sealant joint against failure of sealant and against water penetration through each sealed joint for five years.

## PART 2 PRODUCTS

### 2.1 SEALANTS

Provide sealant that has been tested and found suitable for the substrates to which it will be applied.

#### 2.1.1 Interior Sealant

Provide ASTM C 920, Type S or M, Grade NS, Class 12.5, Use NT. Location(s) and color(s) of sealant for the following:

| LOCATION   | COLOR       |
|--|-------------|
| a. Small voids between walls or partitions and adjacent lockers, casework, shelving, door frames, built-in or surface-mounted equipment and fixtures, and similar items. | As selected |
| b. Perimeter of frames at doors, windows, and access panels which adjoin exposed interior concrete and masonry surfaces.   | As selected |
| c. Joints of interior masonry walls and partitions which adjoin columns, pilasters, concrete walls, and exterior walls unless otherwise detailed.                        | As selected |
| d. Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.  | As selected |
| e. Joints formed between tile floors and tile  | As selected |

| LOCATION   | COLOR       |
|--|-------------|
| base cove; joints between tile and dissimilar materials; joints occurring where substrates change. |             |
| f. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.                 | As selected |

#### 2.1.2 Exterior Sealant

For joints in vertical surfaces, provide ASTM C 920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C 920, Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows:

| 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.   | As selected |
| c. Expansion and control joints.   | As selected |
| d. Voids where items pass through exterior walls.  | As selected |
| e. Metal-to-metal joints where sealant is indicated or specified.  | As selected |

#### 2.1.3 Floor Joint Sealant

ASTM C 920, Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows:

| LOCATION  | COLOR |
|---|-------|
| a. Seats of metal thresholds for exterior doors.                              | Gray  |
| b. Control and expansion joints in floors, slabs, ceramic tile, and walkways. | Gray  |

#### 2.2 PRIMERS

Provide a nonstaining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

#### 2.3 BOND BREAKERS

Provide the type and consistency recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

## 2.4 BACKSTOPS

Provide glass fiber roving or 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. Make backstop material compatible with sealant. Do not use oakum and other types of absorptive materials as backstops.

### 2.4.1 Rubber

Conform to ASTM D 1056, Type 2, closed cell, Class A round cross section for cellular rubber sponge backing.

### 2.4.2 Neoprene

Conform to ASTM D 1056, closed cell expanded neoprene cord Type 2, Class C, Grade 2C2.

## 2.5 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer except for aluminum and bronze surfaces that will be in contact with sealant.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Clean surfaces from dirt frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Remove oil and grease with solvent. Surfaces must be wiped dry with clean cloths. When resealing an existing joint, remove existing calk or sealant prior to applying new sealant. For surface types not listed below, contact sealant manufacturer for specific recommendations.

#### 3.1.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue-free solvent.

#### 3.1.2 Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. For removing protective coatings and final cleaning, use nonstaining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

#### 3.1.3 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, remove materials by sandblasting or wire brushing. Remove laitance, efflorescence and loose mortar from the joint cavity.

### 3.1.4 Wood Surfaces

Keep wood surfaces to be in contact with sealants free of splinters and sawdust or other loose particles.

## 3.2 SEALANT PREPARATION

Do not add liquids, solvents, or powders to the sealant. Mix multicomponent elastomeric sealants in accordance with manufacturer's instructions.

## 3.3 APPLICATION

### 3.3.1 Joint Width-To-Depth Ratios

#### a. Acceptable Ratios:

| <u>JOINT WIDTH</u>                             | <u>JOINT DEPTH</u>                       |                |
|--|--|----------------|
|  | Minimum                                  | Maximum        |
| For metal, glass, or other nonporous surfaces: |  |                |
| 1/4 inch (minimum)                             | 1/4 inch                                 | 1/4 inch       |
| over 1/4 inch                                  | 1/2 of width                             | Equal to width |
| For wood, concrete or 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 2 inch                        | 1/2 inch                                 | 5/8 inch       |
| Over 2 inch.                                   | (As recommended by sealant manufacturer) |                |

- b. 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 not required on metal surfaces.

### 3.3.2 Masking Tape

Place masking tape on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Remove masking tape within 10 minutes after joint has been filled and tooled.

### 3.3.3 Backstops

Install backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide a joint of the depth specified. Install backstops in the following locations:

- Where indicated.
- Where backstop is not indicated but joint cavities exceed the acceptable maximum depths specified in paragraph entitled, "Joint

## Width-to-Depth Ratios".

## 3.3.4 Primer

Immediately prior to application of the sealant, clean out loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's instructions. Do not apply primer to exposed finish surfaces.

## 3.3.5 Bond Breaker

Provide bond breakers to the back or bottom of joint cavities, as recommended by the sealant manufacturer for each type of joint and sealant used, to prevent sealant from adhering to these surfaces. Carefully apply the bond breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond breaker.

## 3.3.6 Sealants

Provide a sealant compatible with the material(s) to which it is applied. Do not use a sealant that has exceeded shelf life or has jelled and can not be discharged in a continuous flow from the gun. Apply the sealant in accordance with the manufacturer's printed instructions with a gun having a nozzle that fits the joint width. Force sealant into joints to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Make sealant uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply sealant, and tool smooth as specified. Apply sealer over the sealant when and as specified by the sealant manufacturer.

## 3.4 PROTECTION AND CLEANING

## 3.4.1 Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

## 3.4.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

- a. Masonry and Other Porous Surfaces: Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding.
- b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent-moistened cloth.

-- End of Section --

## SECTION 08 11 13

## STEEL DOORS AND FRAMES

02/10

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2010) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A 653/A 653M (2009a) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 879/A 879M (2006) Standard Specification for Steel Sheet, zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface

ASTM A 924/A 924M (2009a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM C 578 (2015) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

ASTM C 591 (2009) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

ASTM D 2863 (2009) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

ASTM E 1300 (2009a) Determining Load Resistance of Glass in Buildings

ASTM F 2248 (2009) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.115 (2006) Hardware Preparation in Steel Doors

## and Steel Frames

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

|          |  |
|----------|--|
| NFPA 105 | (2010) Installation of Smoke Door Assemblies                 |
| NFPA 252 | (2012) Standard Methods of Fire Tests of Door Assemblies     |
| NFPA 80  | (2013) Standard for Fire Doors and Other Opening Protectives |

## STEEL DOOR INSTITUTE (SDI/DOOR)

|                  |  |
|------------------|--|
| SDI/DOOR 111     | (2009) Recommended Selection and Usage Guide for Standard Steel Doors, Frames and Accessories        |
| SDI/DOOR 113     | (2001; R 2006) Determining the Steady State Thermal Transmittance of Steel Door and Frame Assemblies |
| SDI/DOOR A250.11 | (2001) Recommended Erection Instructions for Steel Frames  |
| SDI/DOOR A250.6  | (2003) Hardware on Steel Doors (Reinforcement - Application)   |
| SDI/DOOR A250.8  | (2003) Recommended Specification for Standard Steel Doors and Frames                                 |

## UNDERWRITERS LABORATORIES (UL)

|        |   |
|--------|---|
| UL 10C | (2009) UL Standard for Safety Positive Pressure Fire Tests of Door Assemblies |
|--------|---|

## 1.2 SUBMITTALS

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

## SD-02 Shop Drawings

Doors

Frames

Accessories

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

## Accessories

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction.

## 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Strap knock-down frames in bundles. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4 inch airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

## PART 2 PRODUCTS

## 2.1 STANDARD STEEL DOORS

SDI/DOOR A250.8, except as specified otherwise. Prepare doors to receive door hardware as specified in Section 08 71 00. Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 1-3/4 inch thick, unless otherwise indicated. Provide exterior glazing in accordance with ASTM F 2248 and ASTM E 1300.

## 2.1.1 Classification - Level, Performance, Model

## 2.1.1.1 Extra Heavy Duty Doors

SDI/DOOR A250.8, Level 3, physical performance Level A, Model 2 Seamless with core construction as required by the manufacturer, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation.

Exterior doors are to be insulated. Interior doors are to be insulated at locations identified on the Drawings.

## 2.2 ACCESSORIES

## 2.2.1 Louvers

## 2.2.1.1 Interior Louvers

SDI/DOOR 111, Louvers shall be stationary sightproof type. Detachable moldings on room or non security side of door; on security side of door, moldings to be integral part of louver. Form louver frames of 20 gage steel and louver blades of a minimum 24 gage. Sightproof louvers to be inverted "V" blade design with minimum 55 percent net-free opening.

## 2.2.1.2 Exterior Louvers

Louvers shall be inverted "V" type with minimum of 55 percent net-free



opening. Weld or tenon louver blades to continuous channel frame and weld assembly to door to form watertight assembly. Form louvers of hot-dip galvanized steel of same gage as door facings. Louvers shall have steel-framed insect screens secured to room side and readily removable. Provide aluminum wire cloth, 18 by 18 or 18 by 16 inch mesh, for insect screens. Net-free louver area to be before screening.

#### 2.2.2 Moldings

Provide moldings around glass of interior and exterior doors and louvers of interior doors. Provide nonremovable moldings on outside of exterior doors and on corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to stationary moldings, or provide snap-on moldings. Muntins shall interlock at intersections and shall be fitted and welded to stationary moldings.

#### 2.3 INSULATION CORES

Insulated cores shall be of type specified, and provide an apparent U-factor of .48 in accordance with SDI/DOOR 113 and shall conform to:

- a. Rigid Cellular Polyisocyanurate Foam: ASTM C 591, 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 D 2863; or
- b. Rigid Polystyrene Foam Board: ASTM C 578, Type I or II

#### 2.4 STANDARD STEEL FRAMES

SDI/DOOR A250.8, Level 3, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners and knock-down field-assembled corners. Provide steel frames for doors, sidelights, and interior glazed panels, unless otherwise indicated.

##### 2.4.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

Weld frames in accordance with the recommended practice of the Structural Welding Code Sections 1 through 6, AWS D1.1/D1.1M and in accordance with the practice specified by the producer of the metal being welded.

##### 2.4.2 Knock-Down Frames

Design corners for simple field assembly by concealed tenons, splice plates, or interlocking joints that produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for bolted connections.

##### 2.4.3 Mullions and Transom Bars

Mullions and transom bars shall be closed or tubular construction and be a member with heads and jambs butt-welded thereto or knock-down for field assembly. Bottom of door mullions shall have adjustable floor anchors and spreader connections.

#### 2.4.4 Stops and Beads

Form stops and beads from 20 gage steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 12 to 16 inch on center. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

#### 2.4.5 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.

#### 2.4.6 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

##### 2.4.6.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.

- a. Masonry: Provide anchors of corrugated or perforated steel straps or 3/16 inch diameter steel wire, adjustable or T-shaped;
- b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding;
- c. Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with SDI/DOOR 111, "Recommended Existing Wall Anchors for Standard Steel Doors and Frames".

##### 2.4.6.2 Floor Anchors

Provide floor anchors drilled for 3/8 inch anchor bolts at bottom of each jamb member. Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.

#### 2.5 FIRE AND SMOKE DOORS AND FRAMES

NFPA 80 and NFPA 105 and this specification. The requirements of NFPA 80 and NFPA 105 shall take precedence over details indicated or specified.

##### 2.5.1 Labels

Fire doors and frames shall bear the label of Underwriters Laboratories (UL), Factory Mutual Engineering and Research (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing shall be in accordance with NFPA 252 or UL 10C. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame

manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted.

## 2.5.2 Oversized Doors

For fire doors and frames which exceed the size for which testing and labeling are available, furnish certificates stating that the doors and frames are identical in design, materials, and construction to a door which has been tested and meets the requirements for the class indicated.

## 2.6 WEATHERSTRIPPING

As specified in Section 08 71 00 DOOR HARDWARE.

## 2.7 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in SDI/DOOR A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI/DOOR A250.8 and SDI/DOOR A250.6. For additional requirements refer to ANSI/BHMA A156.115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI/DOOR A250.8, as applicable. Punch door frames, with the exception of frames that will have weatherstripping to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

## 2.8 FINISHES

### 2.8.1 Factory-Primed Finish

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in SDI/DOOR A250.8. Where coating is removed by welding, apply touchup of factory primer.

### 2.8.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate exterior doors and frames and indicated interior doors and frames from hot dipped zinc coated steel, alloyed type, that complies with ASTM A 924/A 924M and ASTM A 653/A 653M. 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.

### 2.8.3 Electrolytic Zinc-Coated Anchors and Accessories

Provide electrolytically deposited zinc-coated steel in accordance with ASTM A 879/A 879M, Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in SDI/DOOR A250.8.

## 2.9 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp,

and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. Design frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive calking compound.

#### 2.9.1 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.

#### 2.10 PROVISIONS FOR GLAZING

Materials are specified in Section 08 81 00, GLAZING.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Frames

Set frames in accordance with SDI/DOOR A250.11. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Backfill frames with mortar. Coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

##### 3.1.2 Doors

Hang doors in accordance with clearances specified in SDI/DOOR A250.8. After erection and glazing, clean and adjust hardware. Move doors and extend walls as required to clear fire alarm junction boxes and conduit. Door 243B to be moved as required.

##### 3.1.3 Fire and Smoke Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80. Install fire rated smoke doors and frames in accordance with NFPA 80 and NFPA 105.

#### 3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

#### 3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

-- End of Section --

## SECTION 08 51 13

## ALUMINUM WINDOWS

05/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

|                              |   |
|------------------------------|---|
| AAMA 1302.5                  | (1976) Voluntary Specifications for Forced-Entry Resistant Aluminum Prime Windows   |
| AAMA 1503                    | (2009) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections                           |
| AAMA 2605                    | (2013) Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels |
| AAMA/WDMA/CSA 101/I.S.2/A440 | (2011; Update 1 2014) North American Fenestration Standard/Specification for Windows, Doors, and Skylights  |

## ASTM INTERNATIONAL (ASTM)

|            |  |
|------------|--|
| ASTM F2248 | (2012) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass |
|------------|--|

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

|          |                                    |
|----------|------------------------------------|
| NFPA 101 | (2015; ERTA 2015) Life Safety Code |
|----------|------------------------------------|

## 1.2 CERTIFICATION

Each prime window unit must bear the AAMA Label warranting that the product complies with AAMA/WDMA/CSA 101/I.S.2/A440. Certified test reports attesting that the prime window units meet the requirements of AAMA/WDMA/CSA 101/I.S.2/A440, including test size, will be acceptable in lieu of product labeling.

## 1.3 SUBMITTALS

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

SD-02 Shop Drawings

Windows;

Fabrication Drawings

SD-03 Product Data

Windows;

Hardware;

Fasteners;

Window Performance;

Thermal-Barrier Windows;

Screens;

Weatherstripping;

Accessories;

Adhesives

Submit manufacturer's product data, indicating VOC content.

Thermal Performance;

SD-04 Samples

Finish Sample

SD-05 Design Data

Structural Calculations for Deflection;

SD-06 Test Reports

Minimum Condensation Resistance Factor

Resistance to Forced Entry

SD-10 Operation and Maintenance Data

Windows, Data Package 1;

Submit in accordance with Section 01 78 23 OPERATION AND  
MAINTENANCE DATA.

1.4 QUALITY ASSURANCE

1.4.1 Shop Drawing Requirements

Provide drawings that indicate elevations of windows, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, method and materials for weatherstripping, method of attaching screens, material and method of attaching subframes, stools, casings, sills, trim, installation details, and other related items.

#### 1.4.2 Sample Requirements

##### 1.4.2.1 Finish Sample Requirements

Submit color chart of standard factory color coatings when factory-finish color coating is to be provided.

##### 1.4.3 Test Report Requirements

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to AAMA/WDMA/CSA 101/I.S.2/A440 including test size, and minimum condensation resistance factor (CRF), and resistance to forced entry.

#### 1.5 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Repair damaged windows to an "as new" condition as approved. If windows can not be repaired, provide a new unit.

#### 1.6 PROTECTION

Protect finished surfaces during shipping and handling using the manufacturer's standard method. Do not apply coatings or lacquers to surfaces to which caulking and glazing compounds must adhere.

#### 1.7 FIELD MEASUREMENTS

Take field measurements prior to preparation of the drawings and fabrication.

#### 1.8 PERFORMANCE REQUIREMENTS

##### 1.8.1 Wind Loading Design Pressure

Design window components, including mullions, hardware, and anchors, to withstand a minimum wind-loading design pressure of 138 miles per hour.

In addition to the above, exterior window and glazing shall meet the requirements of paragraph 1609.1.2 of the 2015 International Building Code, with the exception that an impact-resistant covering meeting the requirements of an approved impact-resistant standard, will not be permitted.

##### 1.8.2 Tests

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

Perform tests by a nationally recognized independent testing laboratory equipped and capable of performing the required tests. Submit the results of the tests as certified laboratory reports required herein.

Minimum design load for a uniform-load structural test must be 50 psf.



## 1.9 DRAWINGS

Submit the Fabrication Drawings for aluminum window units showing complete window assembly including hardware, weatherstripping, and subframe assembly details.

## 1.10 WINDOW PERFORMANCE

Aluminum windows must meet the following performance requirements. Perform testing requirements by an independent testing laboratory or agency.

### 1.10.1 Structural Performance

Structural test pressures on window units must be for positive load (inward) and negative load (outward). After testing, there will be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There must be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA/WDMA/CSA 101/I.S.2/A440 for the window types and classification specified in this section.

### 1.10.2 Minimum Antiterrorism Performance

Windows must meet the minimum antiterrorism performance as specified in the paragraphs below. Conformance to the performance requirements must be validated by one of the following methods.

#### 1.10.2.1 Computational Design Analysis Method

The glazing frame bite for the window frames must be in accordance with ASTM F2248.

### 1.10.3 Air Infiltration

Air infiltration must not exceed the amount established by AAMA/WDMA/CSA 101/I.S.2/A440 for each window type.

### 1.10.4 Water Penetration

Water penetration must not exceed the amount established by AAMA/WDMA/CSA 101/I.S.2/A440 for each window type.

### 1.10.5 Thermal Performance

Aluminum windows (including frames and glass) must be certified by the National Fenestration Rating Council .

### 1.10.6 Life Safety Criteria

Provide windows that conform to NFPA 101 Life Safety Code when rescue and/or second means of escape are indicated.

### 1.10.7 Sound Attenuation

The window unit must have a minimum STC of 35-40 with the window glazed with 1/2 inch air space between two pieces of 1/4 inch thick glass when tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 acoustical

performance (optional).

#### 1.11 QUALIFICATION

Window manufacturer must specialize in designing and manufacturing the type of aluminum windows specified in this section, and have a minimum of five years of documented successful experience. Manufacturer must have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

#### 1.12 WARRANTY

Provide Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

### PART 2 PRODUCTS

#### 2.1 WINDOWS

Provide prime windows that comply with AAMA/WDMA/CSA 101/I.S.2/A440 and the requirements specified herein. In addition to compliance with AAMA/WDMA/CSA 101/I.S.2/A440, window framing members for each individual light of glass must not deflect to the extent that deflection perpendicular to the glass light exceeds  $L/175$  of the glass edge length when subjected to uniform loads at specified design pressures. Provide Structural calculations for deflection to substantiate compliance with deflection requirements. Provide windows of types, performance classes, performance grades, combinations, and sizes indicated or specified. Design windows to accommodate hardware, glass, weatherstripping, screens, and accessories to be furnished. Each window must be a complete factory assembled unit with or without glass installed. Dimensions shown are minimum. Provide windows with insulating glass and thermal break necessary to achieve a minimum Condensation Resistance Factor (CRF) of 62 when tested in accordance with AAMA 1503.

##### 2.1.1 Horizontal Sliding Windows (HS)

Type HS-AW-80 (Optional Performance Grade).

All aluminum frame and sash extrusions shall be commercial quality 6063-T5 alloy and have a minimum wall thickness of 0.070 inch. Mechanical fasteners, welded compartments and hardware items shall not bridge thermal barriers. Thermal barriers shall align at all frame and sash corners.

Master frame depth shall be 4.25 inches minimum, exclusive of blast resistive anchor. Frame components shall be mechanically fastened.

##### 2.1.2 Forced Entry Resistant Windows

In addition to meeting the requirements of AAMA/WDMA/CSA 101/I.S.2/A440, windows designated for resistance to forced entry must conform to the requirements of AAMA 1302.5.

##### 2.1.3 Glass and Glazing

Materials are specified in Section 08 81 00 GLAZING.

#### 2.1.4 Caulking and Sealing

Are specified in Section 07 92 00 JOINT SEALANTS.

#### 2.1.5 Weatherstripping

AAMA/WDMA/CSA 101/I.S.2/A440.

### 2.2 FABRICATION

Fabrication of window units must comply with AAMA/WDMA/CSA 101/I.S.2/A440.

#### 2.2.1 Provisions for Glazing

Design windows and rabbets suitable for glass thickness specified. For minimum antiterrorism windows, attach glazing to its supporting frame using structural silicone sealant or adhesive glazing tape in accordance with ASTM F2248. Design sash for inside glazing and for securing glass with glazing channels, or glazing compound as required to meet Minimum Antiterrorism Performance specified in this specification section.

#### 2.2.2 Weatherstripping

Provide for ventilating sections of all windows to ensure a weather-tight seal meeting the infiltration requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440. Provide easily replaceable factory-applied weatherstripping. Use molded vinyl, molded or molded-expanded neoprene or molded or expanded Ethylene Propylene Diene Terpolymer (EPDM) compression-type weatherstripping for compression contact surfaces. Use treated woven pile or wool, or polypropylene or nylon pile bonded to nylon fabric and metal or plastic backing strip weatherstripping for sliding surfaces. Do not use neoprene or polyvinylchloride weatherstripping where exposed to direct sunlight.

#### 2.2.3 Fasteners

Use window manufacturer's standard for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than 1/16 inch thick.

#### 2.2.4 Adhesives

Provide joint sealants as specified in Section 07 92 00 JOINT SEALANTS. For interior application of joint sealants, comply with applicable regulations regarding reduced VOC's, and as specified in Section 07 92 00 JOINT SEALANTS.

#### 2.2.5 Drips and Weep Holes

Provide continuous drips over heads of top ventilators. Where fixed windows adjoin ventilators, drips must be continuous across tops of fixed windows. Provide drips and weep holes as required to return water to the outside.

#### 2.2.6 Accessories

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation. Furnish extruded aluminum subframe

receptors and subsill with each window unit.

#### 2.2.6.1 Hardware

AAMA/WDMA/CSA 101/I.S.2/A440. The item, type, and functional characteristics must be the manufacturer's standard for the particular window type. Provide hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip all operating ventilators with a lock or latching device which can be secured from the inside.

#### 2.2.6.2 Fasteners

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners must be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 6 inches from each end and at midpoint.

#### 2.2.6.3 Window Anchors

Anchoring devices for installing windows must be made of aluminum, cadmium-plated steel, stainless steel, or zinc-plated steel conforming to AAMA/WDMA/CSA 101/I.S.2/A440.

#### 2.2.7 Finishes

Exposed aluminum surfaces must be factory finished with an organic coating. Color must be silver. All windows must have the same finish.

##### 2.2.7.1 Organic Coating

Clean and prime exposed aluminum surfaces. Provide a high-performance finish in accordance with AAMA 2605 with total dry film thickness of not less than 1.2 mils.

#### 2.2.8 Screens

AAMA/WDMA/CSA 101/I.S.2/A440. Provide one insect screen for each operable exterior sash or ventilator. Design screens to be rewirable, easily removable from inside the building, and to permit easy access to operating hardware.

### 2.3 THERMAL-BARRIER WINDOWS

Provide thermal-barrier windows, complete with accessories and fittings, .  
Specify material and construction except as follows:

- a. Aluminum alloy must be 6063-T5.
- b. Frame construction, including operable sash, must be factory-assembled and factory-sealed inner and outer aluminum completely separated from metal-to-metal contact. Join assembly by a continuous, concealed, low conductance divider housed in an interlocking extrusion of the inner frame. Metal fasteners, straps, or anchors must not bridge the connection between the inner and outer frame.
- c. Operating hardware for each sash must consist of spring-loaded nylon

cushion blocks and pin locks designed to lock in predetermined locations.

- d. Sash must be completely separated from metal-to-metal contact by means of woven-pile weatherstripping, plastic, or elastomeric separation members.
- e. Operating and storm sash must be factory-glazed with the type of glass indicated and of the quality specified in Section 08 81 00 GLAZING.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt and building materials by keeping ventilators tightly closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install and caulk windows in a manner that will prevent entrance of water and wind. Fasten insect screens securely in place.

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

#### 3.1.2 Dissimilar Materials

Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, protect the aluminum surface from dissimilar materials as recommended in the Appendix to AAMA/WDMA/CSA 101/I.S.2/A440. Do not coat surfaces in contact with sealants after installation with any type of protective material.

#### 3.1.3 Anchors and Fastenings

Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls must have head and jamb members designed to recess into masonry wall not less than 7/16 inch.

#### 3.1.4 Adjustments After Installation

After installation of windows and completion of glazing and field painting, adjust all ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary. Verify that products are properly installed, connected, and adjusted.

### 3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster,

paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weather-stripping, and to prevent interference with the operation of hardware. Replace all stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

-- End of Section --

## SECTION 08 71 00

DOOR HARDWARE  
**08/08**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

|            |  |
|------------|--|
| ASTM E 283 | (2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen |
|------------|--|

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

|                   |   |
|-------------------|---|
| ANSI/BHMA A156.13 | (2012) Mortise Locks & Latches Series 1000        |
| BHMA A156.1       | (2006) Butts and Hinges                           |
| BHMA A156.13      | (2005) Mortise Locks & Latches, Series 1000       |
| BHMA A156.16      | (2008) Auxiliary Hardware                         |
| BHMA A156.18      | (2006) Materials and Finishes                     |
| BHMA A156.2       | (2003) Bored and Preassembled Locks and Latches   |
| BHMA A156.21      | (2009) Thresholds                                 |
| BHMA A156.22      | (2005) Door Gasketing and Edge Seal Systems       |
| BHMA A156.3       | (2008) Exit Devices                               |
| BHMA A156.4       | (2008) Door Controls - Closers                    |
| BHMA A156.5       | (2001) Auxiliary Locks & Associated Products      |
| BHMA A156.6       | (2005) Architectural Door Trim                    |
| BHMA A156.7       | (2003; R 2009) Template Hinge Dimensions          |
| BHMA A156.8       | (2005) Door Controls - Overhead Stops and Holders |

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

|          |                                    |
|----------|------------------------------------|
| NFPA 101 | (2015; ERTA 2015) Life Safety Code |
|----------|------------------------------------|

NFPA 80 (2013) Standard for Fire Doors and Other  
Opening Protectives

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR A250.8 (2003) Recommended Specification for  
Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES (UL)

UL 10B (2008; Reprint Apr 2009) Fire Tests of  
Door Assemblies

UL 10C (2009) UL Standard for Safety Positive  
Pressure Fire Tests of Door Assemblies

UL Bld Mat Dir (2011) Building Materials Directory

## 1.2 SUBMITTALS

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

SD-02 Shop Drawings

Hardware schedule

Keying system

SD-03 Product Data

Hardware items

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Hardware Schedule items, Data Package 1

Submit data package in accordance with Section 01 78 23 OPERATION  
AND MAINTENANCE DATA.

SD-11 Closeout Submittals

Key Bitting

## 1.3 HARDWARE SCHEDULE

Prepare and submit hardware schedule in the following form:

| Hard-<br>ware<br>Item | Quan-<br>tity | Size  | Reference<br>Publi-<br>cation<br>Type<br>No. | Finish | Mfr.<br>Name<br>and<br>Catalog<br>No. | Key<br>Con-<br>trol<br>Symbols | UL Mark<br>(If fire<br>rated<br>and<br>listed) | BHMA<br>Finish<br>Designa-<br>tion |
|-----------------------|---------------|-------|--|--------|---------------------------------------|--------------------------------|--|------------------------------------|
| -----                 | -----         | ----- | -----  | -----  | -----                                 | -----                          | -----  | -----                              |



#### 1.4 KEY BITTING CHART REQUIREMENTS

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

- a. Complete listing of all keys (AA1, AA2, etc.).
- 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.

#### 1.5 QUALITY ASSURANCE

##### 1.5.1 Hardware Manufacturers and Modifications

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

##### 1.5.1 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 shall meet to discuss key requirements for the facility.

#### 1.6 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 in 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

Provide hardware to be applied to metal manufactured to template. Promptly furnish template information or templates to door and frame manufacturers. Conform to BHMA A156.7 for template hinges. Coordinate hardware items to prevent interference with other hardware.

#### 2.2 HARDWARE FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of NFPA 80 for fire doors and NFPA 101 for exit doors, as well as to other requirements indicated, even if such hardware is not specifically mentioned under paragraph entitled "Hardware Schedule." Provide the label of Underwriters Laboratories, Inc. for such hardware listed in UL Bld Mat Dir or labeled and listed by another testing laboratory acceptable to 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 will be visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover.

### 2.3.1 Hinges

BHMA A156.1, 4-1/2 by 4-1/2 inch unless otherwise indicated. Construct loose pin hinges for exterior doors and reverse-bevel interior doors so that pins will be nonremovable when door is closed.

### 2.3.2 Locks and Latches

#### 2.3.2.1 Bored Locks and Latches

BHMA A156.2, Series 4000, Grade 1.

#### 2.3.2.2 Auxiliary Locks

BHMA A156.5, Grade 1.

### 2.3.3 Card Key System

The lock system shall be an RFID electronic lock system with SFIC key override, and a deadbolt. Provide alkaline battery powered, RFID keycard locksets that are ANSI/BHMA A156.13, Series 1000, Grade 1, mortise locks, lever trim, tamper resistant, UL listed with 1" throw deadbolt and 3/4" throw latch bolt, auxiliary deadlocking latch. The latch bolt and the deadbolt shall be operated simultaneously by rotating the inside lever.

Provide an SFIC key over-ride cylinder to allow opening of the lock with a hard key in case of electronics failure. Use of a newly issued card key automatically re-keys the lock and voids the previous card key. The lock shall re-lock immediately after the outside lever is rotated and the latch retracted. Locks shall have a memory that is capable of recording a minimum of 600 events, identification of the key card used to pass the lock, and the date and time of each entry. Information can be extracted at the lock by a dedicated Service Terminal and Contact Card unit that can be downloaded to the Front Desk Computer for review. Other components that are required for this system, in addition to the front desk PC are an RFID Encoder to program each key card.

System shall be capable of accepting a minimum of 12 key card access levels, security auditing and computer interfacing with the existing installation management system.

Provide the following:

- a. One Front Desk System (Computer/Monitor/Software/RFID Encoder). The computer shall be loaded with the operating system and shall be incorporated with the minimum hardware/performance requirements necessary to run the card reader software and the RFID encoder hardware.
- b. Four Spare RFID locksets.
- c. Two Service Terminals and Two RFID Contact Cards.

- d. 1500 1K RFID Cards (Resident Cards) Included and 100 4K Cards (Staff Cards).
- e. 3-Day Training and System Setup. (Train Staff, Build Room Data Base, Setup Computer and Encoder).
- f. One year warranty and One year 24 phone support agreement.

#### 2.3.4 Cylinders and Cores

Provide cylinders and cores for new locks, including locks provided under other sections of this specification. Provide cylinders and cores with seven pin tumblers. Provide cylinders from Best Lock Corp., with removable core, master key system, "A" keyway. Rim cylinders, mortise cylinders, and knobs of bored locksets shall have interchangeable cores which are removable by special control keys. Stamp each interchangeable core with a key control symbol in a concealed place on the core. Provide construction interchangeable cores.

#### 2.3.5 Keying System

Provide a master keying system for each floor of the building. Provide construction interchangeable cores. Provide key cabinet as specified.

#### 2.3.6 Lock Trim

Cast, forged, or heavy wrought construction and commercial plain design.

##### 2.3.6.1 Knobs and Roses

Conform to the minimum test requirements of BHMA A156.2 and BHMA A156.13 for knobs, roses, and escutcheons. For unreinforced knobs, roses, and escutcheons, provide 0.050 inch thickness. For reinforced knobs, roses, and escutcheons, provide outer shell of 0.035 inch thickness, and combined thickness of 0.070 inch, except for knob shanks, which are 0.060 inch thick. For bored locksets and latches, knobs are to be similar to Best knob 4 with rose "C".

##### 2.3.6.2 Texture

Provide knurled or abrasive coated knobs or lever handles for doors which are accessible to blind persons and which lead to dangerous areas.

#### 2.3.7 Keys

Furnish one file key, one duplicate key, and one working key for each key change. Furnish one additional working key for each lock of each keyed-alike group. Furnish two additional keys for each sleeping room. Furnish a quantity of key blanks equal to 20 percent of the total number of file keys. Stamp each key with appropriate key control symbol and "U.S. property - Do not duplicate." Do not place room number on keys.

#### 2.3.8 Door Bolts

BHMA A156.16. Provide dustproof strikes for bottom bolts, except for doors having metal thresholds. Automatic latching flush bolts: BHMA A156.3, Type 25.

### 2.3.9 Closers

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

#### 2.3.9.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation located to be visible after installation.

#### 2.3.10 Overhead Holders

BHMA A156.8.

#### 2.3.11 Architectural Door Trim

BHMA A156.6. Door pulls shall be 1 inch diameter, 12 inches center to center with 1-3/4 inch clearance, stainless steel finish.

#### 2.3.12 Door Protection Plates

BHMA A156.6.

##### 2.3.12.1 Sizes of Armor Mop and Kick Plates

Plates shall be 2 inches less than door width for single doors; one inch less than door width for pairs of doors. Provide 10 inch kick plates for flush doors. Provide a minimum 36 inch armor plates for flush doors completely cover lower panels of panel doors, except 16 inch high armor plates on fire doors. Provide 6 inch mop plates.

#### 2.3.13 Door Stops and Silencers

BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each pair.

#### 2.3.14 Thresholds

BHMA A156.21. Use J32130, handicap accessible, unless specified otherwise.

#### 2.3.15 Weather Stripping Gasketing

BHMA A156.22. Provide the type and function designation where specified in paragraph entitled "Hardware Schedule". Provide a set to include head and jamb seals, sweep strips, and, for pairs of doors, astragals. Air leakage of weather stripped doors not to exceed 1.25 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E 283. Provide weather stripping with one of the following:

##### 2.3.15.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than 0.050 inch wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Provide clear (natural) anodized aluminum.

### 2.3.16 Smoke Gasketing

Smoke gasketing shall be UL 10B classified and UL 10C classified

### 2.3.17 Rain Drips

Extruded aluminum, not less than 0.08 inch thick, clear anodized. Set drips in sealant and fasten with stainless steel screws.

#### 2.3.17.1 Door Rain Drips

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

#### 2.3.17.2 Overhead Rain Drips

Approximately 1-1/2 inch high by 2-1/2 inch projection, with length equal to overall width of door frame. Align bottom with door frame rabbet.

### 2.3.18 Special Tools

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

## 2.4 FASTENERS

Provide fasteners of proper type, quality, size, quantity, and finish with hardware. Provide stainless steel or nonferrous metal fasteners that are exposed to weather. Provide fasteners of type necessary to accomplish a permanent installation.

## 2.5 FINISHES

BHMA A156.18. Provide hardware in BHMA 630 finish (satin stainless steel), unless specified otherwise. Provide items not manufactured in stainless steel in BHMA 626 finish (satin chromium plated) over brass or bronze, except aluminum paint finish for surface door closers, and except BHMA 652 finish (satin chromium plated) for steel hinges. Provide hinges for exterior doors in stainless steel with BHMA 630 finish or chromium plated brass or bronze with BHMA 626 finish. Furnish exit devices in BHMA 626 finish in lieu of BHMA 630 finish except where BHMA 630 is specified under paragraph entitled "Hardware Sets". Match exposed parts of concealed closers to lock and door trim.

## 2.6 KEY CABINET AND CONTROL SYSTEM

BHMA A156.5, provide type required to yield a capacity (number of hooks) 50 percent greater than the number of key changes used for door locks.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install 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 Weather Stripping Installation

Handle and install weather stripping to prevent damage. Provide full contact, weather-tight seals. Operate doors without binding.

#### 3.1.1.1 Stop-Applied Weather Stripping

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

Install hardware in accordance with NFPA 80 for fire doors, NFPA 101 for exit doors.

## 3.3 HARDWARE LOCATIONS

SDI/DOOR A250.8, unless indicated or specified otherwise.

- a. Kick and Armor Plates: Push side of single-acting doors. Both sides of double-acting doors.
- b. Mop Plates: Bottom flush with bottom of door.

## 3.4 KEY CABINET AND CONTROL SYSTEM

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

## 3.5 FIELD QUALITY CONTROL

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

## 3.6 HARDWARE SETS

Provide hardware for aluminum doors under this section. Deliver Hardware templates and hardware, except field-applied hardware to the aluminum door and frame manufacturer for use in fabricating the doors and frames.

| Quantity  | Item                 | Description  |
|---|----------------------|--------------|
| HW-1 Doors 101A, 201A, 301A   |                      |              |
| 1 1/2 Pair  | Hinges               | A5111        |
| 1   | Card Key System      | As Specified |
| 1   | Door Viewer          | L03171       |
| 1   | Closer/Stop          | C02211       |
| 1   | Kickplate            | J102         |
| 1 set   | Weatherstripping     | As Specified |
| 1   | Threshold            | As Specified |
| 1   | Door Rain Drip       | As Specified |
| HW-2 Doors 101B, 201B, 301B   |                      |              |
| 1 1/2 Pair  | Hinges               | A5112        |
| 1   | *Lockset             | F76          |
| 1   | *Auxiliary Dead Lock | E0191        |
| 1   | Closer/Stop          | C42021       |
| 3   | Silencers            | L03011       |
| *Coordinate installation/location of locksets with the Government                       |                      |              |
| HW-3 Doors 140A, 158B, 241A, 252B, 341A, 352B   |                      |              |
| 1 1/2 Pair  | Hinges               | A5112        |
| 1   | Lockset              | F86          |
| 1   | Wall Stop            | L02251       |
| 1 set   | Weatherstripping     | As Specified |
| 1   | Door Rain Drip       | As Specified |
| 1   | Threshold            | As Specified |
| HW-4 Door 140B, 158A, 241A, 341A  |                      |              |
| 1 1/2 Pair  | Hinges               | A5112        |
| 1   | Lockset              | F86          |
| 1   | Closer/Stop          | C42021       |
| 1 set   | Weatherstripping     | As Specified |
| HW-5 Doors 141A, 141B, 157A, 157B, 242A, 242B, 244A, 251A, 251B, 342A, 342B, 351A, 351B |                      |              |
| 1 1/2 Pair  | Hinges               | A5112        |
| 1   | Lockset              | F86          |
| 1   | Overhead Stop        | C02541       |
| 1 set   | Weatherstripping     | As Specified |
| 1   | Door Rain Drip       | As Specified |
| 1   | Threshold            | As Specified |
| HW-6 Doors 144A, 144B, 154A   |                      |              |
| 1 1/2 Pair  | Hinges               | A5111        |
| 1   | Push Plate           | J301         |
| 1   | Pull Plate           | J405         |
| 1   | Closer               | C42021       |

| Quantity               | Item              | Description  |
|------------------------|-------------------|--------------|
| 1                      | Wall Stop         | L02011       |
| 1                      | Kickplate         | J102         |
| 1 set                  | Weatherstripping  | As Specified |
| 1                      | Threshold         | As Specified |
| HW-7 Door 145A         |                   |              |
| 1 1/2 Pair             | Hinges            | A5112        |
| 1                      | Lockset           | F109         |
| 1                      | Overhead Stop     | C02541       |
| 3                      | Silencers         | L03011       |
| HW-8 Door 146A         |                   |              |
| 1 1/2 Pair             | Hinges            | A5112        |
| 1                      | Lockset           | F86          |
| 1                      | Overhead Stop     | C02541       |
| 3                      | Silencers         | L03011       |
| HW-9 Door 148A         |                   |              |
| 1 1/2 Pair             | Hinges            | A5111        |
| 1                      | Lockset           | F109         |
| 1                      | Closer            | C42021       |
| 1                      | Wallstop          | L02011       |
| 1                      | Kickplate         | J102         |
| 3                      | Silencers         | L03011       |
| HW-10 Door 149A        |                   |              |
| 1 1/2 Pair             | Hinges            | A5112        |
| 1                      | Lockset           | F76          |
| 1                      | Overhead Stop     | C02541       |
| 3                      | Silencers         | L03011       |
| HW-11 Door 150A        |                   |              |
| 1 1/2 Pair             | Hinges            | A5111        |
| 1                      | Lockset           | F109         |
| 1                      | Wallstop          | L02011       |
| 3                      | Silencers         | L03011       |
| HW-12 Doors 151A       |                   |              |
| 1 1/2 Pair             | Hinges            | A5112        |
| 1                      | Lockset           | F86          |
| 1                      | Wall Stop         | L02011       |
| 3                      | Silencers         | L03011       |
| HW-13 Doors 152A, 344A |                   |              |
| 3 Pair                 | Hinges            | A5112        |
| 1                      | Lockset           | F86          |
| 2                      | Flushbolts        | L04081       |
| 1                      | Overhead Stop     | C02541       |
| 1                      | Wall Stop         | L02251       |
| 1                      | Dust Proof Strike | L04021       |



| Quantity                           | Item               | Description  |
|------------------------------------|--------------------|--------------|
| 2                                  | Silencers          | L03011       |
| HW-14 Doors 154B, 245B, 345B       |                    |              |
| 1 1/2 Pair                         | Hinges             | A5111        |
| 1                                  | Lockset            | F75          |
| 1                                  | Closer             | C42021       |
| 1                                  | Wall Stop          | L02251       |
| 1                                  | Kickplate          | J102         |
| 1 set                              | Weatherstripping   | As Specified |
| 1                                  | Threshold          | As Specified |
| HW-15 Doors 156A                   |                    |              |
| 3 Pair                             | Hinges             | A5112        |
| 1                                  | Lockset            | F86          |
| 1                                  | Single Dummy Trim  |              |
| 2                                  | Overhead Hold-Open | C02531       |
| 2                                  | Flushbolts         | L04081       |
| 1                                  | Dust Proof Strike  | L04021       |
| 2                                  | Silencers          | L03011       |
| HW-16 Door 243A                    |                    |              |
| 1 1/2 Pair                         | Hinges             | A5111        |
| 1                                  | Card Reader System | As Specified |
| 1                                  | Closer/Stop        | C42021       |
| 1                                  | Kickplate          | J102         |
| 1 set                              | Weatherstripping   | As Specified |
| HW-17 Door 243B, 243E              |                    |              |
| 1 1/2 Pair                         | Hinges             | A5112        |
| 1                                  | Lockset            | F86          |
| 1                                  | Wall Stop          | L02251       |
| 1 set                              | Weatherstripping   | As Specified |
| HW-18 Doors 243C, 243D             |                    |              |
| 1 1/2 Pair                         | Hinges             | A5112        |
| 1                                  | Lockset            | F86          |
| 1                                  | Overhead Stop      | C02541       |
| 1 set                              | Weatherstripping   | As Specified |
| HW-19 Doors 245A, 245C, 345A, 345C |                    |              |
| 1 1/2 Pair                         | Hinges             | A5111        |
| 1                                  | Push Plate         | J301         |
| 1                                  | Pull Plate         | J405         |
| 1                                  | Closer             | C42011       |
| 1                                  | Wall Stop          | L02011       |
| 1                                  | Kickplate          | J102         |
| 1 set                              | Weatherstripping   | As Specified |
| 1                                  | Threshold          | As Specified |
| HW-20 Doors 246A, 346A             |                    |              |

| Quantity                          | Item               | Description  |
|-----------------------------------|--------------------|--------------|
| 1 1/2 Pair                        | Hinges             | A5111        |
| 1                                 | Card Reader System | As Specified |
| 1                                 | Closer             | C42021       |
| 1                                 | Wall Stop          | L02251       |
| 1                                 | Kickplate          | J102         |
| 1 set                             | Weatherstripping   | As Specified |
| HW-21 Doors 247A, 347A            |                    |              |
| 1 1/2 Pair                        | Hinges             | A5112        |
| 1                                 | Lockset            | F76          |
| 1                                 | Closer/Stop        | C42021       |
| 1                                 | Kickplate          | J102         |
| 3                                 | Silencers          | L03011       |
| HW-22 Door 248A, 249A, 348A, 349A |                    |              |
| 1 1/2 Pair                        | Hinges             | A5112        |
| 1                                 | Lockset            | F86          |
| 1                                 | Closer/Stop        | C42021       |
| 1                                 | Kickplate          | J102         |
| 3                                 | Silencers          | L03011       |
| HW-23 Doors 250A, 350A            |                    |              |
| 1 1/2 Pair                        | Hinges             | A5112        |
| 1                                 | Lockset            | F86          |
| 1                                 | Closer             | C42021       |
| 1                                 | Wall Stop          | L02251       |
| 1                                 | Kickplate          | J102         |
| 3                                 | Silencers          | L03011       |
| HW-24 Doors 252A, 352A            |                    |              |
| 1 1/2 Pair                        | Hinges             | A5112        |
| 1                                 | Lockset            | F86          |
| 1                                 | Closer             | C42021       |
| 1                                 | Wall Stop          | L02251       |
| 1 set                             | Weatherstripping   | As Specified |
| HW-25 Doors 343A, 343B            |                    |              |
| 1 1/2 Pair                        | Hinges             | A5111        |
| 1                                 | Lockset            | F109         |
| 1                                 | Closer/Stop        | C42021       |
| 1                                 | Kickplate          | J102         |
| 3                                 | Weatherstripping   | As Specified |

| Quantity | Item | Description |
|----------|------|-------------|
|----------|------|-------------|

-- End of Section --

## SECTION 08 81 00

## GLAZING

**08/11**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (2009; Errata 2010) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

## ASTM INTERNATIONAL (ASTM)

ASTM C1036 (2006) Standard Specification for Flat Glass

ASTM C1048 (2004) Standard Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass

ASTM C1172 (2009e1) Standard Specification for Laminated Architectural Flat Glass

ASTM C1184 (2005) Standard Specification for Structural Silicone Sealants

ASTM C509 (2006; R 2011) Elastomeric Cellular Preformed Gasket and Sealing Material

ASTM C864 (2005; R 2011) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers

ASTM C920 (2011) Standard Specification for Elastomeric Joint Sealants

ASTM D 2287 (1996; R 2010) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

ASTM D 395 (2003; R 2008) Standard Test Methods for Rubber Property - Compression Set

ASTM E 119 (2011) Standard Test Methods for Fire Tests of Building Construction and Materials

ASTM E 1300 (2009a) Determining Load Resistance of Glass in Buildings

ASTM E2074 (2000e1) Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual (2004) Glazing Manual

GANA Sealant Manual (2008) Sealant Manual

GANA Standards Manual (2001) Tempering Division's Engineering Standards Manual

INSULATING GLASS MANUFACTURERS ALLIANCE (IGMA)

IGMA TB-3001 (1990) Guidelines for Sloped Glazing

IGMA TM-3000 (1997) Glazing Guidelines for Sealed Insulating Glass Units

IGMA TR-1200 (1983) Commercial Insulating Glass Dimensional Tolerances

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 252 (2012) Standard Methods of Fire Tests of Door Assemblies

NFPA 80 (2013) Standard for Fire Doors and Other Opening Protectives

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

16 CFR 1201 Safety Standard for Architectural Glazing Materials

UNDERWRITERS LABORATORIES (UL)

UL 10B (2008; Reprint Apr 2009) Fire Tests of Door Assemblies

UL 10C (2009) UL Standard for Safety Positive Pressure Fire Tests of Door Assemblies

## 1.2 SUBMITTALS

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

SD-02 Shop Drawings

Installation

Drawings showing complete details of the proposed setting methods, edge blocking, size of openings, frame details, materials, and types and thickness of glass.

## SD-03 Product Data

## Insulating Glass

## Glazing Accessories

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions.

## SD-04 Samples

## Insulating Glass

Two 8 by 10 inch samples of each of the following: tinted glass, patterned glass, and insulating glass units.

## SD-07 Certificates

## Insulating Glass

Certificates stating that the glass meets the specified requirements. Labels or manufacturers marking affixed to the glass will be accepted in lieu of certificates.

## SD-08 Manufacturer's Instructions

## Setting and sealing materials

## Glass setting

Submit glass manufacturer's recommendations for setting and sealing materials and for installation of each type of glazing material specified.

## 1.3 SYSTEM DESCRIPTION

Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work. Glazed panels shall comply with the safety standards, as indicated in accordance with ANSI Z97.1. Glazed panels shall comply with indicated wind/snow loading in accordance with ASTM E 1300.

Exterior glazing shall meet the requirements of paragraph 1609.1.2 of the 2015 International Building Code, with the exception that an impact-resistant covering meeting the requirements of an approved impact-resistant standard, will not be permitted.

## 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in safe, enclosed dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.

## 1.5 ENVIRONMENTAL REQUIREMENTS

Do not start glazing work until the outdoor temperature is above 40 degrees F and rising, unless procedures recommended by the glass manufacturer and approved by the Contracting Officer are made to warm the glass and rabbet surfaces. Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp or rainy weather.

## 1.6 WARRANTY

### 1.6.1 Warranty for Insulating Glass Units

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

## PART 2 PRODUCTS

### 2.1 GLASS

ASTM C1036, unless specified otherwise. In doors and sidelights, provide safety glazing material conforming to 16 CFR 1201. Glazing for windows and doors that are required to comply with UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings, dated 9 February 2012, Change 1, 1 October 2013, shall be sized and configured to satisfy the glazing requirement for that application. Glazing thicknesses specified herein are minimum requirements.

#### 2.1.1 Annealed Glass

Annealed glass shall be Type I transparent flat type, Class 1 - clear, Quality q3 - glazing select, 47 percent light transmittance, 0.27 percent shading coefficient, conforming to ASTM C1036. Color shall be clear.

#### 2.1.2 Laminated Glass

ASTM C1172, Kind LA fabricated from two nominal 1/8 inch pieces of Type I, Class 1, Quality q3, flat annealed transparent glass conforming to ASTM C1036. Flat glass shall be laminated together with a minimum of 0.090 inch thick, clear polyvinyl butyral interlayer. The total thickness shall be nominally 1/4 inch. Provide as a interior lite at all exterior glazing locations.

#### 2.1.3 Tempered Glass

ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (transparent), Quality q3, 1/4 inch thick, 47 percent light transmittance, 0.27 percent shading coefficient conforming to ASTM C1048 and GANA Standards Manual. Color shall be clear. Provide wherever safety glazing material is indicated or specified.

#### 2.1.4 Heat-Strengthened Glass

ASTM C1048, Kind HS (heat strengthened), Condition A (uncoated), Type I, Class 1 (clear), Quality q3, 1/4 inch thick.

## 2.1.5 Fire/Safety Rated Glass

### 2.1.5.1 Fire Rated Doors

Fire protection-rated glazing used in doors shall bear the identification D-H-NT-XXX, where the "XXX" is the placeholder that specifies the fire protection rating period in minutes. See door schedule, located on the drawings, for required fire protection rating for specific doors. Glass shall meet NFPA 252, NFPA 80, UL 10B for wood doors, UL 10C for steel doors, and ASTM E2074. Glass shall meet CPSC 16 CFR 1201 (Cat: I and II) for Impact Safety Resistance.

### 2.1.5.2 Fire Rated Wall and Partitions

Fire/safety rated glass shall be laminated Type I transparent flat type, Class 1-clear. Glass shall have a 20, 45, or 60 minute rating when tested in accordance with ASTM E 119. Glass shall be permanently labeled with appropriate markings. Glass shall meet ANSI Z97.1 and CPSC 16 CFR 1201 (Cat: I and II) for Impact Safety Resistance.

## 2.2 INSULATING GLASS UNITS

Two panes of glass separated by a dehydrated airspace and hermetically sealed. Dimensional tolerances shall be as specified in IGMA TR-1200. Spacer shall be roll-formed, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

### 2.2.1 Buildings

Two panes of glass separated by a dehydrated airspace, filled with argon gas and hermetically sealed.

Insulated glass units shall have a Solar Heat Gain Coefficient (SHGC) maximum of 0.24 and a U-factor maximum of 0.28 Btu per square foot by hr by degree F.

Dimensional tolerances shall be as specified in IGMA TR-1200. Spacer shall be black, roll-formed, steel-reinforced butyl rubber, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

The inner light shall be ASTM C1172, laminated glass, clear annealed flat glass Type I, Class I, Quality q3, 1/4 inch thick. The outer light shall be ASTM C1036, Type I, Class 1 (transparent) Quality q4, 1/4 inch thick and where indicated, ASTM C1048, Grade B (fully tempered), Style I (uncoated), Type I, Class 1 (clear), Quality q4, 1/4 inch thick.

### 2.2.2 Low Emissivity Insulating Glass

Interior and exterior glass panes for Low-E insulating units shall be Type I annealed flat glass, Class 1-clear with anti-reflective low-emissivity coating on No. 2 surface (inside surface of exterior pane), Quality q3 - glazing select, conforming to ASTM C1036. Glass performance shall be U



value winter nighttime maximum of 0.28 Btu/hr-ft<sup>2</sup>-F, Solar Heat Gain Coefficient (SHGC) maximum of 0.24 and shading coefficient of 0.27. Color shall be clear.

## 2.3 SETTING AND SEALING MATERIALS

Provide as specified in the GANA Glazing Manual, IGMA TM-3000, IGMA TB-3001, and manufacturer's recommendations, unless specified otherwise herein. Do not use metal sash putty, nonskinning compounds, nonresilient preformed sealers, or impregnated preformed gaskets. Materials exposed to view and unpainted shall be gray or neutral color.

### 2.3.1 Sealants

Provide elastomeric and structural sealants.

#### 2.3.1.1 Elastomeric Sealant

ASTM C920, Type S, Grade NS, Class 12.5, Use G. Use for channel or stop glazing metal sash. Sealant shall be chemically compatible with setting blocks, edge blocks, and sealing tapes, with sealants used in manufacture of insulating glass units. Color of sealant shall be white.

#### 2.3.1.2 Structural Sealant

ASTM C1184, Type S.

### 2.3.2 Joint Backer

Joint backer shall have a diameter size at least 25 percent larger than joint width; type and material as recommended in writing by glass and sealant manufacturer.

### 2.3.3 Preformed Channels

Neoprene, vinyl, or rubber, as recommended by the glass manufacturer for the particular condition.

### 2.3.4 Sealing Tapes

Preformed, semisolid, PVC-based material of proper size and compressibility for the particular condition, complying with ASTM D 2287. Use only where glazing rabbet is designed for tape and tape is recommended by the glass or sealant manufacturer. Provide spacer shims for use with compressible tapes. Tapes shall be chemically compatible with the product being set.

### 2.3.5 Setting Blocks and Edge Blocks

Closed-cell neoprene setting blocks shall be dense extruded type conforming to ASTM C509 and ASTM D 395, Method B, Shore A durometer between 70 and 90. Edge blocking shall be Shore A durometer of 50 (plus or minus 5). Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer. Block color shall be black.

### 2.3.6 Glazing Gaskets

Glazing gaskets shall be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a

watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Glazing gasket profiles shall be as indicated on drawings.

#### 2.3.6.1 Fixed Glazing Gaskets

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM C509, Type 2, Option 1.

#### 2.3.6.2 Wedge Glazing Gaskets

Wedge glazing gaskets shall be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to ASTM C864, Option 1, Shore A durometer between 65 and 75.

#### 2.3.6.3 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing shall be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight.

#### 2.3.7 Accessories

Provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide noncorroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers.

### PART 3 EXECUTION

#### 3.1 PREPARATION

Preparation, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, IGMA TM-3000, and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work. Leave labels in place until the installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

#### 3.2 GLASS SETTING

Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, IGMA TM-3000, and manufacturer's recommendations. Aluminum windows, wood doors, and wood windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place. Verify products are properly installed, connected, and adjusted.

### 3.2.1 Sheet Glass

Cut and set with the visible lines or waves horizontal.

### 3.2.2 Insulating Glass Units

Do not grind, nip, or cut edges or corners of units after the units have left the factory. Springing, forcing, or twisting of units during setting will not be permitted. Handle units so as not to strike frames or other objects. Installation shall conform to applicable recommendations of IGMA TB-3001 and IGMA TM-3000.

### 3.2.3 Installation of Laminated Glass

Sashes which are to receive laminated glass shall be weeped to the outside to allow water drainage into the channel.

## 3.3 CLEANING

Clean glass surfaces and remove labels, paint spots, putty, and other defacement as required to prevent staining. Glass shall be clean at the time the work is accepted.

## 3.4 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Upon removal, separate protective materials for reuse or recycling. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

-- End of Section --

## SECTION 08 91 00

## METAL WALL LOUVERS

05/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D (2012) Laboratory Methods of Testing  
Dampers for Rating

AMCA 511 (2010) Certified Ratings Program for Air  
Control Devices

## ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System  
for Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 2605 (2013) Voluntary Specification,  
Performance Requirements and Test  
Procedures for Superior Performing Organic  
Coatings on Aluminum Extrusions and Panels

AAMA 611 (1998; R 2004) Voluntary Specification for  
Anodized Architectural Aluminum

## ASTM INTERNATIONAL (ASTM)

ASTM B209 (2010) Standard Specification for Aluminum  
and Aluminum-Alloy Sheet and Plate

ASTM B221 (2014) Standard Specification for Aluminum  
and Aluminum-Alloy Extruded Bars, Rods,  
Wire, Profiles, and Tubes

## 1.2 SUBMITTALS

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

SD-02 Shop Drawings

Wall louvers

SD-03 Product Data

Metal Wall Louvers

### 1.3 DELIVERY, STORAGE, AND PROTECTION

Deliver materials to the site in an undamaged condition. Carefully store materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

### 1.4 DETAIL DRAWINGS

Show all information necessary for fabrication and installation of wall louvers. Indicate materials, sizes, thicknesses, fastenings, and profiles.

### 1.5 COLOR SAMPLES

Colors of finishes for wall louvers and door louvers shall closely approximate colors indicated. Where color is not indicated, submit the manufacturer's standard colors to the Contracting Officer for selection.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Aluminum Sheet

ASTM B209, alloy 3003 or 5005 with temper as required for forming.

#### 2.1.2 Extruded Aluminum

ASTM B221, alloy 6063-T5 or -T52.

### 2.2 METAL WALL LOUVERS

Weather resistant type, with bird screens and made to withstand a wind load of not less than 40 pounds per square foot. Wall louvers shall bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500-D and AMCA 511. The rating shall show a water penetration of 0.20 or less ounce per square foot of free area at a free velocity of 800 feet per minute. High Performance Louvers shall have a minimum 62% free area.

#### 2.2.1 Extruded Aluminum Louvers

Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than 0.081 inch for blades. Frame depth shall be 6 inches minimum with 0.125 inch nominal wall thickness.

#### 2.2.2 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.

#### 2.2.3 Screens and Frames

For aluminum louvers, provide 5/8 inch square mesh, 14 or 16 gage aluminum, 16 gage aluminum bird screening. Mount screens in removable, rewirable frames of same material and finish as the louvers.

## 2.3 FASTENERS AND ACCESSORIES

Provide stainless steel screws and fasteners for aluminum louvers. Provide other accessories as required for complete and proper installation.

## 2.4 FINISHES

### 2.4.1 Aluminum

Exposed aluminum surfaces shall be factory finished with an anodic coating. Louvers in the gable of the Building shall have a organic coating. Color shall be as selected.

#### 2.4.1.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish shall be:

- a. Architectural Class I ( 0.7 mil or thicker), designation A44, electrolytically deposited color anodized.

#### 2.4.1.2 Organic Coating

Clean and prime exposed aluminum surfaces. Provide a high-performance finish in accordance with AAMA 2605, with total dry film thickness of not less than 1.2 mil.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Wall Louvers

Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations.

#### 3.1.2 Screens and Frames

Attach frames to louvers with screws or bolts.

### 3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

#### 3.2.1 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

#### 3.2.2 Metal

Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

-- End of Section --

## SECTION 09 22 00

## SUPPORTS FOR PLASTER AND GYPSUM BOARD

02/10

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 341 (2005; Supp 2005) Seismic Provisions for Structural Steel Buildings

## ASTM INTERNATIONAL (ASTM)

ASTM A 463/A 463M (2009a) Standard Specification for Steel Sheet, Aluminum-Coated

ASTM A 653/A 653M (2009a) 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 C645 (2014) Nonstructural Steel Framing Members

ASTM C955 (2011c) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases

## 1.2 SUBMITTALS

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

## 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 A 653/A 653M, G-60; aluminum coating ASTM A 463/A 463M, T1-25; or a 55-percent aluminum-zinc coating, and other coatings as indicated. Provide support systems and attachments per AISC 341 and UFC 3-310-04, "Seismic Design for Buildings" in seismic zones.

#### 2.1.1 Materials for Attachment of Gypsum Wallboard

##### 2.1.1.1 Suspended and Furred Ceiling Systems

ASTM C645 ASTM C955. Provide 1 1/2 inch-16 gauge (54 mils) steel cold-rolled channels, CP60 coating (main runners) at 4 ft -0 inches o.c. with 7/8 inch - 20 gauge (30 mils) thickness metal furring channels, G60 coating at 2 ft-0 inches o.c. with exception at shower, toilet and laundry areas where 1 ft -0 inches o.c. spacing is required for the 20 gauge metal furring channels. Provide No. 8 gauge galvanized hanger wire spaced 4 ft o.c. maximum. Attach furring channels perpendicular to cold-rolled channels with double strand of saddle-tied No. 16 gauge galvanized tie wire or 1 1/2 inch furring channel clips.

##### 2.1.1.2 Gypsum Board Furring Channels

ASTM C645 ASTM C955. Provide 20 gauge (30 mils), 7/8 inch height, and 2-1/2 inch base.

##### 2.1.1.3 Nonload-Bearing Wall Framing and Ceiling Framing

ASTM C 645, but not thinner than 0.0329 inch (30 mils) minimum thickness. The ASTM certified third party testing statement for equivalent thicknesses shall not apply.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Systems for Attachment of Gypsum Wallboard

##### 3.1.1.1 Suspended and Furred Ceiling Systems

ASTM C 754, except provide framing members 16 inches o.c. unless indicated otherwise.

##### 3.1.1.2 Non-loadbearing Wall Framing and Ceiling Framing

ASTM C 754, except provide framing members at 16 inches o.c. unless indicated otherwise.

### 3.2 ERECTION TOLERANCES

Provide framing members which will be covered by finish materials such as wallboard, plaster, or ceramic tile set in a mortar setting bed, within the following limits:

- a. Layout of walls and partitions: 1/4 inch from intended position;



- b. Plates and runners: 1/4 inch in 8 feet from a straight line;
- c. Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and
- d. Face of framing members: 1/4 inch in 8 feet from a true plane.

Provide framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive within the following limits:

- a. Layout of walls and partitions: 1/4 inch from intended position;
- b. Plates and runners: 1/8 inch in 8 feet from a straight line;
- c. Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and
- d. Face of framing members: 1/8 inch in 8 feet from a true plane.

-- End of Section --

## SECTION 09 29 00

## GYPSUM BOARD

05/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.11 (1992; Reaffirmed 2005) Specifications for Interior Installation of Cementitious Backer Units

## ASTM INTERNATIONAL (ASTM)

ASTM C 1002 (2007) 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 C 1047 (2010a) Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base

ASTM C 1396/C 1396M (2009a) Standard Specification for Gypsum Board

ASTM C 475/C 475M (2002; R 2007) Joint Compound and Joint Tape for Finishing Gypsum Board

ASTM C 840 (2008) Application and Finishing of Gypsum Board

ASTM C 954 (2010) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

ASTM C1325 (2008b) Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement Substrate Sheets

ASTM C1629/C1629M (2006) Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels

ASTM D 1037 (2006a) Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

|                   |   |
|-------------------|---|
| ASTM D 226/D 226M | (2009) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing                          |
| ASTM D 2394       | (2005; R 2011) Simulated Service Testing of Wood and Wood-Base Finish Flooring  |
| ASTM D 5420       | (2010) Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Strike Impacted by a Falling Weight (Gardner Impact) |
| ASTM E 695        | (2003; R 2009) Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading                        |
| ASTM E 84         | (2015a) Standard Test Method for Surface Burning Characteristics of Building Materials                                      |

GYPSUM ASSOCIATION (GA)

|        |   |
|--------|---|
| GA 214 | (2007) Recommended Levels of Gypsum Board Finish          |
| GA 216 | (2010) Application and Finishing of Gypsum Panel Products |

UNDERWRITERS LABORATORIES (UL)

|                    |                                  |
|--------------------|----------------------------------|
| UL Fire Resistance | (2014) Fire Resistance Directory |
|--------------------|----------------------------------|

1.2 SUBMITTALS

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

SD-03 Product Data

Cementitious backer units

Impact Resistant Gypsum Board

Accessories

Submit for each type of gypsum board and for cementitious backer units.

Gypsum Board;

Joint Treatment Materials

Submit manufacturer's product data, indicating VOC content.

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.

SD-08 Manufacturer's Instructions

Material Safety Data Sheets

SD-10 Operation and Maintenance Data

Manufacturer maintenance instructions

Waste Management

### 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. Gypsum wallboard shall not be stored with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants. Do not store panels near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

#### 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 ENVIRONMENTAL CONDITIONS

#### 1.4.1 Temperature

Maintain a uniform temperature of not less than 50 degrees F in the structure for at least 48 hours prior to, during, and following the application of gypsum board, cementitious backer units, and joint treatment materials, or the bonding of adhesives.

#### 1.4.2 Exposure to Weather

Protect gypsum board and cementitious backer unit products from direct exposure to rain, snow, sunlight, and other extreme weather conditions.

#### 1.4.3 Temporary Ventilation

Provide temporary ventilation for work of this section.

## 1.5 QUALIFICATIONS

Furnish type of gypsum board work specialized by the installer with a minimum of 3 years of documented successful experience.

## 1.6 SCHEDULING

The gypsum wallboard shall be taped, spackled and primed before the installation of the highly-emitting materials.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Conform to specifications, standards and requirements specified. Provide gypsum board types, gypsum backing board types, cementitious backing units, and joint treating materials manufactured from asbestos free materials only.

Submit Material Safety Data Sheets and manufacturer maintenance instructions for gypsum materials including adhesives.

#### 2.1.1 Gypsum Board

ASTM C 1396/C 1396M. All gypsum board shall be impact resistant gypsum board.

#### 2.1.2 Impact Resistant Gypsum Board

48 inch wide, 5/8 inch thick, Type X, tapered edges, moisture and mold resistant Type X gypsum core encased in a heavy, abrasion and mold/mildew/moisture resistant paper. At all Sleeping Room bathroom ceiling locations provide 48 inch wide, 5/8 inch thick, Type X, tapered edges, moisture and mold resistant Type X gypsum core encased in a heavy, abrasion and mold/mildew/moisture resistant coated fiberglass mat. Reinforced gypsum panel with imbedded fiber mesh or lexan backing testing in accordance with the following tests. Hard body impact test must attain a Level 2 performance in accordance with ASTM C1629/C1629M. Provide fasteners that meet manufacturer requirements and specifications stated within this section. Impact resistant gypsum board, when tested in accordance with ASTM E 84, have a flame spread rating of 15 or less and a smoke developed rating of 0 or less.

##### 2.1.2.1 Structural Failure Test

ASTM E 695 or ASTM D 2394 for structural failure (drop penetration). ASTM E 695 using a 60 lb sand filled leather bag, resisting no less than 300 ft. lb. cumulative impact energy before failure or ASTM D 2394 using 5.5 inch hemispherical projectile resisting no less than 264 ft. lb. before failure. Provide test specimen stud spacing a minimum 16 inch on center.

##### 2.1.2.2 Indentation Test

ASTM D 5420 or ASTM D 1037 for indentation resistance. ASTM D 5420 using a 32 oz weight with a 5/8 inch hemispherical impacting head dropped once 3 feet creating not more than 0.137 inch indentation or ASTM D 1037 using no less than 470 lb weight applied to the 0.438 inch diameter ball to create not more than a 0.0197 inch indentation depth.

### 2.1.3 Cementitious Backer Units

In accordance with the Tile Council of America (TCA) Handbook, surfaced with fiberglass reinforcing mesh on front and back; long edges wrapped; complying with ANSI A118.9 and ASTM C1325 .

### 2.1.4 Joint Treatment Materials

ASTM C 475/C 475M. Use all purpose joint and texturing compound containing inert fillers and natural binders, including lime compound. Pre-mixed compounds shall be free of antifreeze, vinyl adhesives, preservatives, biocides and other slow releasing compounds.

#### 2.1.4.1 Embedding Compound

Specifically formulated and manufactured for use in embedding tape at gypsum board joints and compatible with tape, substrate and fasteners.

#### 2.1.4.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound.

#### 2.1.4.3 All-Purpose Compound

Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape, substrate and fasteners.

#### 2.1.4.4 Setting or Hardening Type Compound

Specifically formulated and manufactured for use with fiber glass mesh tape.

#### 2.1.4.5 Joint Tape

Use cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape recommended by the manufacturer.

### 2.1.5 Fasteners

#### 2.1.5.1 Screws

ASTM C 1002, 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 C 954 steel drill screws for fastening gypsum board to steel framing members 0.033 to 0.112 inch thick. Provide cementitious backer unit screws with a polymer coating.

### 2.1.6 Accessories

ASTM C 1047. Fabricate from corrosion protected steel or plastic designed for intended use. Accessories manufactured with paper flanges are not acceptable. Flanges shall be free of dirt, grease, and other materials that may adversely affect bond of joint treatment. Provide prefinished or job decorated materials.

### 2.1.7 Asphalt Impregnated Building Felt

Provide a 15 lb asphalt moisture barrier over gypsum sheathing. Conforming to ASTM D 226/D 226M Type 1 (No. 15) for asphalt impregnated building felt.

### 2.1.8 Water

Provide clean, fresh, and potable water.

## PART 3 EXECUTION

### 3.1 EXAMINATION

#### 3.1.1 Framing and Furring

Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board and cementitious backer units. Verify that all blocking, headers and supports are in place to support plumbing fixtures and to receive soap dishes, grab bars, towel racks, and similar items. Do not proceed with work until framing and furring are acceptable for application of gypsum board and cementitious backer units.

### 3.2 APPLICATION OF GYPSUM BOARD

Apply gypsum board to framing and furring members in accordance with ASTM C 840 or GA 216 and the requirements specified. Apply gypsum board with separate panels in moderate contact; do not force in place. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length; select panel sizes to minimize waste. Cut out gypsum board to make neat, close, and tight joints around openings. In vertical application of gypsum board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece. Lay out panels to minimize waste; reuse cutoffs whenever feasible. Surfaces of gypsum board and substrate members may not be bonded together with an adhesive, except where prohibited by fire rating(s). Treat edges of cutouts for plumbing pipes, screwheads, and joints with water-resistant compound as recommended by the gypsum board manufacturer.

#### 3.2.1 Application of Gypsum Board to Steel Framing and Furring

Apply in accordance with ASTM C 840, System VIII or GA 216.

#### 3.2.2 Control Joints

Install expansion and contraction joints in ceilings and walls in accordance with ASTM C 840, System XIII or GA 216. Fill control joints between studs in fire-rated construction with firesafing insulation to match the fire-rating of construction.

### 3.3 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 C 840, 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 C 1396/C 1396M, to receive ceramic tile to Level 2 in accordance with GA 214. Unless otherwise specified, finish all gypsum board walls, partitions and ceilings to Level 5 in accordance with GA 214. Provide joint, fastener depression, and corner treatment. Tool joints as smoothly as possible to minimize sanding and dust. Do not use fiber glass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer. Protect workers, building occupants, and HVAC systems from gypsum dust.

#### 3.4.1 Uniform Surface

In accordance with GA 214 Level 5, apply a thin skim coat of joint compound to the entire gypsum board surface, after the two-coat joint and fastener treatment is complete and dry.

### 3.5 SEALING

Seal openings around pipes, fixtures, and other items projecting through gypsum board and cementitious backer units as specified in Section 07 92 00 JOINT SEALANTS. Apply material with exposed surface flush with gypsum board or cementitious backer units.

### 3.6 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated construction is indicated, provide materials and application methods, including types and spacing of fasteners, wall and ceiling framing in accordance with the specifications contained in UL Fire Resistance for the Design Number(s) indicated. Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL test requirements or GA requirements. Seal penetrations through rated partitions and ceilings tight in accordance with tested systems.

### 3.7 PATCHING

Patch surface defects in gypsum board to a smooth, uniform appearance, ready to receive finishes.

### 3.8 WASTE MANAGEMENT

As specified in Waste Management Plan and as follows. Separate clean waste gypsum products from contaminants. Do not include wood, plastic, metal, asphalt-impregnated gypsum board, or any gypsum board coated with glass fiber, vinyl, decorative paper, or other finish. Place in designated area and protect from moisture and contamination.

-- End of Section --



## SECTION 09 30 13

## CERAMIC TILING

11/13

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- |              |   |
|--------------|---|
| ANSI A137.1  | (2012) American National Standards<br>Specifications for Ceramic Tile   |
| ANSI A137.2  | (2012) American National Standards<br>Specifications for Glass Tile   |
| ANSI A118.10 | (2003) Load Bearing, Bonded, Waterproof<br>Membranes For Thin-Set Ceramic Tile And<br>Dimension Stone Installations |

## ASTM INTERNATIONAL (ASTM)

- |                   |  |
|-------------------|--|
| ASTM A1064/A1064M | (2013) Standard Specification for<br>Carbon-Steel Wire and Welded Wire<br>Reinforcement, Plain and Deformed, for<br>Concrete |
| ASTM C1027        | (2009) Standard Test Method for<br>Determining Visible Abrasion Resistance of<br>Glazed Ceramic Tile                         |
| ASTM C144         | (2011) Standard Specification for<br>Aggregate for Masonry Mortar  |
| ASTM C150/C150M   | (2015) Standard Specification for Portland<br>Cement   |
| ASTM C206         | (2003; R 2009) Standard Specification for<br>Finishing Hydrated Lime   |
| ASTM C207         | (2006; R 2011) Standard Specification for<br>Hydrated Lime for Masonry Purposes  |
| ASTM C241/C241M   | (2013) Standard Specification for Abrasion<br>Resistance of Stone Subjected to Foot<br>Traffic                               |
| ASTM C33/C33M     | (2013) Standard Specification for Concrete<br>Aggregates   |
| ASTM C373         | (2014) Water Absorption, Bulk Density,<br>Apparent Porosity, and Apparent Specific   |

## Gravity of Fired Whiteware Products

ASTM C648

(2004; R 2009) Breaking Strength of  
Ceramic Tile

ASTM C847

(2014) Standard Specification for Metal  
Lath

## MARBLE INSTITUTE OF AMERICA (MIA)

MIA Design Manual

(2003) Dimension Stone Design Manual

## TILE COUNCIL OF NORTH AMERICA (TCNA)

TCNA Hdbk

(2013) Handbook for Ceramic, Glass, and  
Stone Tile Installation

## 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  
Tile;  
Reinforcing Wire Fabric;  
Aluminum Trim  
waterproof membrane

## SD-04 Samples

Tile  
Accessories  
Transition Strips  
Grout  
Aluminum Trim

## 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, the exception being glass tile. Furnish glass tiles that comply with ANSI A137.2. Provide a minimum breaking strength of 125 lbs. for wall tile and 250 lbs. for floor tile in accordance with ASTM C648. 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 porcelain 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 Porcelain Floor Tile (PT-2)

Furnish unglazed porcelain tile, and trim pieces with color extending uniformly through the body of the tile. Provide tile with a V2 aesthetic classification. Blend tiles in factory and in a packages to have same color range and continuous blend for installation. Provide nominal tile size(s) of 6 by 24 inch and 5/16 inch thick. Provide a 0.50 percent maximum water absorption in accordance with ASTM C373.

##### 2.1.2 Porcelain Wall Tile

Provide tile with a V3 aesthetic classification. Blend tiles in factory and in a packages to have same color range and continuous blend for installation. Provide a 0.50 percent maximum water absorption in accordance with ASTM C373.

###### a. Porcelain Wall Tile (PT-1)

Provide porcelain wall tile and trim. Provide tile 12 by 12 inch by 3/8 inch.

###### b. Porcelain Wall Tile (T-1)

Provide porcelain wall tile and trim. Provide tile 6 by 12 inch by 3/8 inch.

### 2.1.3 Glass Tile (MT-1)

Furnish ceramic-free recycled glass mosaic tile and matching trim that complies with ANSI A137.2. Provide nominal tile size(s) of 1 by 1 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

Provide mortars specifically formulated or recommended for glass tile.

### 2.4.1 Dry-Set Portland Cement Mortar

TCNA Hdbk.

### 2.4.2 Latex-Portland Cement Mortar

TCNA Hdbk.

### 2.4.3 Ceramic Tile Grout

TCNA Hdbk; petroleum-free and plastic-free sand portland cement grout, dry-set grout, latex-portland cement grout, or commercial portland cement grout.

#### 2.4.4 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.

#### 2.4.5 Cementitious Backer Board

Provide cementitious backer units, for use as tile substrate over wood sub-floors, in accordance with TCNA Hdbk. Furnish 1/2 inch thick cementitious backer units.

#### 2.5 TRANSITION STRIPS

Provide marble thresholds of size required by the drawings or conditions. Provide 5/8 inch minimum thickness. Categorize marble Group A as classified by MIA Design Manual. Provide a fine sand-rubbed finish marble, white gray in color. Provide minimum 12.0 marble abrasion when tested in accordance with ASTM C241/C241M.

#### 2.6 COLOR, TEXTURE, AND PATTERN

Provide color, pattern and texture as indicated on the drawings. Color listed is not intended to limit the selection of equal colors from other manufacturers. Provide floor patterns as specified on the drawings.

#### 2.7 Aluminum Trim

Provide a symmetrically rounded profile of satin anodized aluminum at all outside corners of ceramic tile.

### 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:

| TYPE                         | WALLS             | FLOORS             |
|------------------------------|-------------------|--------------------|
| Dry-Set Mortar               | 1/8 inch in 8 ft. | 1/8 inch in 10 ft. |
| Organic Adhesives            | 1/8 inch in 8 ft. | 1/16 inch in 3 ft. |
| Latex Portland Cement Mortar | 1/8 inch in 8 ft. | 1/8 inch in 10 ft. |
| Epoxy                        | 1/8 inch in 8 ft. | 1/8 inch in 10 ft. |

#### 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.

### 3.3 INSTALLATION OF WALL TILE

Install wall tile in accordance with the TCNA Hdbk, method W222 and with grout joints as recommended by the manufacturer for the type of tile. Install thinner wall tile flush with thicker wall tile applied on same wall and provide installation materials as recommended by the tile and setting materials manufacturer's to achieve flush installation.

#### 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 Latex-Portland Cement 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.

### 3.4 INSTALLATION OF FLOOR TILE

Install floor tile in toilets on the first floor in accordance with TCNA Hdbk method F122. Install floor tile in toilets on the second and third floors in accordance with TCA 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 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. Grout

joints shall be 3/32 inch in width or thickness as recommended by the tile manufacturer.

#### 3.4.4 Waterproofing

Provide waterproof membrane as required by the Handbook for Ceramic Tile Installation and ANSI A118.10

#### 3.4.5 Concrete Fill

Provide a 3500 psi concrete fill mix to dry as consistency as practicable. Compose concrete fill by volume of 1 part Portland cement to 3 parts fine aggregate to 4 parts coarse aggregate, and mix with water to as dry a consistency as practicable. Spread, tamp, and screed concrete fill to a true plane, and pitch to drains or levels as shown. Thoroughly damp concrete fill before applying setting-bed material. Reinforce concrete fill with one layer of reinforcement, with the uncut edges lapped the width of one mesh and the cut ends and edges lapped a minimum 2 inch. Tie laps together with 18 gauge wire every 10 inch along the finished edges and every 6 inch along the cut ends and edges. Provide reinforcement with support and secure in the centers of concrete fills. Provide a continuous mesh; except where expansion joints occur, cut mesh and discontinue across such joints. Provide reinforced concrete fill under the setting-bed where the distance between the under-floor surface and the finished tiles floor surface is a minimum of 2 inches, and of the same thickness that the mortar setting-bed over the concrete fill with the thickness required in the specified TCNA Hdbk method.

### 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 --



## SECTION 09 51 00

## ACOUSTICAL CEILINGS

08/10

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

|                   |   |
|-------------------|---|
| ASTM A 641/A 641M | (2009a; R 2014) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire   |
| ASTM C 423        | (2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method   |
| ASTM C 635/C 635M | (2007) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings                |
| ASTM C 636/C 636M | (2008) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels                   |
| ASTM E 1264       | (2008) Acoustical Ceiling Products  |
| ASTM E 1414       | (2006) Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum   |
| ASTM E 1477       | (1998a; R 2008) Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers                       |
| ASTM E 580/E 580M | (2009a) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Moderate Seismic Restraint |
| ASTM E 795        | (2005) Mounting Test Specimens During Sound Absorption Tests  |

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

|              |   |
|--------------|---|
| UFC 3-310-04 | (2007; Change 1) Seismic Design for Buildings |
|--------------|---|

## UNDERWRITERS LABORATORIES (UL)

|                    |                                  |
|--------------------|----------------------------------|
| UL Fire Resistance | (2014) Fire Resistance Directory |
|--------------------|----------------------------------|

## 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 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 35 for when determined in accordance with ASTM E 1414. 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 C 423 Test Method.

### 1.2.3 Light Reflectance

Determine light reflectance factor in accordance with ASTM E 1477 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 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.

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.

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-03 Product Data

Acoustical Units

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 30 year limited system warranty. Include an agreement to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of grid system.

## PART 2 PRODUCTS

### 2.1 ACOUSTICAL UNITS (ACT-1)

Submit two samples of each type of acoustical unit and each type of

suspension grid tee section showing texture, finish, and color. Conform acoustical units to ASTM E 1264, Class A, and the following requirements:

#### 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:

| Product             | Material            | Percent of Post Consumer Materials | Percent of Total Recovered Materials |
|---------------------|---------------------|------------------------------------|--------------------------------------|
| Laminate Paperboard | Post Consumer Paper | 100                                | 100                                  |
| Rock Wool           | Slag                | 75                                 |                                      |
| Cellulose           | Post Consumer Paper | 75                                 | 75                                   |

a. The recommended recovered materials content levels are based on the weight (not volume) of materials in the insulating core only.

b. For informational purposes, a list of known sources for acoustical ceiling tiles using recycled material is provided in the EPA/CPG Supplier database at [http://www.ergweb2.com/cpg4review/user/cpg\\_search.cfm](http://www.ergweb2.com/cpg4review/user/cpg_search.cfm).

c. Note that the Contractor is not limited to these sources. A product meeting CPG recycle requirements from other sources may be submitted for the Government's approval.

d. Submit recycled material content data for acoustic ceiling tiles indicating compliance with affirmative procurement.

e. Submit total weight and volume quantities of acoustic ceiling tiles with recycle material.

#### 2.1.2 Humidity Resistant Composition Units

a. Type: Type III, Form: 2, 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.

b. Flame Spread: Class: A, 25 or less. Smoke Developed Index 50 or less.

c. Pattern: CE, fine fissured.

d. Texture: Medium

e. Minimum NRC: Minimum 0.70 when tested on Mounting Type E-400 of ASTM E 795.

f. Minimum Light Reflectance Coefficient: LR-1, 0.85 or greater.

g. Nominal Size: 24 by 24 by 7/8 inch.

h. Acoustics AC: 170

i. Edge Detail: Square lay-in.

## 2.2 SUSPENSION SYSTEM

Provide standard exposed-grid standard width flange suspension system conforming to ASTM C 635/C 635M 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 inside and outside corner caps. 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 E 580/E 580M.

## 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 A 641/A 641M, Class 1, 0.11 inch in diameter.

## 2.4 ACCESS PANELS

Provide access panels that match adjacent acoustical units, designed and equipped with suitable framing and fastenings for removal and replacement without damage. Size panel to be not less than 12 by 12 inch or more than 12 by 24 inch.

a. Attach an identification plate of 0.032 inch thick aluminum, 3/4 inch in diameter, stamped with the letters "AP" and finished the same as the unit, near one corner on the face of each access panel.

b. Identify ceiling access panel by a number utilizing white identification plates or plastic buttons with contrasting numerals. Provide plates or buttons of minimum 1 inch diameter and securely attached to one corner of each access unit. Provide a typewritten card framed under glass listing the code identification numbers and corresponding system descriptions listed above. Mount the framed card where directed and furnish a duplicate card to the Contracting Officer. Code identification system is as follows:

- 1 Fire detection/alarm system
- 2 Air conditioning controls
- 3 Plumbing system
- 4 Heating and steam systems
- 5 Air conditioning duct system
- 6 Sprinkler system

## 7 Telephone junction boxes

### 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.

## 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 C 636/C 636M 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.

## 3.2 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 --

## SECTION 09 65 00

## RESILIENT FLOORING

08/10

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

|             |   |
|-------------|---|
| ASTM D2047  | (2011) Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine              |
| ASTM E648   | (2014c) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source |
| ASTM E662   | (2009) Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials                      |
| ASTM F 137  | Standard Test Method for Flexibility of Resilient Flooring Materials with Cylindrical Mandrel Apparatus             |
| ASTM F 1514 | Standard Test Method for Measuring Heat Stability of Resilient Vinyl Flooring by Color Change                       |
| ASTM F 1515 | Standard Test Method for Measuring Light Stability of Resilient Vinyl Flooring by Color Change                      |
| ASTM F 1700 | (2004; R 2010) Solid Vinyl Floor Tile   |
| ASTM F 1861 | (2008) Resilient Wall Base  |
| ASTM F 1869 | (2010) Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride                 |
| ASTM F 1914 | Standard Test Method for Short-Term Indentation and Residual Indentation of Resilient Floor Covering                |
| ASTM F 2170 | (2009) Determining Relative Humidity in Concrete Floor Slabs in situ Probes   |
| ASTM F 386  | Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces                             |



|            |   |
|------------|---|
| ASTM F 536 | Test Method for Size of Resilient Floor Coverings. (This test method was withdrawn by ASTM in 2004) |
| ASTM F 540 | Test Method for Size of Resilient Floor Coverings. (This test method was withdrawn by ASTM in 2004) |
| ASTM F 710 | (2011) Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring                |
| ASTM F 925 | Standard Test Method for Resistance to Chemicals of Resilient Flooring                              |
| ASTM F 970 | Standard Test Method for Static Load Limit  |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

|          |   |
|----------|---|
| NFPA 253 | Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source |
| NFPA 258 | Recommended Practice for Determining Smoke Generation of Solid Materials  |

## 1.2 SYSTEM DESCRIPTION

### 1.2.1 Fire Resistance Requirements

Provide a minimum average critical radiant flux of 1.07 watts per square centimeter for flooring in corridors and exits when tested in accordance with ASTM E648.

## 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

Resilient Flooring and Accessories  
Adhesives;  
Solid Vinyl Planks  
Wall Base

#### SD-04 Samples

Resilient Flooring and Accessories

#### SD-06 Test Reports

Moisture, Alkalinity and Bond Tests

## SD-08 Manufacturer's Instructions

Surface Preparation  
Installation

## SD-10 Operation and Maintenance Data

Resilient Flooring and Accessories

## SD-11 Closeout Submittals

Resilient Flooring and Accessories  
Adhesives

## 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. Materials shall be delivered at least 48 hours before installation to that materials can acclimate to the jobsite temperature. Store materials in a clean, dry, secure, and well-ventilated area free from strong contaminant sources and residues with ambient air temperature maintained above 65 degrees F and below 80 degrees F, stacked according to manufacturer's requirements. Remove resilient flooring products from packaging to allow ventilation prior to installation. Protect materials from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances. Observe ventilation and safety procedures specified in the MSDS. Do not store rubber surface products with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store exposed rubber surface materials in occupied spaces. Do not store near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

## 1.5 ENVIRONMENTAL REQUIREMENTS

Maintain areas to receive resilient flooring at a temperature above 65 degrees F and below 80 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 all other finishing operations. During spackling and/or painting, the substrate shall be covered to prevent contamination or staining, which can cause adhesion failure or product discoloration.

## 1.7 WARRANTY

Provide solid vinyl plank manufacturer's warranties for material and labor for 20 years.

## PART 2 PRODUCTS

## 2.1 SOLID VINYL PLANKS (RPF-1)

Conform to ASTM F 1700 Class III printed (wood grain look) film minimum wear layer thickness 0.04 inch and minimum overall thickness 0.100 inch, Type B (embossed). Provide 4-1/2 inch x 36 inch planks with unbeveled edge. The flooring shall include a protective urethane for ease of maintenance and conform to ASTM E648, Type III Class I. The flooring shall require a no wax finish. Provide vinyl flooring that is easily cleaned with off-the-shelf products. Surface finishes requiring manufacturer supplied or special order cleaning solutions are not acceptable. Solid vinyl planks shall meet A.D.A. slip-resistance requirements.

## 2.1.1 Solid Vinyl Plank Properties

Comply with ASTM F 1700, including the following:

1. Classification (ASTM F 1700): Class III (Printed Film) Types A & B.
2. Flexibility (ASTM F 137): 1 inch mandrel, no crack or break; Pass.
3. Total Thickness (ASTM F 386): 0.100 inch +/- 0.005 inch, satisfies requirement.
4. Chemical Resistance (ASTM F 925): Excellent resistance.
5. Heat Resistance (ASTM F 1514): Delta E < 8 average; satisfies requirement.
6. Light Stability (ASTM F 1515): Delta E < 8 average; satisfies requirement.
7. Short-Term Residual Indentation (ASTM F 1914): < 8%, satisfies requirement.
8. Tile Size (ASTM F 536): +/- 0.016 inch/lineal foot; satisfies requirement.
9. Tile Squareness (ASTM F 540): Maximum 0.010 inch; satisfies requirement.
10. Dimensional Stability (Fed. Std. No. 501a Method 6211):  
Maximum 0.020 inch/lineal foot; satisfies requirement.
- a. Wearlayer Thickness (EN 429): 40 mils minimum.
- b. Weight (EN 430: 29 lb/45 sq ft (0.7 lb/sq ft)).
- c. Static Load Limit/Long-Term Indentation (ASTM F 970) Armstrong Modified 1000 psi: Pass.
- d. Fire Performance:
  - 1) Critical Radiant Flux (ASTM E648 and NFPA 253): > 0.45 W/cm, Class 1.
  - 2) Optical Smoke Density (ASTM E662 and NFPA 258) Non-Flaming DM Corrected: < 450; Pass.

e. Slip Resistance (Dry Static Coefficient of Friction) (ASTM D2047 James Test): 0.6, ADA compliant. (This test method was withdrawn by ADA in 2011).

f. Abrasion Resistance:

1) Taber Test (H22 wheels, 1 kg load, 1000 cycles): 0.14 g. Passes 30,000 revolutions.

2) Thickness Loss (EN 660 Group T): 0.077 mm.

g. Caster Chair Test (EN 425): Pass.

h. Thermal Conductivity (DIN 52612): 3.0 to 4.5 Btu/in/sq ft/degree F (0.4 - 0.65 W/mK); suitable for radiant heating.

## 2.2 WALL BASE(RB-1, RB-2)

Conform to ASTM F 1861, Type TS (vulcanized thermoset rubber) or Type TP (thermoplastic rubber) Style A (straight - installed with carpet) and Style B (coved - installed with resilient flooring). For wall base RB-1, provide 8 inch high and 1/4 inch thick reveal base with a 45 degree angular top and a 7/32 inch wide surface reveal. Provide preformed corners in matching height, shape, and color, typical for all resilient wall base.

## 2.3 ADHESIVES

Provide adhesives for flooring and accessories that are required by the flooring manufacturer for each type flooring installation; and comply with local indoor air quality standards. Provide adhesives for base and accessories that are required by the base manufacturer. Submit manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics. Provide Material Safety Data Sheets (MSDS) for all primers and adhesives to the Contracting Officer. Highlight VOC emissions.

## 2.4 SURFACE PREPARATION MATERIALS

Provide surface preparation materials, such as floor crack fillers as required by the flooring manufacturer for the subfloor conditions.

## 2.5 CAULKING AND SEALANTS

Provide caulking and sealants in accordance with Section 07 92 00 JOINT SEALANTS.

## 2.6 MANUFACTURER'S COLOR, PATTERN AND TEXTURE

Provide color, pattern and texture for resilient flooring and accessories as indicated on the drawings. Color listed is not intended to limit the selection of equal colors from other manufacturers. Provide flooring in any one continuous area from same production run with same shade and pattern. Submit scaled drawings indicating patterns (including location of patterns and colors) and dimensions. 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. Comply with ASTM F 710 for concrete subfloor preparation. Floor fills or toppings may be required as recommended by the flooring manufacturer. 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 F 1869 or ASTM F 2170, unless otherwise recommended by the flooring manufacturer. Moisture emission must not exceed 5 lb/1000 square feet 24 hours before installation of flooring. Conduct alkalinity testing as required by the flooring manufacturer. PH must not exceed 9 before, during, or after installation of flooring. Determine the compatibility of the resilient flooring adhesives to the concrete floors by a bond test in accordance with the flooring manufacturer's recommendations. Each floor of the building shall be tested. The quantity and locations for moisture, alkalinity and bond tests shall be determined by the resilient flooring manufacturer. 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 SOLID VINYL PLANKS

Install flooring and accessories in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's directions. Keep plank lines and joints square, symmetrical, tight, and even. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut, fit, and scribe edge plank 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. No sooner than 5 days after installation, wash flooring with a nonalkaline cleaning solution, rinse thoroughly with clear cold water, and, except for rubber flooring and stair treads, risers and stringers, vinyl and other flooring not requiring polish finish by manufacturer, apply the number of coats of polish in accordance with manufacturer's written instructions. Clean and maintain all other flooring as recommended by the manufacturer.

### 3.7 WASTE MANAGEMENT

Separate offcuts and waste materials and reuse or recycle in accordance with the Waste Management Plan, keeping sheet materials larger than 2 square feet and tiles larger than 1/2 tiles separate for reuse. Identify manufacturer's policy for collection or return of construction scrap, unused material, demolition scrap, and/or packaging material. Place materials defined as hazardous or toxic waste in designated containers and dispose of properly. Close and seal tightly partly used sealant and adhesive containers and store protected in a well ventilated fire-safe area at moderate temperature.

### 3.8 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 --

## SECTION 09 66 23.00 22

## RESINOUS (EPOXY) TERRAZZO FLOORING

4/11

## 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.

## NATIONAL TERRAZZO &amp; MOSAIC ASSOCIATION (NTMA)

NTMA Info Guide

(2000) Terrazzo Information Guide

## 1.2 SYSTEM DESCRIPTION

The resinous terrazzo flooring shall be an epoxy terrazzo. All terrazzo, auxiliary products and materials and application techniques used must be approved by National Terrazzo and Mosaic Association (NTMA) and epoxy terrazzo manufacturer, whichever is more stringent, prior to use. Apply resinous epoxy terrazzo flooring, including substrate preparation, Thin-set pre-cast epoxy terrazzo wall base units and related accessories in the colors indicated, in the areas shown on the approved detail drawings. Submit two 6 x 6 inches, (minimum) samples of each color of resinous terrazzo and two 6 inches lengths, of each type of strip. Flooring shall be an epoxy terrazzo system that conforms to the requirements specified in paragraphs 2.01A and B of NTMA Info Guide.

## 1.3 SUBMITTALS

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

## SD-02 Shop Drawings

Approved Detail Drawings;  
Strips  
Divider Strips;

## SD-03 Product Data

Epoxy Resin  
Mixing, Proportioning, and Installation  
Cleaning and Protection

## SD-04 Samples

Resinous Terrazzo Flooring

Mockup

Provide 3'x 3' shop made mockup of flooring and base to be delivered to the site for approval prior to terrazzo installation.

## SD-07 Certificates

Manufacture Experience: Submit proof of Associate membership in NTMA. Furnish a list of at least 5 epoxy terrazzo projects using material being submitted for this project installed during the last five year of the same scope, complexity and at least 50 percent of the square footage.

Terrazzo product approved by NTMA.

## 1.4 QUALITY ASSURANCE

## 1.4.1 NTMA STANDARDS

Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

## 1.4.2 Installer Qualifications

Installer shall be approved by the resinous terrazzo manufacturer and shall have a minimum of 5 years experience in the installation of the materials to be used and shall have completed at a minimum of 10 successful installations within the past 2 years of projects with comparable scope and complexity. The installer shall furnish and submit a list of at least five epoxy terrazzo projects using material submitted for this project installed during the last two years of the same scope, complexity and at least fifty percent of the square footage of the terrazzo work for this project. The installer must be a member, in good standing, of the NTMA for a minimum of 10 years and have received an honor award for quality workmanship during that time. The installer shall submit a certificate from the NTMA of proof of membership in the NTMA.

## 1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in manufacturer's original unopened containers, labeled with source's or manufacturer's name, physical manufacturing address of product, and product brand name and lot number. Store materials in a well ventilated, clean, dry, area that is protected from weather. Storage temperatures controlled between 60 and 80 degrees F.

## 1.6 PROJECT CONDITIONS

Areas to receive terrazzo shall be thermally conditioned to a temperature and relative humidity as defined and required by the terrazzo system manufacturer two weeks prior to testing moisture transmission in concrete slab; during installation of epoxy terrazzo and continuously after the epoxy terrazzo installation is complete.

## 1.6.1 PRIOR TO SURFACE PREPARATIONS

a. Evaluate slab condition, including slab moisture content and extent of repairs required, if any.

b. Concrete to receive epoxy terrazzo shall have cured for at least 28 days and be free of all curing compounds. Test concrete substrate to determine acceptable moisture levels prior to installation. Testing should be conducted according to ASTM F2170 (determining relative humidity in



concrete slabs using in situ probes). The Epoxy Terrazzo installer shall verify with the Epoxy Terrazzo manufacturer that concrete substrates (existing and new) are acceptable for the installation of the epoxy terrazzo system.

c. The building shall be enclosed and the HVAC system operational prior to and during each day of installation, the terrazzo contractor shall verify that the dew point is at least 5 F (-15 C) less than the slab and air temperature.

#### 1.6.2 ACCEPTABLE SUBSTRATES

a. Flatness tolerance: Concrete sub-floor shall be flat with a maximum variation from flat of 1/4" in 10 feet. Any irregularity of the surface requiring patching and/or leveling shall be done with manufacturers approved product and procedures.

b. Concrete floor shall be prepared mechanically by shot blasting (NO ALTERNATIVE ACCEPTED) in accordance with ICRI Guideline No. 03732. Specifically, surface preparation results should achieve a CSP3-CSP5 profile.

c. Concrete floor shall receive a steel trowel finish.

d. Concrete shall be cured a minimum of 28 days. No curing agents are to be used in areas to receive terrazzo.

e. Concrete slab shall have an efficient moisture vapor barrier, minimum reinforced 15 mils thickness, directly under the concrete slab. Moisture barrier shall NOT be punctured, and all joints shall be overlapped six inches, sealed and taped with tape required by the vapor barrier manufacturer.

f. Saw cutting of control joints must be done between 12 and 24 hours after placement of the structural concrete and at a frequency compatible to ACI recommendations.

#### 1.6.3 LIGHTING

Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.

#### 1.6.4 PROTECTION

General contractor to provide protection from other trades prior to final acceptance by owner.

#### 1.7 PRE-INSTALLATION CONFERENCE

a. Conduct conference at the Project site to review methods and procedures related to terrazzo including, but not limited to, the following:

1. Discuss installation procedures, joint details, jobsite conditions, substrate specification, vapor barrier details and coordination with other trades.

2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment and facilities needed to make progress and avoid delays.

3. Review special terrazzo designs and patterns.
4. Review dust control procedures.
5. Review plans for concrete curing and site drying to enable timely achievement of suitable slab moisture conditions.

## PART 2 PRODUCTS

No products shall contain VOC's or formaldehydes.  
Terrazzo product shall be approved by NTMA.

### 2.1 MOISTURE VAPOR PRIMER

Physical properties of the moisture migrating primer shall have a maximum of 0.3 perms with 100% RH. Primer shall be a material recommended by the resin manufacturer which will penetrate the pores of the substrate and bond with the topping to form a permanent monolithic bond between the substrate and the topping.

### 2.2 EPOXY RESIN (ETZ-1, ETZ-2, ETZ-3)

The Epoxy Resin for the specified terrazzo flooring shall conform to the requirements shown in NTMA Info Guide. Submit resin manufacturer's descriptive data, plus mixing, proportioning, and installation instructions. Epoxy resin must be provided by NTMA member in good standings and his resin must be approved by NTMA for terrazzo installations. Minimum requirements are as follows:

- a. Thickness 3/8" cast in place
- b. Hardness: 60-85 per ASTM D-2240
- c. Tensile Strength: 3,000 psi (min) per ASTM D-638
- d. Compressive Strength: 10,000 psi (min) per ASTM D-695
- e. Chemical Resistance: No deleterious effects per ASTM D-1308

### 2.3 FILLERS

Fillers, if required, shall be inert mineral or cellulosic material as recommended by the manufacturer and best suited for the resin binder used. Fillers shall be furnished in the quantity necessary to impart the required color and physical characteristics.

### 2.4 MARBLE CHIPS

Use only post-industrial recycled glass, marble or granite terrazzo chips of domestic origin. Sizes and colors to match NTMA Info Guide color plate indicated on the drawings. Chips shall be a range of sizes up to and including the NTMA Standard No. 0 and Standard No. 1 for 1/4 inch thick floors and Standard No. 0 through Standard No. 2 for 3/8 inch thick floors. Standard No. 1 chips are the largest marble chip to be used in a 3/8 inch epoxy system and Standard No. 2 marble chips used in a 1/2 inch epoxy system.

### 2.5 STRIPS

Submit drawings indicating the type, size, and layout of divider strips and control joint strips.

### 2.5.1 Divider Strips

Divider strips shall be as deep as required, 16 gauge separate double "L" shape with minimum 1/8 inch separation, and of aluminum. Divider strips shall be located directly above control joints, cold joints and expansion joints in the concrete slab. Fill joint and area between strips with 100% semi-flexible epoxy joint filler.

### 2.6 FLEXIBLE REINFORCING MEMBRANE

A flexible crack suppression reinforcing membrane (elastomeric) shall be installed over all cracks and saw cuts in the concrete slab. Fill all cracks and saw cuts with 100% solids epoxy, followed by an application of the flexible reinforcing membrane across the crack, allowing 12 inches on either side of the crack or joint. Imbed fiberglass mesh reinforcement a minimum of 9 inches into the wet membrane and saturate with additional membrane.

### 2.7 Expansion Joint Filler

Expansion Joint Filler shall be 100% Epoxy Solids flexible resin, tinted to match the adjoining terrazzo matrix and shall be as recommended by the manufacturer of the resin.

### 2.8 Miscellaneous Accessories

All miscellaneous accessories and materials to be approved by the terrazzo manufacture and installer.

a. Strip Adhesive: 100% solids epoxy resin adhesive with a VOC content of 50g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

b. Anchoring Devices:

1. Strips: Provide epoxy adhesive/mechanical anchoring devices for strip materials as required for secure attachment to substrate.

2. Precast Terrazzo: Provide mechanical anchoring devices as recommended by terrazzo contractor for proper anchorage and support of units for conditions of installation and support.

c. Patching and Fill Material: Provide aggregates as recommended by terrazzo manufacturer.

d. Joint Compound: Color to be selected by architect

e. Cleaner: To be a neutral cleaner with pH factor between 7 and 10 specifically designed for the terrazzo to be installed.

f. Surface Finish System: Type and level of polish to be specified by architect for desired appearance and level of reflectivity.

g. Sealer: Provide a slip and stain-resistant sealer that is chemically neutral with a pH factor between 7 and 10, a standard coefficient of friction of 0.6 or higher, does not affect physical properties of terrazzo and complies with NTMA's "Terrazzo Specifications and Design Guide."

### 2.9 Precast Terrozzo

a. Precast Terrazzo Units: Precast epoxy terrazzo base units.

b. Precast Terrazzo Base Units: 3/8" thick, cast in maximum lengths possible, but not less than 36".

1. Type: As indicated on drawings.
2. Height: As indicated on drawings.
3. Outside Corner Units with finished returned edges at outside corner.
4. Color and Pattern: Match adjacent poured-in-place terrazzo flooring.

### PART 3 EXECUTION

#### 3.1 PREPARATION OF CONCRETE SUBFLOOR

Installation of the floor topping shall not commence until the concrete substrate is at least 28 days old. The concrete surfaces shall be prepared in accordance with the instructions of the resin manufacturer.

a. After the HVAC system has been in operation for 14 continuous days then the concrete slab is to be tested for moisture transmission using ASTM 2170 Probe Test.

b. The concrete surface shall use shot blasting only (NO ALTERNATE METHOD TO BE USED). All surface contaminants must be removed.

c. A flexible crack suppression membrane (elastomeric) shall be installed over all cracks in the subfloor. The crack membrane is to be used to treat all cracks in the slab in accordance with NTMA standards & guidelines. A minimum of 5% of the total terrazzo square footage will be bid to address all cracks exposed by the shot blasting of the concrete slab.

#### 3.2 MIXING, PROPORTIONING, AND INSTALLATION

Mixing, proportioning, and installing shall be in accordance with the approved instructions of the manufacturer. The topping shall be applied to give a finish thickness of 3/8 inch. Bases shall be cove type cast-in-place with 1 inch radius cove and shall be 4 inch high.

#### 3.3 SURFACE POLISHING

Grind with 120 grit or finer stones until all grout is removed from the surface. Repeat rough grinding, grout coat and polishing if large terrazzo chip voids exist after initial polishing. When completed the terrazzo shall show a minimum of 70% decorative aggregate chips on the surface.

#### 3.4 Surface Finishing

a. Flood mop and wet vac all slurry from surface using manufacturers recommended cleaner, to insure all latency and particulate matter is removed.

b. Continue grinding process with grits 220, 400, 600 and to 800 grit minimum. Repeat flood mop and wet vac noted in item a. above between steps to insure all previous latency and particulate matter is removed.

- c. Inspect entire surface for consistent appearance, manifestating no abrasion scratches from previous grit. Re-address any area manifesting previous grit pattern not matching 800 grit and finish before continuing.
- d. Mechanically polish surface using 1,000 grit diamond pad as supplied by terrazzo manufacturer. Surface shall have uniform reflective appearance showing no high or low sheen variances.
- e. Flood mop and wet vac as described in item a. above to insure all particulate matter or dirt and soil from other trades is removed.
- f. Final polish surface using white polishing pad equipped with 175 RPM floor machine with solution tank and standard pad driver as recommended by terrazzo manufacturer.
- g. Thoroughly scrub and agitate entire surface using manufacturers recommended cleaner, wet vac scrub from surface insuring all final chemistry is removed.
- h. When the surface is entirely dry, allowing four hours minimum, impregnate and seal surface per manufacturers recommendation.
- i. Allow 24 hours before use. Maintain surface per manufacturers instructions.

### 3.5 CLEANING AND PROTECTION

- a. The terrazzo shall be washed with a neutral, manufacturer approved, cleaner to remove all grinding dust. The cleaned surfaces shall be rinsed. Submit maintenance literature for terrazzo cleaning and sealing.
- b. The general contractor shall cover and protect from damage all terrazzo work until all the trades have completed their work.

-- End of Section --

## SECTION 09 67 23.13

## STANDARD RESINOUS FLOORING

08/10

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

|            |   |
|------------|---|
| ASTM C307  | (2003; R 2008) Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing  |
| ASTM C579  | (2001; R 2006) Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes                        |
| ASTM C580  | (2002; R 2008) Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes |
| ASTM D4226 | 2011 Standard Test Methods for Impact Resistance of Rigid Poly(Vinyl Chloride) (PVC) Building Products  |
| ASTM D2047 | (2011) Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine  |
| ASTM D2240 | (2005; R 2010) Standard Test Method for Rubber Property - Durometer Hardness  |
| ASTM D4060 | (2010) Abrasion Resistance of Organic Coatings by the Taber Abraser   |
| ASTM D4541 | (2009; E 2010) Pull-Off Strength of Coatings Using Portable Adhesion Testers  |

## 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

Manufacturer's Catalog Data

Urethane Mortar

Quartz Aggregate

Epoxy grout coat

Urethane Sealer

SD-04 Samples

Hardboard Mounted Epoxy Flooring;

SD-05 Design Data

Design Mix Data

Urethane Mortar

SD-06 Test Reports

Records of Inspection

SD-07 Certificates

Listing of Product Installations

Referenced Standards Certificates

Warranty;

### 1.3 ADMINISTRATIVE REQUIREMENTS

Submit installation drawings for heavy duty epoxy flooring systems clearly designating the areas of application.

#### 1.3.1 Product Data

Within 30 days of contract award, submit manufacturer's catalog data for the following items:

- a. Urethane Mortar
- b. Quartz Aggregate
- c. Epoxy grout coat
- d. Urethane Sealer

#### 1.3.2 Design Mix Data

Within 30 days of contract award, submit design mix data for the following items, including a complete list of ingredients and admixtures:

- a. Urethane Mortar
- b. Epoxy grout coat

c. Urethane Sealer

Ensure applicable test reports verify the mix has been successfully tested and meets design requirements.

1.4 QUALITY ASSURANCE

Prior to commencement of work, submit referenced standards certificates for the following, showing conformance with the referenced standards contained in this section:

- a. Urethane Mortar
- b. Quartz Aggregate
- c. Epoxy grout coat
- d. Urethane Sealer

Submit a sample records of inspection plan, including the records of corrective action to be taken.

The ROICC reserves the right to randomly core the floor for thickness verification. The correction of any deficiencies are the responsibility of the Contractor. Areas found to be in compliance shall be repaired at the expense of the Government.

1.4.1 Qualifications

Submit a listing of product installations for heavy duty epoxy flooring including identification of at least 5 units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. Identify purchaser, address of installation, service organization, and date of installation.

Ensure floor system applicators are experienced in the application of troweled urethane quartz aggregate thin-set floor topping.

1.4.2 Sampling

Submit hardboard mounted epoxy flooring samples not less than 12 inch square for each required color.

Provide panels showing nominal thickness of finished toppings, color, and texture of finished surfaces. Finished floor toppings and the approved samples are to match in color and texture.

1.5 DELIVERY, HANDLING, AND STORAGE

Protect materials from weather, soil, and damage during delivery, storage, and construction. Deliver materials in original packages, containers, or bundles bearing brand name and name of material.

Maintain materials used in the installation of floor topping at a temperature between 65 and 85 degrees F.



## PART 2 PRODUCTS

## 2.1 RESINOUS FLOORING (SRF-1)

Resinous flooring spec shall be a nominal 3/16" thick system comprised of a high performance, four-component mortar consisting of urethane resin, curing agent, graded aggregates and inorganic pigments to be spread at 50 square feet per unit; broadcast to rejection with colored quartz aggregate; two-component clear epoxy grout coat at 16 mil; and one coat of a high performance, two-component, clear urethane sealer.

## 2.1.1 Physical Properties

Provide flooring system in which physical properties of topping including aggregate, when tested in accordance with standards or procedures referenced below, are as follows:

|   |   |
|---|---|
| Compressive Strength (ASTM C579)                            | 9,000 psi   |
| Tensile Strength (ASTM C307)                                | 2,500 psi   |
| Flexural Strength (ASTM C580)                               | 4,300 psi   |
| Hardness (ASTM D2240/Shore D Durometer)                     | 85  |
| Bond Strength (ASTM D4541)                                  | >400 psi<br>(100% concrete failure)   |
| Impact Resistance (ASTM D4226)                              | >160 in. lbs.   |
| Abrasion Resistance (ASTM D4060, Taber Abrader CS-17 wheel) | 0.1 gm max. weight loss   |
| Coefficient of Friction (ASTM D2047)                        | 0.6-0.79  |
| Cure Rate allow<br>(at 77oF/25oC)                           | 4 hours for foot traffic<br>8 hours for light traffic<br>12 hours for normal operations |

## PART 3 EXECUTION

## 3.1 INSTALLATION

## 3.1.1 Safety Precautions

Prior to application in confined spaces of toppings and coatings containing flammable or toxic properties, provide forced ventilation to ensure that vapor concentration is kept at acceptable limits recommended by the manufacturer of the product.

Erect "NO SMOKING" signs, and prohibit smoking or use of spark- or flame-producing devices within 50 feet of any mixing or placing operation involving flammable materials.

Provide personnel required to handle, mix, or apply toppings containing toxic or flammable properties with such items of personal protective equipment and apparel for eye, skin, and respiratory protection as are recommended by the manufacturer of the product. Ensure all personnel are trained in the appropriate use and wearing of personal protection equipment.

Accomplish sand blasting under approved controlled conditions with respect to sand and dust control to prevent damage to personnel and facility.

### 3.2 PREPARATION

Prior to applying resinous flooring material, inspect substrate and immediately report any unsatisfactory conditions that exist and repair.

#### 3.2.1 Concrete Subfloor

##### 3.2.1.1 Existing Concrete Floors

Concrete preparation shall be by mechanical means and include use of a scabber, scarifier or shot blast machine for removal of bond inhibiting materials such as curing compounds or laitance. Fill all cracks with an elastomeric jointing compound compatible with the resinous flooring system used.

#### 3.2.2 Protection

In addition to the protection of adjacent surfaces during installation, provide areas used to store and mix materials with a protective covering under the materials. After application of the sealer coats, protect finished flooring during the remainder of the construction period. In areas of expected minimum or moderate traffic, cover floors with 70-pound kraft paper, a 30-30-30 waterproof kraft paper, or an approved substitute, with strips taped together and edges secured to prevent roll-up. Place vegetable fiberboard, plywood, or other suitable material that does not mar the flooring over the paper to protect areas used as passages by workmen and areas subject to floor damage because of subsequent building operations. Upon completion of construction, remove the protection, clean flooring and, where necessary, repair, reseal, or both, at no additional cost to the Government.

### 3.3 APPLICATION

General: Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic wearing surface of thickness indicated, uninterrupted except at divider strips, sawn joints or other types of joints (if any), indicated or required.

Troweled Mortar: Mix mortar material according to manufacturer's recommended procedures. Uniformly spread mortar over substrate using manufacturer's specially designed screed box adjusted to manufacturer's recommended height. Hand trowel apply mixed material over freshly primed substrate using steel finishing trowels or power trowel material.

Broadcast: Immediately broadcast colored quartz aggregate into the mortar by hand to refusal. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

Grout coat: Remove any surface irregularities by lightly abrading and vacuuming the floor surface. Mix and apply grout coat with strict adherence to manufacturer's installation procedures and coverage rates.

Sealer: Remove excess unbonded quartz aggregate by lightly brushing and vacuuming the floor surface. Mix and apply sealer with strict

adherence to manufacturer's installation procedures.

Sanding: Lightly sand the floor with 80-grit sandpaper on a rotary sander. Remove all dust by vacuuming the floor surface.

Second Sealer: Mix and apply sealer with strict adherence to manufacturer's installation procedures.

### 3.4 FIELD QUALITY CONTROL

#### 3.4.1 Repairing

Remove and replace damaged or unacceptable portions of completed work with new work to match adjacent surfaces at no additional cost to the Government.

### 3.5 CURING, PROTECTION AND CLEANING

Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.

Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

### 3.6 WARRANTY

Submit a 2 year written warranty for all materials and installation work to the Contracting Officer.

-- End of Section --

## SECTION 09 68 00

CARPETING  
11/13

## PART 1 GENERAL

## 1.1 REFERENCES

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

## 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 D1335 | (2012) Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings  |
| ASTM D3278 | (1996; R 2011) Flash Point of Liquids by Small Scale Closed-Cup Apparatus   |
| ASTM D5793 | (2013) Binding Sites Per Unit Length or Width of Pile Yarn Floor Coverings  |
| ASTM D5848 | (2010; E 2010) Mass Per Unit Area of Pile Yarn Floor Coverings  |
| ASTM D6859 | (2011) Standard Test Method for Pile Thickness of Finished Level Pile Yarn Floor Coverings                          |
| ASTM E648  | (2014c) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source |

## CARPET AND RUG INSTITUTE (CRI)

|         |                                     |
|---------|-------------------------------------|
| CRI CIS | (2011) Carpet Installation Standard |
|---------|-------------------------------------|

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

|          |   |
|----------|---|
| ISO 2551 | (1981) Machine-made Textile Floor Coverings - Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions |
|----------|---|

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

|             |   |
|-------------|---|
| 16 CFR 1630 | Standard for the Surface Flammability of Carpets and Rugs (FF 1-70)             |
| 40 CFR 247  | Comprehensive Procurement Guideline for Products Containing Recovered Materials |

1.2 SYSTEM DESCRIPTION

1.3 SUBMITTALS

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

SD-02 Shop Drawings

Installation Drawings  
Moldings

SD-03 Product Data

Carpet  
Moldings  
Physical Characteristics;

SD-04 Samples

Carpet  
Moldings

SD-06 Test Reports

Moisture and Alkalinity Tests

SD-07 Certificates

Carpet  
Regulatory Requirements

SD-08 Manufacturer's Instructions

Surface Preparation  
Installation

SD-10 Operation and Maintenance Data

Carpet  
Cleaning and Protection;  
Maintenance Service

#### 1.4 QUALITY ASSURANCE

Provide the Carpet and Rug Institute (CRI) Indoor Air Quality (IAQ) label for carpet, carpet cushion, and adhesives or demonstrate compliance with testing criteria and frequencies through independent laboratory test results. Carpet, carpet cushion, and adhesives bearing the label will indicate that the carpet has been tested and meets the Regulatory Requirements and criteria of the CRI IAQ Carpet Testing Program, and minimizes the impact on indoor air quality. Procure carpet in accordance with 40 CFR 247, and where possible, purchased locally to reduce emissions of fossil fuels from transporting. Conform to EPA requirements for carpet. Submit certificates, showing conformance with the referenced standards contained in this section, for the following: Carpet, Carpet Cushion and Molding. Include in the report percentage of post-industrial and post-consumer recycled material.

#### 1.5 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 (100 percent outside air supply, minimum of 1.5 air changes per hour, and no recirculation), protected from damage, soiling, and moisture, and strong contaminant sources and residues, and maintain at a temperature above 60 degrees F for 2 days prior to installation. Do not store carpet or carpet tiles with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants. Do not store carpet near materials that may off gas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

#### 1.6 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.

#### 1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties including minimum ten year wear warranty, two year material and workmanship and ten year tuft bind and delamination.

### PART 2 PRODUCTS

#### 2.1 CARPET (CPT-1)

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, 2) Carpet Cushion, and 3) Moldings. Also, submit samples of the following:

- a. Carpet: Two "Production Quality" samples 24 by 24 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
- c. Special Treatment Materials: Two samples showing system and installation method

#### 2.1.1.1 Physical Characteristics for Modular Tile Carpet

##### 2.1.1.1.1 Carpet Construction

Tufted texture loop.

##### 2.1.1.1.2 Type

Modular tile 24 by 24 inch square with 0.15 percent growth/shrink rate in accordance with ISO 2551.

##### 2.1.1.1.3 Pile Fiber

Commercial 100 percent branded (federally registered trademark) nylon continuous filament

##### 2.1.1.1.4 Gauge or Pitch

Minimum 1/10 inch in accordance with ASTM D5793

##### 2.1.1.1.5 Stitches per inch

Minimum 8 per inch

##### 2.1.1.1.6 Tufted Weight

15 ounces per square yard. This does not include weight of backings. Determine weight in accordance with ASTM D5848.

##### 2.1.1.1.7 Finished Pile Thickness

Minimum .069 inch in accordance with ASTM D6859

##### 2.1.1.1.8 Pile Density

Minimum 7,304 oz/yd<sup>3</sup>

##### 2.1.1.1.9 Dye Method

100% Solution dyed

##### 2.1.1.1.10 Backing Materials

Provide primary backing materials like of synthetic material. Provide secondary backing to suit project requirements of those customarily used and accepted by the trade for each type of carpet.

## 2.2 PERFORMANCE REQUIREMENTS

### 2.2.1 Static Control

Provide static control to permanently regulate static buildup to less than 3.5 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 0.22 watts per square centimeter when tested in accordance with ASTM E648. Smoke tests results shall be 450 or less.

### 2.2.3 Tuft Bind

comply with ASTM D1335 for tuft bind force required to pull a tuft or loop free from carpet backing with a minimum 8 pound average force for modular carpet tile.

### 2.2.4 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.

### 2.2.5 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.

### 2.2.6 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.

### 2.2.7 Delamination Strength

Provide delamination strength for tufted carpet with a secondary back of minimum 2.5 lbs/inch.

### 2.2.8 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

Adhesives and concrete primers shall 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

Install carpet moldings where floor covering material changes or carpet edge does not abut a vertical surface. 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. Any seam sealant shall have a maximum VOC content of 50 grams/liter. Do not use sealants that contain 1,1,1-trichloroethane or toluene.

## 2.6 COLOR, TEXTURE, AND PATTERN

Provide color, texture, and pattern as indicated on the drawings.

# 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

Isolate area of installation from rest of building. 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. Use autofoam mothproofing system for wool carpets. 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, 2) Carpet Cushion, and 3) Moldings indicating areas receiving carpet, carpet types, patterns, direction of pile, location of seams, and locations of edge molding.

#### 3.4.1 Modular Tile Installation

Install modular tiles as required by the manufacturer. Lay tiles in brick pattern installation method. Provide accessibility to the subfloor where required.

### 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 with a high-efficiency particulate air (HEPA) filtration vacuum.

#### 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 REMNANTS

Manage waste as specified in the Waste Management Plan. Provide remnants remaining from the installation, consisting of scrap pieces more than 2 feet in dimension with more than 6 square feet total to the Government. Non-retained scraps shall be set aside and returned to manufacturer for recycling into new product.

### 3.7 MAINTENANCE

#### 3.7.1 Maintenance Service

Collect information from the manufacturer about maintenance agreement options, and submit to Contracting Officer. Service shall reclaim materials for recycling and/or reuse. Service shall not landfill or burn reclaimed materials. When such a service is not available, seek local recyclers to reclaim the materials. Submit documentation of manufacturer's maintenance agreement for carpet. Include 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.

-- End of Section --

## SECTION 09 83 13

ACOUSTICAL WALL TREATMENT  
08/10

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC TM 16 (1964; R 2004) Colorfastness to Light

## ASTM INTERNATIONAL (ASTM)

ASTM C 423 (2009a) Sound Absorption and Sound  
Absorption Coefficients by the  
Reverberation Room Method

ASTM E 84 (2015a) Standard Test Method for Surface  
Burning Characteristics of Building  
Materials

## INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2012) International Building Code

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 255 (2006) Standard Method of Test of Surface  
Burning Characteristics of Building  
Materials

NFPA 265 (2007) Standard Methods of Fire Tests for  
Evaluating Room Fire Growth Contribution  
of Textile Coverings on Full Height Panels  
and Walls

## 1.2 SUBMITTALS

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

SD-02 Shop Drawings

Approved Detail Drawings

SD-03 Product Data

Installation  
Acoustical Wall Panels

SD-04 Samples

## Acoustical Wall Panels

## SD-07 Certificates

## Acoustical Wall Panels

## 1.3 DELIVERY, STORAGE, AND HANDLING

Protect materials delivered and placed in storage from the weather, humidity and temperature variations, dirt, dust, or other contaminants.

## 1.4 WARRANTY

Provide manufacturer's warranty of one year from the date of substantial completion.

## PART 2 PRODUCTS

## 2.1 FABRIC COVERED ACOUSTICAL WALL PANELS (EFP-1)

Provide acoustical wall panels consisting of prefinished, factory assembled, seamless fabric covered, fiber glass core system as described below manufactured to the dimensions and configurations shown on the approved detail drawings; submit drawings showing plan locations, elevations and details of method of anchorage, location of doors and other openings, base detail and shape and thickness of materials. Perimeter edges shall be reinforced by aluminum frame. Acoustical wall panels installed in non-sprinklered areas shall comply with the requirements of ICC IBC, Standard 42-2. Submit manufacturer's descriptive data and catalog cuts; fabric, minimum 18 inches wide by 24 inches long 3 samples of each color range specified; and certificates of compliance from an independent laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards. A label or listing from the testing laboratory will be acceptable evidence of compliance. Wall panels shall conform to the following:

- a. Panel Width: Widths shall be 30 inches. End panels may vary in width as necessary to cover wall.
- b. Panel Height: 72 inches.
- c. Thickness: 3/4 inch fabric finished.
- d. Fabric Covering: Seamless woven stain resistant, 58% Polyolefin, 42% Post-Consumer Recycled Polyester with an acrylic backing. Fabric shall be a PFOA free, solution-dyed product and shall be Greenguard certified for indoor air quality. Fabric covering shall be stretched free of wrinkles and then bonded to the edges and back or bonded directly to the panel face, edges, and back of panel a minimum distance standard with the manufacturer. Light fastness (fadeometer) shall be minimum of 40 hours in accordance with AATCC TM 16. Fabric covering shall be Class A fire rated in accordance with ASTM E 84 tunnel test and NFPA 255 and passes NFPA 265.
- e. Fire rating for the complete composite system: Class A, 200 or less smoke density and flame spread less than 25, when tested in accordance with ASTM E 84.

- f. Substrate: Fiber glass or mineral fiber.
- g. Noise Reduction Coefficient (NRC) Range: one inch: .80 minimum, ASTM C 423.
- h. Edge Detail: Standard-Fabric wrapped on two long panel sides. .
- i. Core Type: Standard acoustical fiberglass, 5-7 pcf density .
- j. Mounting: Acoustical panels shall be mounted by manufacturer's standard Z- clips.

## 2.2 COLOR

Color shall be as indicated on the drawings. Color listed is not intended to limit the selection of equal colors from other manufacturers.

## PART 3 EXECUTION

### 3.1 SURFACE CONDITIONS

Walls shall be clean, smooth, oil free and prepared in accordance with panel manufacturer's instructions. Do not begin installation until all wet work, such as, plastering, painting, and concrete are completely dry.

### 3.2 INSTALLATION

Panel installation shall be by personnel familiar with and normally engaged in installation of acoustical wall panels. Apply panels in accordance with the manufacturer's installation instructions. Submit manufacturer's installation instructions and recommended cleaning instructions.

### 3.3 CLEANING

Following installation, dirty or stained panel surfaces shall be cleaned in accordance with manufacturer's instructions and left free from defects. Panels that are damaged, discolored, or improperly installed shall be removed and new panels provided as directed.

-- End of Section --

## SECTION 09 90 00

## PAINTS AND COATINGS

05/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 0100Doc (2005) Documentation of the Threshold  
Limit Values and Biological Exposure  
Indices

## ASTM INTERNATIONAL (ASTM)

ASTM D 235 (2002; R 2007) Mineral Spirits (Petroleum  
Spirits) (Hydrocarbon Dry Cleaning Solvent)

ASTM D 4214 (2007) Standard Test Method for Evaluating  
the Degree of Chalking of Exterior Paint  
Films

ASTM D 4263 (1983; R 2005) Indicating Moisture in  
Concrete by the Plastic Sheet Method

ASTM D 4444 (2008) Use and Calibration of Hand-Held  
Moisture Meters

ASTM D 523 (2008) Standard Test Method for Specular  
Gloss

ASTM D 6386 (2010) Standard Practice for Preparation  
of Zinc (Hot-Dip Galvanized) Coated Iron  
and Steel Product and Hardware Surfaces  
for Painting

ASTM D3273 (2012) Resistance to Growth of Mold on the  
Surface of Interior Coatings in an  
Environmental Chamber

ASTM D412 (2006a; E 2008; R 2008) Standard Test  
Methods for Vulcanized Rubber and  
Thermoplastic Elastomers - Tension

ASTM D4541 (2009; E 2010) Pull-Off Strength of  
Coatings Using Portable Adhesion Testers

ASTM D6904 (2007) Standard Practice for Resistance to  
Wind-Driven Rain for Exterior Coatings  
Applied on Masonry

ASTM E84 (2015a) Standard Test Method for Surface

## Burning Characteristics of Building Materials

|               |  |
|---------------|--|
| ASTM E96/E96M | (2014) Standard Test Methods for Water Vapor Transmission of Materials                                   |
| ASTM F 1869   | (2010) Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride      |
| ASTM G155     | (2005a) Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials |

## MASTER PAINTERS INSTITUTE (MPI)

|         |  |
|---------|--|
| MPI 1   | (Oct 2009) Aluminum Paint  |
| MPI 101 | (Oct 2009) Epoxy Anti-Corrosive Metal Primer   |
| MPI 107 | (Oct 2009) Rust Inhibitive Primer (Water-Based)  |
| MPI 108 | (Oct 2009) High Build Epoxy Coating, Low Gloss   |
| MPI 116 | (Oct 2009) Epoxy Block Filler  |
| MPI 134 | (Oct 2009) Galvanized Primer (Waterbased)  |
| MPI 146 | (Oct 2009) Institutional Low Odor/VOC Interior Latex, MPI Gloss Level 4                            |
| MPI 147 | (Oct 2009) Institutional Low Odor / VOC Interior Latex, Semi-Gloss, MPI Gloss Level 5              |
| MPI 163 | (Oct 2009) Exterior W.B. Light Industrial Coating, Semi-Gloss, MPI Gloss Level 5                   |
| MPI 164 | (Oct 2009) Exterior W.B. Light Industrial Coating, Gloss, MPI Gloss Level 6                        |
| MPI 21  | (Oct 2009) Heat Resistant Enamel, Gloss (up to 205 degrees C and 400 degrees F), MPI Gloss Level 6 |
| MPI 23  | (Oct 2009) Surface Tolerant Metal Primer   |
| MPI 39  | (Oct 2009) Interior Latex-Based Wood Primer  |
| MPI 4   | (Oct 2009) Interior/Exterior Latex Block Filler  |
| MPI 42  | (Oct 2009) Latex Stucco and Masonry Textured Coating   |
| MPI 47  | (Oct 2009) Interior Alkyd, Semi-Gloss, MPI   |

## Gloss Level 5

|        |  |
|--------|--|
| MPI 50 | (Oct 2009) Interior Latex Primer Sealer                  |
| MPI 57 | (Oct 2009) Interior Oil Modified Urethane Clear Satin    |
| MPI 77 | (Oct 2009) Epoxy Gloss                                   |
| MPI 79 | (Oct 2009) Alkyd Anti-Corrosive Metal Primer             |
| MPI 94 | (Oct 2009) Exterior Alkyd, Semi-Gloss, MPI Gloss Level 5 |
| MPI 95 | (Oct 2009) Quick Drying Primer for Aluminum              |

## SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

|           |   |
|-----------|---|
| SCS SP-01 | (2000) Environmentally Preferable Product Specification for Architectural and Anti-Corrosive Paints |
|-----------|---|

## THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

|                       |   |
|-----------------------|---|
| SSPC Guide 6          | (2004) Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations          |
| SSPC Guide 7          | (2004; E 2004) Guide to the Disposal of Lead-Contaminated Surface Preparation Debris                      |
| SSPC PA 1             | (2000; E 2004) Shop, Field, and Maintenance Painting of Steel   |
| SSPC PA Guide 3       | (1982; E 1995) A Guide to Safety in Paint Application   |
| SSPC SP 1             | (1982; E 2004) Solvent Cleaning   |
| SSPC SP 10/NACE No. 2 | (2007) Near-White Blast Cleaning  |
| SSPC SP 12/NACE No.5  | (2002) Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating                      |
| SSPC SP 2             | (1982; E 2004) Hand Tool Cleaning   |
| SSPC SP 3             | (1982; E 2004) Power Tool Cleaning  |
| SSPC SP 6/NACE No.3   | (2007) Commercial Blast Cleaning  |
| SSPC SP 7/NACE No.4   | (2007) Brush-Off Blast Cleaning   |
| SSPC VIS 1            | (2002; e 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning |
| SSPC VIS 3            | (2004) Guide and Reference Photographs for  |



Steel Surfaces Prepared by Hand and Power  
Tool Cleaning

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2008; Errata 1-2010; Changes 1-3 2010;  
Changes 4-6 2011; Change 7 2012) Safety  
and Health Requirements Manual

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101 (1970; Rev B) Color Code for Pipelines &  
for Compressed Gas Cylinders

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA Method 24 (2000) Determination of Volatile Matter  
Content, Water Content, Density, Volume  
Solids, and Weight Solids of Surface  
Coatings

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-313 (Rev D; Am 1) Material Safety Data,  
Transportation Data and Disposal Data for  
Hazardous Materials Furnished to  
Government Activities

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

29 CFR 1910.1000 Air Contaminants

29 CFR 1910.1025 Lead

29 CFR 1926.62 Lead

1.2 SUBMITTALS

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

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

Samples of specified materials may be taken and tested for compliance with specification requirements.

In keeping with the intent of Executive Order 13101, "Greening the Government through Waste Prevention, Recycling, and Federal Acquisition", products certified by SCS as meeting SCS SP-01 shall be given preferential consideration over registered products. Products that are registered shall be given preferential consideration over products not carrying any EPP designation.

## SD-03 Product Data

## Coating

## Manufacturer's Technical Data Sheets

Indicate VOC content.

## SD-04 Samples

## Color

Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated.

## SD-07 Certificates

## Applicator's qualifications

## SD-08 Manufacturer's Instructions

## Application instructions

## Mixing

Detailed mixing instructions, minimum and maximum application temperature and humidity, potlife, and curing and drying times between coats.

## Manufacturer's Material Safety Data Sheets

Submit manufacturer's Material Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

## SD-10 Operation and Maintenance Data

## Coatings:

Preprinted cleaning and maintenance instructions for all coating systems shall be provided.

## SD-11 Closeout Submittals

## Materials;

## 1.3 APPLICATOR'S QUALIFICATIONS

## 1.3.1 Contractor Qualification

Submit the name, address, telephone number, FAX number, and e-mail address of the contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on a minimum of three similar projects within the past three years. List information by individual and include the following:

- a. Name of individual and proposed position for this work.

b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address, telephone number, and telex number (if non-US) of facility owner

Name of individual in facility owner's organization who can be contacted as a reference

Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

1.4 QUALITY ASSURANCE

1.4.1 Field Samples and Tests

The Contracting Officer may choose up to two coatings that have been delivered to the site to be tested at no cost to the Government. Take samples of each chosen product as specified in the paragraph "Sampling Procedures." Test each chosen product as specified in the paragraph "Testing Procedure." Products which do not conform, shall be removed from the job site and replaced with new products that conform to the referenced specification. Testing of replacement products that failed initial testing shall be at no cost to the Government.

1.4.1.1 Sampling Procedure

The Contracting Officer will select paint at random from the products that have been delivered to the job site for sample testing. The Contractor shall provide one quart samples of the selected paint materials. The samples shall be taken in the presence of the Contracting Officer, and labeled, identifying each sample. Provide labels in accordance with the paragraph "Packaging, Labeling, and Storage" of this specification.

1.5 REGULATORY REQUIREMENTS

1.5.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

1.5.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

### 1.5.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

### 1.5.4 Asbestos Content

Materials shall not contain asbestos.

### 1.5.5 Mercury Content

Materials shall not contain mercury or mercury compounds.

### 1.5.6 Silica

Abrasive blast media shall not contain free crystalline silica.

### 1.5.7 Human Carcinogens

Materials shall not contain ACGIH 0100Doc and ACGIH 0100Doc confirmed human carcinogens (A1) or suspected human carcinogens (A2).

## 1.6 PACKAGING, LABELING, AND STORAGE

Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons. Paints and thinners shall be stored in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 40 to 95 degrees F. Do not store paint, polyurethane, varnish, or wood stain products with materials that have a high capacity to adsorb VOC emissions. Do not store paint, polyurethane, varnish, or wood stain products in occupied spaces.

## 1.7 SAFETY AND HEALTH

Apply coating materials using safety methods and equipment in accordance with the following:

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in Section 01 35 26 GOVERNMENT SAFETY REQUIREMENTS and in Appendix A of EM 385-1-1. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

### 1.7.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC PA Guide 3.

### 1.7.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

- a. The applicable manufacturer's Material Safety Data Sheets (MSDS) or

local regulation.

- b. 29 CFR 1910.1000.
- c. ACGIH 0100Doc, threshold limit values.
- d. The appropriate OSHA standard in 29 CFR 1910.1025 and 29 CFR 1926.62 for surface preparation on painted surfaces containing lead. Removal and disposal of coatings which contain lead is specified in Section 02 83 13.00 20 LEAD IN CONSTRUCTION. Additional guidance is given in SSPC Guide 6 and SSPC Guide 7. Refer to drawings for list of hazardous materials located on this project. Contractor to coordinate paint preparation activities with this specification section.

#### 1.8 ENVIRONMENTAL CONDITIONS

Comply, at minimum, with manufacturer recommendations for space ventilation during and after installation. Isolate area of application from rest of building when applying high-emission paints or coatings.

##### 1.8.1 Coatings

Do not apply coating when air or substrate conditions are:

- a. Less than 5 degrees F above dew point;
- b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

##### 1.8.2 Post-Application

Vacate space for as long as possible after application. Wait a minimum of 48 hours before occupying freshly painted rooms. Maintain one of the following ventilation conditions during the curing period, or for 72 hours after application:

- a. Supply 100 percent outside air 24 hours a day.
- b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30 percent and 60 percent.
- c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

#### 1.9 SCHEDULING

Allow paint, polyurethane, varnish, and wood stain installations to cure prior to the installation of materials that adsorb VOCs.

##### 1.10 LOCATION AND SURFACE TYPE TO BE PAINTED

###### 1.10.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

- a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.
- b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.
- c. Existing coated surfaces that are damaged during performance of the work.

#### 1.10.1.1 Exterior Painting

Includes new surfaces, existing coated surfaces, of the building and appurtenances. Also included are existing coated surfaces made bare by cleaning operations.

#### 1.10.1.2 Interior Painting

Includes new surfaces 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.

#### 1.10.2 Painting Excluded

Do not paint the following unless indicated otherwise.

- a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.
- b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.
- c. Steel to be embedded in concrete.
- d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.
- e. Hardware, fittings, and other factory finished items.

#### 1.10.3 Mechanical and Electrical Painting

Includes field coating of interior and exterior new surfaces.

- a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.
  - (1) Exposed piping, conduit, and ductwork;
  - (2) Supports, hangers, air grilles, and registers;
  - (3) Miscellaneous metalwork and insulation coverings.
- b. Do not paint the following, unless indicated otherwise:

- (1) New zinc-coated, aluminum, and copper surfaces under insulation
- (2) New aluminum jacket on piping
- (3) New interior ferrous piping under insulation.

#### 1.10.3.1 Fire Extinguishing Sprinkler Systems

Clean, pretreat, prime, and paint new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories. Apply coatings to clean, dry surfaces, using clean brushes. Clean the surfaces to remove dust, dirt, rust, and loose mill scale. Immediately after cleaning, provide the metal surfaces with one coat primer per schedules. Shield sprinkler heads with protective covering while painting is in progress. Upon completion of painting, remove protective covering from sprinkler heads. Remove sprinkler heads which have been painted and replace with new sprinkler heads. Provide primed surfaces with the following:

- a. Piping in Unfinished Areas: Provide primed surfaces with one coat of red alkyd gloss enamel applied to a minimum dry film thickness of 1.0 mil in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.
- b. Piping in Finished Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel applied to a minimum dry film thickness of 1.0 mil.

#### 1.10.4 Definitions and Abbreviations

##### 1.10.4.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

##### 1.10.4.2 Batch Quality Conformance Testing

Batch quality conformance testing determines that the product provided is the same as the product qualified to the appropriate product specification. This testing shall only be accomplished by MPI testing lab.

##### 1.10.4.3 Coating

A film or thin layer applied to a base material called a substrate. A coating may be a metal, alloy, paint, or solid/liquid suspensions on various substrates (metals, plastics, wood, paper, leather, cloth, etc.). They may be applied by electrolysis, vapor deposition, vacuum, or mechanical means such as brushing, spraying, calendaring, and roller coating. A coating may be applied for aesthetic or protective purposes or both. The term "coating" as used herein includes emulsions, enamels, stains, varnishes, sealers, epoxies, and other coatings, whether used as primer, intermediate, or finish coat. The terms paint and coating are used interchangeably.

## 1.10.4.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

## 1.10.4.5 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five (5) levels are generically defined under the Assessment sections in the MPI Maintenance Repainting Manual.

## 1.10.4.6 EPP

Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

## 1.10.4.7 EXT

MPI short term designation for an exterior coating system.

## 1.10.4.8 INT

MPI short term designation for an interior coating system.

## 1.10.4.9 micron / microns

The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

## 1.10.4.10 mil / mils

The English measurement for 0.001 in or one/one-thousandth of an inch, equal to 25.4 microns or 0.0254 mm.

## 1.10.4.11 mm

The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

## 1.10.4.12 MPI Gloss Levels

MPI system of defining gloss. Seven (7) gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

| Gloss Level | Description   | Units at 60 degrees | Units at 85 degrees |
|-------------|---------------|---------------------|---------------------|
| G1          | Matte or Flat | 0 to 5              | 10 max              |
| G2          | Velvet        | 0 to 10             | 10 to 35            |
| G3          | Eggshell      | 10 to 25            | 10 to 35            |
| G4          | Satin         | 20 to 35            | 35 min              |
| G5          | Semi-Gloss    | 35 to 70            |                     |
| G6          | Gloss         | 70 to 85            |                     |
| G7          | High Gloss    |                     |                     |



Gloss is tested in accordance with ASTM D 523. Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

#### 1.10.4.13 MPI System Number

The MPI coating system number in each Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN). The Division number follows the CSI Master Format.

#### 1.10.4.14 Paint

See Coating definition.

#### 1.10.4.15 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

#### 1.10.4.16 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents. Submit color samples for approval. Comply with applicable regulations regarding toxic and hazardous materials.

### PART 3 EXECUTION

#### 3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

#### 3.2 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, disintegrated coatings, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

### 3.2.1 Additional Requirements for Preparation of Surfaces With Existing Coatings

Before application of coatings, perform the following on surfaces covered by soundly-adhered coatings, defined as those which cannot be removed with a putty knife:

- a. Test existing finishes for lead before sanding, scraping, or removing. If lead is present, refer to paragraph Toxic Materials.
- b. Wipe previously painted surfaces to receive solvent-based coatings, except stucco and similarly rough surfaces clean with a clean, dry cloth saturated with mineral spirits, ASTM D 235. 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 D 4214, 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 D 4214, 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 cleaner or detergent wash in accordance with SSPC SP 1 to remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 2, SSPC SP 3, SSPC SP 6/NACE No.3, or SSPC SP 10/NACE No. 2. Brush-off blast remaining surface in accordance with SSPC SP 7/NACE No.4. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.
- b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with SSPC SP 6/NACE No.3 /SSPC SP 12/NACE No.5 WJ-3 SSPC SP 10/NACE No. 2/SSPC SP 12/NACE No.5 WJ-2.

#### 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 SP 7/NACE No.4, SSPC SP 6/NACE No.3, and SSPC SP 10/NACE No. 2. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 1.

#### 3.3.3 Galvanized Surfaces

- a. New or Existing Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with solvent, in accordance with SSPC SP 1. If the galvanized metal has been passivated or stabilized, the coating shall be completely removed by brush-off abrasive blast. New galvanized steel to be coated shall not be "passivated" or "stabilized" If the absence of hexavalent stain inhibitors is not documented, test as described in ASTM D 6386, Appendix X2, and remove by one of the methods described therein.
- b. Galvanized with Slight Coating Deterioration or with Little or No Rusting: Water jetting to SSPC SP 12/NACE No.5 WJ3 to remove loose coating from surfaces with less than 20 percent coating deterioration and no blistering, peeling, or cracking. Use inhibitor as recommended by the coating manufacturer to prevent rusting.

- c. Galvanized With Severe Deteriorated Coating or Severe Rusting: Spot abrasive blast rusted areas as described for steel in SSPC SP 6/NACE No.3, and waterjet to SSPC SP 12/NACE No.5, WJ3 to remove existing coating.

#### 3.3.4 Non-Ferrous Metallic Surfaces

Aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces.

Surface Cleaning: Solvent clean in accordance with SSPC SP 1 and wash with mild non-alkaline detergent to remove dirt and water soluble contaminants.

#### 3.3.5 Existing Surfaces with a Bituminous or Mastic-Type Coating

Remove chalk, mildew, and other loose material by washing with a solution of 1/2 cup trisodium phosphate, 1/4 cup household detergent, one quart 5 percent sodium hypochlorite solution and 3 quarts of warm water.

### 3.4 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

#### 3.4.1 Concrete and Masonry

- a. Curing: Concrete, stucco and masonry surfaces shall be allowed to cure at least 30 days before painting, except concrete slab on grade, which shall be allowed to cure 90 days before painting.
- b. Surface Cleaning: Remove the following deleterious substances.
  - (1) Dirt, Chalking, Grease, and Oil: Wash new 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. For large areas, water blasting may be used.
  - (2) Fungus and Mold: Wash new, existing coated, and existing uncoated surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, 1 quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.
  - (3) Paint and Loose Particles: Remove by wire brushing.
  - (4) Efflorescence: Remove by scraping or wire brushing followed by washing with a 5 to 10 percent by weight aqueous solution of hydrochloric (muriatic) acid. Do not allow acid to remain on the surface for more than five minutes before rinsing with fresh water. Do not acid clean more than 4 square feet of surface, per workman, at one time.
  - (5) Removal of Existing Coatings: For surfaces to receive textured coating MPI 42, remove existing coatings including soundly adhered coatings if recommended by textured coating manufacturer.
- c. Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.
- d. Allowable Moisture Content: Latex coatings may be applied to damp

surfaces, but not to surfaces with droplets of water. Do not apply epoxies to damp vertical surfaces as determined by ASTM D 4263 or horizontal surfaces that exceed 3 lbs of moisture per 1000 square feet in 24 hours as determined by ASTM F 1869. In all cases follow manufacturers recommendations. Allow surfaces to cure a minimum of 30 days before painting.

#### 3.4.2 Gypsum Board, Plaster, and Stucco

- a. Surface Cleaning: Plaster and stucco shall be clean and free from loose matter; gypsum board shall be dry. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be used if paint will be water-based.
- b. Repair of Minor Defects: Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.
- c. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not surfaces with droplets of water. Do not apply epoxies to damp surfaces as determined by ASTM D 4263. New plaster to be coated shall have a maximum moisture content of 8 percent, when measured in accordance with ASTM D 4444, Method A, unless otherwise authorized. In addition to moisture content requirements, allow new plaster to age a minimum of 30 days before preparation for painting.

#### 3.5 PREPARATION OF WOOD AND PLYWOOD SURFACES

##### 3.5.1 New and Existing Coated Plywood and Wood Surfaces, Except Floors:

- a. Wood surfaces shall be cleaned of foreign matter.  
  
Surface Cleaning: Surfaces shall be free from dust and other deleterious substances and in a condition approved by the Contracting Officer prior to receiving paint or other finish. Do not use water to clean uncoated wood. Scrape to remove loose coatings. Lightly sand to roughen the entire area of previously enamel-coated wood surfaces.
- b. Removal of Fungus and Mold: Wash existing coated surfaces with a solution composed of 3 ounces (2/3 cup) trisodium phosphate, 1 ounce (1/3 cup) household detergent, 1 quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.
- c. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter in accordance with ASTM D 4444, Method A, unless otherwise authorized.
- d. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints.
- e. Cracks and Nailheads: Set and putty stop nailheads and putty cracks after the prime coat has dried.
- f. Cosmetic Repair of Minor Defects:
  - (1) Knots and Resinous Wood: Prior to application of coating, cover knots and stains with two or more coats of 3-pound-cut shellac varnish, plasticized with 5 ounces of castor oil per gallon.

Scrape away existing coatings from knotty areas, and sand before treating. Prime before applying any putty over shellacked area.

(2) Open Joints and Other Openings: Fill with whiting putty, linseed oil putty. Sand smooth after putty has dried.

(3) Checking: Where checking of the wood is present, sand the surface, wipe and apply a coat of pigmented orange shellac. Allow to dry before paint is applied.

g. Prime Coat For New Exterior Surfaces: Prime coat trim before wood becomes dirty, warped, or weathered.

### 3.5.2 Interior Wood Surfaces, Stain Finish

Interior wood surfaces to receive stain shall be sanded. Oak and other open-grain wood to receive stain shall be given a coat of wood filler not less than 8 hours before the application of stain; excess filler shall be removed and the surface sanded smooth.

## 3.6 APPLICATION

### 3.6.1 Coating Application

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.

At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application.

Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Use trigger operated spray nozzles for water hoses. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Wear protective clothing and respirators when applying oil-based paints or using spray equipment with any paints.

Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

Thoroughly work coating materials into joints, crevices, and open spaces. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.

Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

Apply paint to new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metal work, and accessories. Shield sprinkler heads with protective coverings while

painting is in progress. Remove sprinkler heads which have been painted and replace with new sprinkler heads. For piping in unfinished spaces, provide primed surfaces with one coat of red alkyd gloss enamel to a minimum dry film thickness of 1.0 mil. Unfinished spaces include attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and space where walls or ceiling are not painted or not constructed of a prefinished material. For piping in finished areas, provide prime surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel. Upon completion of painting, remove protective covering from sprinkler heads.

- a. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.
- b. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover surface of preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.
- c. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.
- d. Thermosetting Paints: Topcoats over thermosetting paints (epoxies and urethanes) should be applied within the overcoating window recommended by the manufacturer.

### 3.6.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

### 3.6.3 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

### 3.6.4 Coating Systems

- a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table

|              |   |
|--------------|---|
| Division 3.  | Exterior Concrete Paint Table   |
| Division 4.  | Exterior Concrete Masonry Units Paint Table                               |
| Division 5.  | Exterior Metal, Ferrous and Non-Ferrous Paint Table                       |
| Division 6.  | Exterior Wood; Dressed Lumber, Paneling, Decking,<br>Shingles Paint Table |
| Division 9:  | Exterior Stucco Paint Table   |
| Division 10. | Exterior Cloth Coverings and Bituminous Coated<br>Surfaces Paint Table    |
| Division 3.  | Interior Concrete Paint Table   |
| Division 4.  | Interior Concrete Masonry Units Paint Table                               |
| Division 5.  | Interior Metal, Ferrous and Non-Ferrous Paint Table                       |
| Division 6.  | Interior Wood Paint Table   |
| Division 9:  | Interior Plaster, Gypsum Board, Textured Surfaces<br>Paint Table          |

- b. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.
- c. Coatings for Surfaces Not Specified Otherwise: Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.
- d. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:
  - (1) One coat of primer.
  - (2) One coat of undercoat or intermediate coat.
  - (3) One topcoat to match adjacent surfaces.
- e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

## 3.7 COATING SYSTEMS FOR METAL

Apply coatings of Tables in Division 5 for Exterior and Interior.

- a. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.
- b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.
- c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.
- d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.



- e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.
- f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

### 3.8 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings of Tables in Division 3, 4 and 9 for Exterior and Interior.

### 3.9 COATING SYSTEMS FOR WOOD AND PLYWOOD

- a. Apply coatings of Tables in Division 6 for Exterior and Interior.
- b. Prior to erection, apply two coats of specified primer to treat and prime wood and plywood surfaces which will be inaccessible after erection.
- c. Apply stains in accordance with manufacturer's printed instructions.

### 3.10 PIPING IDENTIFICATION

Piping Identification, Including Surfaces In Concealed Spaces: Provide in accordance with MIL-STD-101. Place stenciling in clearly visible locations. On piping not covered by MIL-STD-101, stencil approved names or code letters, in letters a minimum of 1/2 inch high for piping and a minimum of 2 inches high elsewhere. Stencil arrow-shaped markings on piping to indicate direction of flow using black stencil paint.

### 3.11 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

### 3.12 WASTE MANAGEMENT

As specified in the Waste Management Plan and as follows. Do not use kerosene or any such organic solvents to clean up water based paints. Properly dispose of paints or solvents in designated containers. Close and seal partially used containers of paint to maintain quality as necessary for reuse. Store in protected, well-ventilated, fire-safe area at moderate temperature. Place materials defined as hazardous or toxic waste in designated containers. Coordinate with manufacturer for take-back program. Set aside scrap to be returned to manufacturer for recycling into new product. When such a service is not available, local recyclers shall be sought after to reclaim the materials. Set aside extra paint for future color matches or reuse by the Government. Where local options exist for leftover paint recycling, collect all waste paint by type and provide for delivery to recycling or collection facility for reuse by local organizations.

## 3.13 PAINT TABLES

All DFT's are minimum values. Use only materials with a GPS green check mark having a minimum MPI "Environmentally Friendly" E1, E2 or E3 rating based on VOC (EPA Method 24) content levels. Use only interior paints and coatings that meet VOC requirements of LEED low emitting materials credit. Acceptable products are listed in the MPI Green Approved Products List, available at <http://www.specifygreen.com/APL/ProductIdxByMPInum.asp>.

## 3.13.1 EXTERIOR PAINT TABLES

## DIVISION 5: EXTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

## STEEL / FERROUS SURFACES

## A. New Steel that has been hand or power tool cleaned to SSPC SP 2 or SSPC SP 3

## 1. Alkyd

New; MPI EXT 5.1Q-G5 (Semigloss) Existing; MPI REX 5.1D-G5  
 Primer: Intermediate: Topcoat:  
 MPI 23 MPI 94 MPI 94  
 System DFT: 5.25 mils

## B. New Steel that has been blast-cleaned to SSPC SP 6/NACE No.3:

## 2. Alkyd

New; MPI EXT 5.1D-G5 (Semigloss) / Existing; MPI REX 5.1D-G5  
 Primer: Intermediate: Topcoat:  
 MPI 79 MPI 94 MPI 94  
 System DFT: 5.25 mils

## C. Existing steel that has been spot-blasted to SSPC SP 6/NACE No.3:

## 1. Surface previously coated with alkyd or latex:

Waterborne Light Industrial Coating  
 MPI REX 5.1C-G5 (Semigloss)  
 Spot Primer: Intermediate: Topcoat:  
 MPI 79 MPI 163 MPI 163  
 System DFT: 5 mils

## 2. Surface previously coated with epoxy:

Waterborne Light Industrial  
 a. MPI REX 5.1L-G5 (Semigloss)  
 Spot Primer: Intermediate: Topcoat:  
 MPI 101 MPI 163 MPI 163  
 System DFT: 5 mils

## D. New and existing steel blast cleaned to SSPC SP 10/NACE No. 2:

## 1. Waterborne Light Industrial

MPI EXT 5.1R-G5 (Semigloss)  
 Primer: Intermediate: Topcoat:  
 MPI 101 MPI 108 MPI 163  
 System DFT: 8.5 mils

## STEEL / FERROUS SURFACES

## EXTERIOR GALVANIZED SURFACES

## F. New Galvanized surfaces:

## 1. Waterborne Primer / Waterborne Light Industrial Coating

MPI EXT 5.3J-G6 (Gloss)

Primer: Intermediate: Topcoat:

MPI 134 MPI 164 MPI 164

System DFT: 4.5 mils

## G. Galvanized surfaces with slight coating deterioration; little or no rusting:

## 1. Waterborne Light Industrial Coating

MPI REX 5.3J-G6 (Gloss)

Primer: Intermediate: Topcoat:

MPI 134 N/A MPI 163

System DFT: 4.5 mils

## H. Galvanized surfaces with severely deteriorated coating or rusting:

## 1. Waterborne Light Industrial Coating

MPI REX 5.3L-G5 (Semigloss)

Primer: Intermediate: Topcoat:

MPI 101 MPI 108 MPI 163

System DFT: 8.5 mils

## EXTERIOR SURFACES, OTHER METALS (NON-FERROUS)

## I. Aluminum, aluminum alloy and other miscellaneous non-ferrous metal items not otherwise specified except hot metal surfaces, roof surfaces, and new prefinished equipment. Match surrounding finish:

## 1. Alkyd

MPI EXT 5.4F-G5 (Semigloss)

Primer: Intermediate: Topcoat:

MPI 95 MPI 94 MPI 94

System DFT: 5 mils

## J. Surfaces adjacent to painted surfaces; Mechanical, Electrical, Fire extinguishing sprinkler systems including valves, conduit, hangers, supports, and miscellaneous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment. Match surrounding finish:

## 1. Alkyd

MPI EXT 5.1D-G5 (Semigloss)

Primer: Intermediate: Topcoat:

MPI 79 MPI 94 MPI 94

System DFT: 5.25 mils

## K. Hot metal surfaces subject to temperatures up to 400 degrees F:

## 1. Heat Resistant Enamel

MPI EXT 5.2A

Primer: Intermediate: Topcoat:

## EXTERIOR SURFACES, OTHER METALS (NON-FERROUS)

MPI 21 Surface preparation and number of coats per manufacturer's instructions.  
System DFT: Per Manufacturer

## DIVISION 9: EXTERIOR STUCCO PAINT TABLE

A. Existing synthetic stucco:  
Acrylic Coatings

A. Primer for filling open or porous substrates shall be as required by the acrylic coating manufacturer for the existing coating.

B. Weatherproofing integrally colored coating: single component coating, containing polymer and colored pigments. Product shall comply with the following:

Performance and Physical Properties: meet or exceed the following values for material cured at 73 degrees F and 50 percent relative humidity (unless otherwise specified).

- a. Working Time: 10-20 minutes, depending on ambient conditions.
- b. Solids: 52 %, by volume
- c. Application: spray, roller, or brush.
- d. Water Vapor Permeability: 40 perms (2290 ng/Pa.s.m2), tested at 6 dry mils applied in two coats, ASTM E96/E96M, wet cup method.
- e. Flame Spread Index: <25, ASTM E84, Class A building material
- f. Smoke Developed: <450, ASTM E84
- g. Accelerated Weathering: no cracking, peeling, blistering, or other deleterious effects after 2000 hours exposure, ASTM G155
- h. Tensile Strength: 182 psi (1.3 MPa), minimum, ASTM D412
- i. Mold Resistance: no Mold Growth at 28 days, ASTM D3273
- j. Adhesion to Concrete: 550 psi (3.79 MPa), ASTM D4541
- k. Wind Driven Rain Resistance: PASS, no water penetration, ASTM D6904 (Fed. Spec TTC 555B).
- l. VOC: <50 g/L, meets US EPA (40 CFR 59) emission standards for architectural coatings, complies with South Coast AQMD Rule 1113

## Installation of Coating

A. Examine substrates and conditions under which materials will be installed. Do not proceed with installation until unsatisfactory conditions are corrected.

1. Existing substrate and coating must be structurally sound and fully adhered.
2. Existing acrylic elastomeric coatings must be weathered to an essentially non-elastomeric condition.
3. Verify adhesion to existing substrate/coating with field or lab adhesion tests as required by the acrylic coating manufacturer.
4. Construct full-scale mock up using proposed materials and methods on selected sample wall area as directed by the Contracting Officer.

B. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas and landscaping from contact due to mixing and handling of materials.

C. Surface Preparation: comply with manufacturer's printed instructions and the following.

1. Clean surfaces of bond-inhibiting materials including oil, mildew, dust, and dirt.
2. Surface must be dry at time of application.

D. Mixing: comply with manufacturer's printed instructions and the following.

1. Precondition to temperature of 70 plus or minus 5 degrees F prior to application.
2. Mix using a mechanical mixer to achieve a uniform consistency immediately prior to use.

E. Application: comply with manufacturer's printed instructions and the following.

1. Apply when ambient and surface temperatures are 40 degrees F and expected to remain above 40 degrees F for 24 hours after application.
2. Do not apply in freezing conditions or during precipitation.
3. Do not apply if the surface temperature is less than 5 degrees F (2.8 degrees C) above the ambient dew point temperature.
4. Apply appropriate primer as dictated by substrate or surface conditions.
5. Apply two uniform coats, 5 - 7 wet mils, per coat, acrylic coating to prepared surface. Allow first coat to dry completely before applying second coat.
6. Protect installed materials from rain, freezing, and continuous high humidity until completely dry.
7. Do not overcoat with solvent-based materials.

### 3.13.2 INTERIOR PAINT TABLES

#### DIVISION 3: INTERIOR CONCRETE PAINT TABLE

A. New and uncoated existing and Existing, previously painted Concrete, vertical surfaces, not specified otherwise:

3. Institutional Low Odor / Low VOC Latex  
New; MPI INT 3.1M-G5 (Semigloss) / Existing; MPI RIN 3.1L-G5 (Semigloss)  
Primer:                      Intermediate:                      Topcoat:  
MPI 50                      MPI 147                      MPI 147  
System DFT:      4 mils

B. Concrete ceilings, uncoated:

## DIVISION 3: INTERIOR CONCRETE PAINT TABLE

## 1. Latex Aggregate

MPI INT 3.1N

|                              |               |          |
|------------------------------|---------------|----------|
| Primer:                      | Intermediate: | Topcoat: |
| N/A                          | N/A           | MPI 42   |
| System DFT: Per Manufacturer |               |          |

Texture - Medium. Surface preparation, number of coats, and primer in accordance with manufacturer's instructions.  
Topcoat: Coating to match adjacent surfaces

## C. Existing, previously painted textured Concrete ceilings:

## 1. Institutional Low Odor / Low VOC Latex

Existing; MPI RIN 3.1L-G4 (satin)

|                    |               |          |
|--------------------|---------------|----------|
| Primer:            | Intermediate: | Topcoat: |
| MPI 50             | MPI 146       | MPI 146  |
| System DFT: 4 mils |               |          |

## D. New and uncoated existing and Existing, previously painted Concrete in toilets, restrooms, laundry areas, shower areas, and other high-humidity areas not otherwise specified except floors:

## 3. Epoxy

New; MPI INT 3.1F-G6 (Gloss) / Existing; MPI RIN 3.1E-G6 (Gloss)

|                    |               |          |
|--------------------|---------------|----------|
| Primer:            | Intermediate: | Topcoat: |
| MPI 77             | MPI 77        | MPI 77   |
| System DFT: 4 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:

## 2. Institutional Low Odor / Low VOC Latex

New; MPI INT 4.2E-G5 (Semigloss)

|                    |         |               |          |
|--------------------|---------|---------------|----------|
| Filler             | Primer: | Intermediate: | Topcoat: |
| MPI 4              | N/A     | MPI 147       | MPI 147  |
| System DFT: 4 mils |         |               |          |

## B. Existing, previously painted Concrete masonry:

## 2. Institutional Low Odor / Low VOC Latex

Existing; MPI RIN 4.2L-G5 (Semigloss)

|                    |               |          |
|--------------------|---------------|----------|
| Spot Primer:       | Intermediate: | Topcoat: |
| MPI 50             | MPI 147       | MPI 147  |
| System DFT: 4 mils |               |          |

## C. New and uncoated Existing Concrete masonry units in toilets, restrooms, laundry areas, shower areas, and other high humidity areas unless otherwise specified:

## 3. Epoxy

MPI INT 4.2G-G6 (Gloss)

|         |         |               |          |
|---------|---------|---------------|----------|
| Filler: | Primer: | Intermediate: | Topcoat: |
|---------|---------|---------------|----------|

## DIVISION 4: INTERIOR CONCRETE MASONRY UNITS PAINT TABLE

|             |         |        |        |
|-------------|---------|--------|--------|
| MPI 116     | N/A     | MPI 77 | MPI 77 |
| System DFT: | 10 mils |        |        |

Fill all holes in masonry surface

- D. Existing, previously painted, concrete masonry units in toilets, restrooms, laundry areas, shower areas, and other high humidity areas unless otherwise specified:

## 3. Epoxy

|                         |               |          |
|-------------------------|---------------|----------|
| MPI RIN 4.2D-G6 (Gloss) |               |          |
| Spot Primer:            | Intermediate: | Topcoat: |
| MPI 77                  | MPI 77        | MPI 77   |
| System DFT:             | 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:

## 2. Alkyd

|                             |               |          |
|-----------------------------|---------------|----------|
| MPI INT 5.1E-G5 (Semigloss) |               |          |
| Primer:                     | Intermediate: | Topcoat: |
| MPI 79                      | MPI 47        | MPI 47   |
| System DFT:                 | 5.25 mils     |          |

- C. Metal in toilets, restrooms, laundry areas, shower areas, and other high-humidity areas not otherwise specified except floors, hot metal surfaces, and new prefinished equipment:

## 1. Alkyd

|                             |               |          |
|-----------------------------|---------------|----------|
| MPI INT 5.1E-G5 (Semigloss) |               |          |
| Primer:                     | Intermediate: | Topcoat: |
| MPI 79                      | MPI 47        | MPI 47   |
| System DFT:                 | 5.25 mils     |          |

- D. Ferrous metal in concealed damp spaces or in exposed areas having unpainted adjacent surfaces.

## 1. Aluminum Paint

|              |               |          |
|--------------|---------------|----------|
| MPI INT 5.1M |               |          |
| Primer:      | Intermediate: | Topcoat: |
| MPI 79       | MPI 1         | MPI 1    |
| System DFT:  | 4.25 mils     |          |

- E. Miscellaneous non-ferrous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment. Match surrounding finish:

## 2. Alkyd

|                             |               |          |
|-----------------------------|---------------|----------|
| MPI INT 5.4J-G5 (Semigloss) |               |          |
| Primer:                     | Intermediate: | Topcoat: |
| MPI 95                      | MPI 47        | MPI 47   |

## INTERIOR STEEL / FERROUS SURFACES

System DFT: 5 mils

F. Hot metal surfaces subject to temperatures up to  
400 degrees F:

## 1. Heat Resistant Enamel

MPI INT 5.2A

|                              |   |          |
|------------------------------|---|----------|
| Primer:                      | Intermediate:   | Topcoat: |
| MPI 21                       | Surface preparation and number of coats per<br>manufacturer's instructions. |          |
| System DFT: Per Manufacturer |   |          |

## DIVISION 6: INTERIOR WOOD PAINT TABLE

A. New and Existing, uncoated Wood and plywood not otherwise specified:

## 3. Institutional Low Odor / Low VOC Latex

New; MPI INT 6.3V-G5 (Semigloss)

|                    |               |          |
|--------------------|---------------|----------|
| Primer:            | Intermediate: | Topcoat: |
| MPI 39             | MPI 147       | MPI 147  |
| System DFT: 4 mils |               |          |

B. Existing, previously painted Wood and plywood not otherwise specified:

## 3. Institutional Low Odor / Low VOC Latex

Existing; MPI RIN 6.4D-G5 (Semigloss)

|                    |               |          |
|--------------------|---------------|----------|
| Primer:            | Intermediate: | Topcoat: |
| MPI 39             | MPI 147       | MPI 147  |
| System DFT: 4 mils |               |          |

C. New Wood and Plywood,  
except floors; natural finish or stained:

## 1. Natural finish, oil-modified polyurethane

New; MPI INT 6.4J-G4 / Existing; MPI RIN 6.4L-G4

|                    |               |          |
|--------------------|---------------|----------|
| Primer:            | Intermediate: | Topcoat: |
| MPI 57             | MPI 57        | MPI 57   |
| System DFT: 4 mils |               |          |

## DIVISION 9: INTERIOR PLASTER, GYPSUM BOARD, TEXTURED SURFACES PAINT TABLE

A. New and Existing, previously painted Wallboard not  
otherwise specified:

## 3. Institutional Low Odor / Low VOC Latex

New; MPI INT 9.2M-G5 (Semigloss) / Existing; MPI RIN 9.2M-G5 (Semigloss)

|                    |               |          |
|--------------------|---------------|----------|
| Primer:            | Intermediate: | Topcoat: |
| MPI 50             | MPI 147       | MPI 147  |
| System DFT: 4 mils |               |          |

B. New and Existing, previously painted Wallboard in  
toilets, restrooms, laundry  
areas, shower areas, and other high humidity areas not otherwise specified.:

## 3. Epoxy

New; MPI INT 9.2E-G6 (Gloss) / Existing; MPI RIN 9.2D-G6 (Gloss)



DIVISION 9: INTERIOR PLASTER, GYPSUM BOARD, TEXTURED SURFACES PAINT TABLE

|             |               |          |
|-------------|---------------|----------|
| Primer:     | Intermediate: | Topcoat: |
| MPI 50      | MPI 77        | MPI 77   |
| System DFT: | 4 mils        |          |

-- End of Section --

## SECTION 09 96 60

## LOW-PROFILE TEXTURED ACRYLIC WALL COATING

## 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 D3273    | (2012) Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber |
| ASTM E84      | (2015a) Standard Test Method for Surface Burning Characteristics of Building Materials              |
| ASTM E96/E96M | (2014) Standard Test Methods for Water Vapor Transmission of Materials                              |
| ASTM D2486    | (2012)e1 Standard Test Methods for Scrub Resistance of Wall Paints                                  |

## 1.2 SUBMITTALS

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

## SD-03 Product Data

Submit manufacturer's technical information including installation instructions, product description, and product test data conforming to the test performances required herein. Test data may be submitted in printed form from the manufacturer's standard printed material; however, if requested, Contractor shall submit specific performance test information as certified by independent laboratory analysis (as furnished by the manufacturer to support performance claims).

## Corner Bead

## High Performance Filling Compound

## SD-04 Samples

## Textured Acrylic Coating

Submit color chips of standard colors.

### High Performance Filling Compound

Submit rigid panels on which the complete coating system is applied. Submit panels of the same materials as the surfaces to which the coating system is to be applied.

#### SD-07 Certificates

##### Corner Bead

Statements signed by the high-build textured acrylic wall coating manufacturer attesting that the proposed corner bead product is an accepted and compatible product to be used with the proposed system. Must be dated after award of project contract and clearly name the project.

#### SD-08 Manufacturer's Instructions

##### Textured Acrylic Coating

##### High Performance Filling Compound

Submit instructions covering application of the wall coating system, including surface preparation, detailed application procedures, number and types of coats required, maximum and minimum application temperatures, and induction, pot life, and intercoat cure times. Material Safety Data Sheets (MSDS) shall address all components of the paint coating system, including solvents, primers, and other hazardous materials.

### 1.3 DELIVERY AND STORAGE

A. DELIVER MATERIALS to jobsite in the original, new and unopened containers bearing manufacturer's name and label, and following information: Name or title of materials, manufacturer's stock and/or batch number, date of manufacture, contents of containers including color name and number.

B. Maintain material pails in a clean condition, free from foreign materials and residue. Protect from freezing and maintain temperatures below 100 degrees F. Keep materials stored in an orderly and organized manner to reduce the risk of error. Do not stack materials more than three (3) containers high. Protect from fire hazards.

#### 1.3.1 JOBSITE ENVIRONMENTAL REQUIREMENTS

Comply with wall coating manufacturer's printed installation instructions for minimum temperature in area to receive product. Provide a minimum of 50 degree F in installation area, 48 hours prior to installation and during installation. Block all wind or strong breezes during spray installation. Observe ventilation and safety procedures.

#### 1.3.2 WARRANTY

Provide manufacturer's standard performance warranties and mold or mildew warranties for a minimum of a five years period from installation. Where finish system is applied over acrylic floating compound, provide combined warranty covering both materials.

### 1.3.3 QUALITY ASSURANCES

A COMPATIBILITY: Only provide primers and other substrate preparation materials that are produced or are specifically recommended by the same manufacturer as the finish materials to insure compatibility of the system. Water is the only permissible thinners approved by the coating manufacturer, and use only within recommended limits.

B. SKILLED WORKMANSHIP: Installation contractor shall be trained and recognized by materials manufacturer. All work shall be done by skilled mechanics in accordance with the best standards practice in the industry. Work shall be consistent in appearance, free of visual defects when viewed at a distance of approximately 3 feet from the wall using typical finished condition lighting.

C. COORDINATION OF WORK: Review other sections of these specifications in which prime paints, raw substrates, or other substances might be present to insure compatibility of total coatings systems. Upon request from other trades, furnish information or characteristics of coating materials provided for use to insure compatible substrate materials and finishes are used.

### 1.3.4 MOCK UP

A. SAMPLES: Prior to beginning work, Contractor shall make and submit a minimum of three (3) 8"X10" samples of the intended selected colors and textures for design control review. Provide for each sample a listing of materials and the application for each coat of material.

In addition to the above, Contractor shall install on the jobsite one mock up sample of each Textured Acrylic Coating finish on each different typical jobsite substrate. Each sample shall be installed over an area of not less than thirty (30) square feet. Contractor shall also create or cause to be created temporary or permanent lighting which accurately reproduces finished-project lighting conditions for the purpose of viewing above samples. Work on the balance of the areas to be coated shall commence after Contractor has received written approval of the installed jobsite samples from the Contracting Officer.

### 1.3.5 JOB CONDITIONS

A. PROTECT finishes from casual impact and rain for a period of forty-eight hours after installation. Protect from heavy traffic for a period of at least three days. Protect all surfaces and adjacent areas not intended to be coated and clean immediately any spillage, droppings, or other extraneous contact of the materials with other surfaces.

## PART 2 PRODUCTS

### 2.1 TEXTURED ACRYLIC COATING

Provide Textured Acrylic Coating (TAC) products as designated specifically for the specified use. All wall coating materials shall be free of mercury, cadmium, lead, and chromium, as well as any heavy metals. Textured Acrylic Coating shall have mold or mildew inhibitors. TAC product(s) shall be applied to result in a minimum dry film thickness (DFT) of 8-10 mils (DFT)

and meet all criteria under sections detailing performance requirements.

#### 2.1.1 PERFORMANCE REQUIREMENTS

##### Standardized Tests:

MATERIAL QUALITY: Finished and fully cured (28 days) finish system materials shall have the following minimum performance characteristics:

- a. ASTM E84 Flame Spread: 5 or less
- b. Smoke contribution 0
- c. Low VOC 50 g/l or less

Scrub Test: ASTM D2486-89                      a minimum of 2670 cycles to failure

##### SPECIFICATIONS:

|                               |                                |
|-------------------------------|--------------------------------|
| Water-base pure acrylic resin |                                |
| Inorganic fillers             |                                |
| Perm Rating: ASTM E96/E96M    | 16.9 Perms                     |
| Film Thickness:               | 8 - 10 mils dry film thickness |
| Mildew Resistance:            | 10- No visible mildew          |
| ASTM D3273                    |                                |
|                               | 95 degrees F. and 90% relative |
|                               | contamination conditions       |
| Gloss;                        | Flat                           |

COLOR OR PIGMENTATION: All pigments shall be VOC free and not contribute to any increase in VOC content of the base materials. Pigments shall not contain any heavy metals. Pigments shall also be light fast and fade resistant to discoloration by common commercial cleaning agents.

#### 2.2 Color

Color: shall be custom colors matched to paint manufacturer's colors, which are shown in the color schedule.

#### 2.3 HIGH PERFORMANCE FILLING COMPOUND

Provide a water-based mineral and acrylic compound to even out the irregularities of the interior concrete masonry walls prior to the application of the textured coating (three coats minimum). The walls shall be filled and leveled to such a degree that there is no visible dimpling or deflection in the planer surface when viewed with finished lighting from a distance of not more than 1 meter from the wall surface. Provide a compound that is acceptable to the manufacturer of the textured acrylic coating and designed to provide a smooth substrate for the textured coating. Mortar joints shall be filled so that they are flush with the concrete masonry units. The entire face of the prepared concrete masonry needs to be floated as well (not just the mortar joints). The filling compound is not required on gypsum board. This application shall be inspected by the Contractor and the manufacturer's technical representative before the Coating is applied.

#### 2.4 CORNER BEAD

Provide a corner bead at each exterior corner of all walls or openings. The low-profile textured acrylic wall coating manufacturer shall approve in

writing the proposed corner bead product. The approval shall be included in the low profile textured acrylic wall coating product submittal.

### PART 3 EXECUTION

#### 3.1 Examination

Inspect all areas and conditions present in area intended to receive wall coatings. Notify the Contracting Officer, in writing, of any conditions detrimental to the proper and timely completion of the installation. Work will only proceed when the substandard conditions have been corrected and accepted by the installer.

#### 3.2 GENERAL

##### A DESCRIPTION OF WORK:

1. EXTENT of wall/ceiling coating work is indicated on drawings and schedules, as herein specified.
2. WORK INCLUDES masking, protection of adjacent surfaces, priming, finishing, and cleanup of all Textured Acrylic Coated areas throughout the project as designated on the drawings and finish schedules, except as otherwise specifically indicated.
3. WORK SPECIFIED IN OTHER SECTIONS: Paint, stain, primer, other specialty coatings, fire proofing, tile, masonry, pre-finished panels, stains, preservative treatments, shop applied finishes, wall coverings, etc.

B. PERFORM preparation and cleaning procedures in accordance with manufacturer's requirements and as herein specified, for each particular substrate condition.

C. REMOVE hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish coated, or provide masking or other protection prior to surface coating operations. Following completion of coating of each space or area, reinstall removed items.

D. Insure surfaces to receive coatings are industry acceptable clean surfaces before applying any materials. Program cleaning and coating so that contaminants from cleaning process will not fall into wet or newly coated surfaces.

#### 3.3 SURFACE PREPARATION OF VARIOUS SUBSTRATES

(Select only those substrates appropriate to the work)

- A. GYPSUM BOARD: Prepare gypsum board to industry acceptable standard for hanging vinyl wall covering. Remove excess gypsum compound dust. Do not prime or seal the drywall except as specifically recommended by Texture Acrylic Coating manufacturer.
- B. CEMENTITIOUS SUBSTRATES: Prepare cementitious surfaces such as concrete, concrete block, cement plaster, etc. by cleaning to remove dust, grease, form release agents, etc.; then patch all major holes and honeycombs using structural grout manufactured for the purpose as specified in the concrete division of these specifications.

Grind or remove all projections of more than 1/8" above the planar surface until flush. Fill, and float smooth all recessed form seams and other minor imperfections using an acrylic surfacing compound. Apply HIGH PERFORMANCE FILLING COMPOUND with sufficient labor passes to completely fill and level the CMU. Allow acrylic surfacing compound to dry at least 24 hours under nominal conditions before applying finish materials.

C. EXISTING PAINTED CEMENTITIOUS SURFACES: All existing painted concrete masonry walls must be prepared in accordance with the WALL PREPARATION REQUIREMENTS as indicated on the drawings. The acrylic coating manufacturer's technical representative must approve the prepared substrate prior to installation of the acrylic coating system. Clean surface to remove dust, grease, paint, etc; then patch all major holes using structural grout manufactured for the purpose as specified in the concrete division of these specifications. Grind or remove all projections of more than 1/8" above the planar surface until flush. Fill and float smooth all recessed form seams and other minor imperfections using an acrylic surfacing compound. Apply HIGH PERFORMANCE FILLING COMPOUND with sufficient labor passes to completely fill and level the CMU. Allow acrylic surfacing compound to dry at least 24 hours under nominal conditions before applying finish materials

NOTE: Water sensitive materials such as gypsum based products are not recommended for skimming over concrete or CMU surfaces.

D. FERROUS METALS: Clean free of oil and surface contaminants with non petroleum based solvent. Prime all bare metal surfaces with a good quality rust inhibiting primer prior to application of any Textured Acrylic Coating materials. Test adequacy of adhesion of primer to substrate prior to application of texture coating. Be sure to document results.

E. GALVANIZED SURFACES: Clean free of oil and surface contaminants with non petroleum based solvent. Prime with good quality primer designed for galvanized metal surfaces. Test adequacy of adhesion of primer to substrate prior to application of texture coating. Be sure to document results.

F. EXISTING PAINTED SURFACES: Clean surface with a mix of household ammonia and water (1 part ammonia to 3 parts water) to remove oils, dust, etc. Test adequacy of adhesion of primer to substrate prior to application of texture coating. Be sure to document results. If necessary, lightly sand surface to improve adhesion (total removal of gloss is not necessary). All previously painted surfaces must be sound with the paint firmly adhered. Test adhesion of paint to substrate prior to application of texture acrylic coating. Be sure to document test results.

### 3.4 APPLICATION

A. After proper preparation of various wall assemblies as described in section 3.3, apply coating materials in accordance with the manufacturer's instructions and recommendations as required to achieve the appearance of the approved samples and achieve performance standards as specified herein. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces Coating materials shall

be used as a system that may include primers or under coatings as required by the manufacturer's installation directions.

B. FINAL DRY FILM thickness of finish system shall be a minimum average of 8-10 mils. FINAL DRY FILM THICKNESS of combined acrylic wall floating compounds over CMU and the finish system shall be adequate to hide all grout lines in CMU. Final appearance of CMU walls shall not have grout lines visible.

### 3.5 CLEANUP AND PROTECTION

A. CLEANUP: During progress of work, remove from site discarded coating materials, rubbish, cans, and rags at the end of each work day in compliance with all local, state, and federal requirements.

B. PROTECTION: Protect work of other trades, whether to be coated or not, against damage by coating work. Correct any damage by cleaning, repairing, replacing, or refinishing. Provide signs, barricades, etc. as required to protect new Textured Acrylic Coating work from damage by others (see Section 1.07-B of this Division for protection times)

C. AFTER COMPLETION of work of all other trades, remove all protection materials (including other trades' if provided by them) and clean/touch up as necessary to restore coating work to new and unblemished condition.

-- End of Section --



## SECTION 10 10 00

VISUAL COMMUNICATIONS SPECIALTIES  
02/09

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM B221 (2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM F148 (2002; R 2007) Binder Durability of Cork Composition Gasket Materials

## 1.2 SYSTEM DESCRIPTION

The term visual display board when used herein includes tackboards; submit manufacturer's descriptive data and catalog cuts plus manufacturer's installation instructions, and cleaning and maintenance instructions. Visual display boards shall be from manufacturer's standard product line. Submit certificate of compliance signed by Contractor attesting that visual display boards conform to the requirements specified.

## 1.3 SUSTAINABILITY REQUIREMENTS

Materials in this technical specification may contribute towards contract compliance with sustainability requirements.

## 1.4 SUBMITTALS

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

SD-03 Product Data

Visual Display Board;

## 1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the building site in the manufacturer's original unopened containers and store them in a clean dry area with temperature maintained above 50 degrees F. Stack materials according to manufacturer's recommendations. Visual display boards shall be allowed to acclimate to the building temperature for 24 hours prior to installation.

## 1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that

extend beyond a one year period.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Submit section of core material showing the lamination of colored cork, natural cork, woven fabric, non-woven fabric, and vinyl wall covering. Submit sample of hardwood and plastic laminate finish, and glass type. Samples shall be minimum 4 by 4 inches and show range of color.

#### 2.1.1 Cork

Cork shall be a continuous resilient sheet made from soft, clean, granulated cork relatively free from hardback and dust and bonded with a binder suitable for the purpose intended. The wearing surface shall be free from streaks, spots, cracks or other imperfections that would impair its usefulness or appearance. The material shall be seasoned, and a clean cut made not less than 1/2 inch from the edge shall show no evidence of soft sticky binder.

##### 2.1.1.1 Colored Cork

Provide colored cork composed of pure cork and natural color pigments that are combined under heat and pressure with linseed oil. Colored cork shall be colored throughout and shall be washable. The burlap backing shall be deeply imbedded and keyed to the work sheet being partially concealed in it and meeting the requirements of ASTM F148.

#### 2.1.2 Aluminum

Aluminum frame extrusions shall be alloy 6063-T5 or 6063-T6, conform to ASTM B221, and be a minimum 0.06 inches thick. Exposed aluminum shall have an anodized, satin finish. Straight, single lengths shall be used wherever possible. Joints shall be kept to a minimum. Corners shall be mitered and shall have a hairline closure.

## 2.2 TACKBOARDS

### 2.2.1 Cork

Tackboard shall consist of a minimum 1/4 inch thick colored cork with burlap backing laminated to a minimum 1/4 inch thick hardboard, and shall have an aluminum frame. The size shall be as shown in the drawings.

## 2.3 COLOR

Finish colors for required items shall be as indicated.

## PART 3 EXECUTION

### 3.1 PLACEMENT SCHEDULE

Location and mounting height of visual display boards shall be as shown on the drawings.

Mounting height is defined as distance from finished floor to top of the display board frame.

### 3.2 INSTALLATION

Perform installation and assembly in accordance with manufacturer's printed instructions. Use concealed fasteners. Visual display boards shall be attached to the walls with suitable devices to anchor each unit. furnish and install trim items, accessories and miscellaneous items in total, including but not limited to hardware, grounds, clips, backing materials, adhesives, brackets, and anchorages incidental to or necessary for a sound, secure, complete and finished installation. Installation shall not be initiated until completion of room painting and finishing operations. Visual display boards shall be installed in locations and at mounting heights indicated. Visual display boards shall be installed level and plumb, and if applicable doors shall be aligned and hardware shall be adjusted. Damaged units shall be repaired or replaced as directed by the Contracting Officer.

### 3.3 CLEANING

Writing surfaces shall be cleaned in accordance with manufacturer's instructions.

-- End of Section --

## SECTION 10 14 00.20

INTERIOR SIGNAGE  
11/12

## PART 1 GENERAL

## 1.1 REFERENCES

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

## INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1 (2009) Accessible and Usable Buildings and Facilities

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2015; ERTA 2015) Life Safety Code

## 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 SUSTAINABILITY REQUIREMENTS

Materials in this technical specification may contribute towards contract compliance with sustainability requirements.

## 1.3 SUBMITTALS

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

## SD-02 Shop Drawings

Detail Drawings  
Sign Schedule

## SD-03 Product Data

Installation  
Warranty

## SD-04 Samples

Interior Signage  
SD-10 Operation and Maintenance Data

Approved Manufacturer's Instructions  
Protection and Cleaning

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 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.

##### 1.4.2 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 sign schedule showing the location, each sign type, and message.

#### 1.5 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.

#### 1.6 WARRANTY

Warrant the interior signage for a period of 2 years against defective workmanship and material. Warranties shall be signed by the authorized representative of the manufacturer. Submit warranty accompanied by the document authenticating the signer as an authorized representative of the guarantor. Guarantee that the signage products and the installation are free from any defects in material and workmanship from the date of delivery.

### PART 2 PRODUCTS

#### 2.1 STANDARD PRODUCTS

Signs shall be the standard product of a manufacturer regularly engaged in the manufacture of such products that essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening. Obtain signage from a single manufacturer with edges and corners of finished letterforms and graphics true and clean.

#### 2.2 ROOM IDENTIFICATION/DIRECTIONAL SIGNAGE SYSTEM

##### 2.2.1 Standard Room Signs

Signs shall consist of 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 in 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 inch 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 materials that are approved by the sign manufacturer for the mounting surface.
- b. Surface mounted on painted concrete masonry: Sign shall be mounted with 1/16 inch thick vinyl foam tape and silicone adhesive.
- c. Surface mounted on unpainted brick masonry: Sign shall be mounted with 1/16 inch 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.

## 2.4 2.11 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.

## 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 inch 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. H

-- End of Section --

## SECTION 10 26 13

## WALL AND CORNER GUARDS

08/10

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

|           |  |
|-----------|--|
| ASTM A167 | (2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip                           |
| ASTM D543 | (2006) Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents   |
| ASTM D635 | (2010) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position |
| ASTM E84  | (2015a) Standard Test Method for Surface Burning Characteristics of Building Materials   |
| ASTM G 21 | (2009) Determining Resistance of Synthetic Polymeric Materials to Fungi  |

## 1.2 SUBMITTALS

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

SD-02 Shop Drawings

Corner Guards

SD-03 Product Data

Corner Guards

SD-04 Samples

Finish

## 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Keep



materials dry, protected from weather and damage, and stored under cover. Materials shall be stored at approximately 70 degrees F for at least 48 hours prior to installation.

#### 1.4 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

### PART 2 PRODUCTS

#### 2.1 STANDARD PRODUCTS

To the maximum extent possible, corner guards, shall be the standard products of a single manufacturer and shall be furnished as detailed. Drawings show general configuration of products required, and items differing in minor details from those shown will be acceptable.

##### 2.1.1 Resilient Material

###### 2.1.1.1 Fire Rating

Fire rating shall be Class 1 when tested in accordance with ASTM E84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less. Material shall be rated self extinguishing when tested in accordance with ASTM D635. Material shall be labeled and tested by an approved nationally known testing laboratory. Resilient material used for protection on fire rated doors and frames shall be listed by the testing laboratory performing the tests. Resilient material installed on fire rated wood/steel door and frame assemblies shall have been tested on similar type assemblies. Test results of material tested on any other combination of door/frame assembly will not be acceptable.

###### 2.1.1.2 Chemical and Stain Resistance

Materials shall be resistant to chemicals and stains reagents in accordance with ASTM D543.

###### 2.1.1.3 Fungal and Bacterial Resistance

Materials shall be resistant to fungi and bacteria in accordance with ASTM G 21, as applicable.

#### 2.2 CORNER GUARDS

##### 2.2.1 Stainless Steel Corner Guards

Stainless steel corner guards shall be fabricated of 18 gauge thick material conforming to ASTM A167, type 302 or 304. Corner guards shall extend from floor to ceiling and have 2-inch legs. Corner guards shall have a adhesive backing for permanent backing.

#### 2.3 FINISH

##### 2.3.1 Stainless Steel Finish

Finish for stainless steel shall be in accordance with ASTM A167, Type 302 or 304, finish number 4.

## 2.4 ADHESIVES

Adhesive for resilient material shall be in accordance with manufacturers recommendations.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Corner Guards

Material shall be mounted at location indicated in accordance with manufacturer's recommendations.

#### 3.1.2 Stainless Steel Guards

- a. Mount guards on external corners of interior walls, partitions and columns as in accordance with manufacturer's recommendations.
- b. Where corner guards are installed on gypsum board, clean surfaces and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from the guard edges and allow to cure undisturbed for 24 hours.

-- End of Section --

## SECTION 10 28 13

TOILET ACCESSORIES  
07/06

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM C1036 (2006) Standard Specification for Flat Glass

## 1.2 SUBMITTALS

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

SD-03 Product Data

Finishes  
Accessory Items

SD-07 Certificates

Accessory Items

## 1.3 DELIVERY, STORAGE, AND HANDLING

Wrap toilet accessories for shipment and storage, then deliver to the jobsite in manufacturer's original packaging, and store in a clean, dry area protected from construction damage and vandalism.

## 1.4 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

## PART 2 PRODUCTS

## 2.1 MANUFACTURED UNITS

Provide toilet accessories where indicated in accordance with paragraph SCHEDULE. Porcelain type, tile-wall accessories are specified in Section 09 30 13 CERAMIC TILING. Provide each accessory item complete with the necessary mounting plates of sturdy construction with corrosion resistant surface.

## 2.1.1 Anchors and Fasteners

Provide anchors and fasteners capable of developing a restraining force commensurate with the strength of the accessory to be mounted and suited

for use with the supporting construction. Provide oval heads exposed fasteners with finish to match the accessory.

### 2.1.2 Finishes

Except where noted otherwise, provide the following finishes on metal:

| Metal                                    | Finish                  |
|--|-------------------------|
| Stainless steel                          | No. 4 satin finish      |
| Carbon steel, copper alloy,<br>and brass | Chromium plated, bright |

## 2.2 ACCESSORY ITEMS

Conform to the requirements for accessory items specified below. Submit fasteners proposed for use for each type of wall construction, mounting, operation, and cleaning instructions and one sample of each other accessory proposed for use. Incorporate approved samples into the finished work, provided they are identified and their locations noted. Submit certificate for each type of accessory specified, attesting that the items meet the specified requirements.

### 2.2.1 Medicine Cabinet (MC)

Construct medicine cabinet with cold-rolled carbon steel sheet of minimum 0.03 inch thickness, formed from a single sheet of steel or mechanically formed and spot welded. Medicine cabinet shall be 17 inches wide by 27 inches high by 5 inches deep (larger dimensions are not permitted).

#### 2.2.1.1 Swinging Door Cabinet, Class 2

Furnish swinging door cabinet assembly, including the lighting arrangement, as indicated. Provide surface mounted assembly. Locate cabinet centrally behind the door with a minimum of two shelves. Provide stainless steel or carbon steel door hinges. Provide permanent type magnets used in door catches. Provide doors with a mirror.

### 2.2.2 Mirrors, Glass (MG)

Provide Type I transparent flat type, Class 1-clear glass for mirrors. Glazing Quality q1 1/4 inch thick conforming to ASTM C1036. Coat glass on one surface with silver coating, copper protective coating, and mirror backing paint. Provide highly adhesive pure silver coating of a thickness which provides reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, free of pinholes or other defects. Provide copper protective coating with pure bright reflective copper, homogeneous without sludge, pinholes or other defects, of proper thickness to prevent "adhesion pull" by mirror backing paint. Provide mirror backing paint with two coats of special scratch and abrasion-resistant paint and baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication. All mirrors are to have frames. Frames shall be as follows: Alloy 18-8, type 304, 18 gauge stainless steel. Unitized all welded construction. Corners mitered, welded and polished. Exposed surfaces shall have No. 4 satin finish. Edges and corners to be burrfree.

### 2.2.3 Paper Towel Dispenser (PTD)

Provide paper towel dispenser constructed of a minimum 0.03 inch Type 304 stainless steel, surface mounted. Provide a towel compartment for each dispenser. Furnish tumbler key lock locking mechanism.

### 2.2.4 Combination Paper Towel Dispenser/Waste Receptacle (PTDWR)

Provide semi-recessed dispenser/receptacle with a capacity of 400 sheets of C-fold, single-fold, or quarter-fold towel. Design waste receptacle to be locked in unit and removable for service. Provide tumbler key locking mechanism. Provide waste receptacle capacity of 12 gallons. Fabricate a minimum 0.03 inch stainless steel welded construction unit with all exposed surfaces having a satin finish. Provide waste receptacle that accepts reusable liner standard for unit manufacturer.

### 2.2.5 Sanitary Napkin Disposer (SND)

Construct a Type 304 stainless steel sanitary napkin disposal with removable leak-proof receptacle for disposable liners. Provide fifty disposable liners of the type standard with the manufacturer. Retain receptacle in cabinet by tumbler lock. Provide disposer with a door for inserting disposed napkins, partition mounted, surface mounted.

### 2.2.6 Shower Curtain (SC)

Provide shower curtain and hooks, size to suit conditions. Provide anti-bacterial nylon/vinyl fabric curtain. Color is to be white.

### 2.2.7 Shower Curtain Rods (SCR)

Provide Type 304 stainless steel shower curtain rods 1-1/4 inch OD by 0.049 inch minimum straight to meet installation conditions.

### 2.2.8 Soap Dispenser (SD)

Provide soap dispenser surface mounted, liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 40 fluid ounces with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps.

### 2.2.9 Shelf, Metal, Heavy Duty (SMHD) with Utility Hooks and Mop strip

Furnish a minimum 18 gauge stainless steel heavy duty metal shelf 8 inches deep with return edges. Mop holders are to be riveted to the strip and rubber cams are to be ribbed.

### 2.2.10 Towel Bar (TB)

Provide stainless steel towel bar with a minimum thickness of 0.015 inch. Provide minimum 3/4 inch diameter bar, or 5/8 inch square. Provide satin finish.

### 2.2.11 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.

### 2.2.12 Robe Hook (RH)

Provide double robe hook, satin finish contoured 4 inch wide bar with hook at each end, projects 1-7/8 inch from wall.

### 2.2.13 Recessed Shower Shelf (RSS)

Provide a solid polymer recessed shower shelf 10-3/4" H x 7-1/2" W x 4-1/8" D with integral trim.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Provide the same finish for the surfaces of fastening devices exposed after installation as the attached accessory. Provide oval exposed screw heads. Install accessories at the location and height indicated. Protect exposed surfaces of accessories with strippable plastic or by other means until the installation is accepted. After acceptance of accessories, remove and dispose of strippable plastic protection. Coordinate accessory manufacturer's mounting details with other trades as their work progresses. Use sealants for brackets, plates, anchoring devices and similar items in showers (a silicone or polysulfide sealant) as they are set to provide a watertight installation. After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

#### 3.1.1 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.

-- End of Section --

SECTION 10 44 16

FIRE EXTINGUISHERS

05/15

PART 1 GENERAL

1.1 SUBMITTALS

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

SD-02 Shop Drawings

Cabinets

Wall Brackets

SD-03 Product Data

Cabinets

Wall Brackets

1.2 DELIVERY, STORAGE, AND HANDLING

Protect materials from weather, soil, and damage during delivery, storage, and construction.

Deliver materials in their original packages, containers, or bundles bearing the brand name and the name and type of the material.

PART 2 PRODUCTS

Submit fabrication drawings consisting of fabrication and assembly details performed in the factory and product data for the following items: cabinets, Wall Brackets.

2.1 EQUIPMENT

2.1.1 Cabinets

2.1.1.1 Material

Provide stainless steel cabinets.

2.1.1.2 Type

Provide semi-recessed cabinet to fit the wall thickness where the cabinets are shown.

Provide a narrow lite acrylic door (stainless steel) with a rolled edge trim.

2.1.1.3 Size

Dimension cabinets to accommodate a 10 pound fire extinguishers.

#### 2.1.2 Wall Brackets

Provide wall-hook fire extinguisher wall brackets for a 10 pound fire extinguisher in each mechanical room.

Provide wall bracket and accessories as approved.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Provide 10lb ABC Fire Extinguishers and cabinets as indicated on the drawings.

Comply with the manufacturer's recommendations for all installations.

#### 3.2 PROTECTION

##### 3.2.1 Repairing

Remove and replace damaged and unacceptable portions of completed work with new work at no additional cost to the Government.

##### 3.2.2 Cleaning

Clean all surfaces of the work, and adjacent surfaces which are soiled as a result of the work. Remove from the site all construction equipment, tools, surplus materials and rubbish resulting from the work.

-- End of Section --



## SECTION 12 48 13

## ENTRANCE FLOOR MATS AND FRAMES

02/14

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

|            |  |
|------------|--|
| ASTM B221  | (2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes   |
| ASTM C1028 | (2007; E 2010) Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method |
| ASTM D2047 | (2011) Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine   |
| ASTM D3884 | (2009) Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method)  |
| ASTM E648  | (2014c) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source  |

## 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-03 Product Data

Entrance Floor Mats and Frames

Adhesives and Concrete Primers

Manufacturer's Standard Color Charts

## SD-04 Samples

## Entrance Floor Mats and Frames

### SD-08 Manufacturer's Instructions

#### Manufacturer's Instructions

### SD-10 Operation and Maintenance Data

#### Protection, Maintenance, and Repair Information

## 1.3 QUALITY ASSURANCE

Comply with 36 CFR 1191 Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines for installed entrance floor mats and frames. Ensure entrance floor mats and frames are slip resistant in accordance with ASTM D2047, Coefficient of Friction, minimum 0.60 for accessible routes and be structurally capable of withstanding a Uniform floor load of 300 lbf/sq. ft.. Ensure flammability is in accordance with ASTM E648, Class 1, Critical Radiant Flux, minimum 0.45 watts/m2.

## 1.4 DELIVERY OF MATERIALS

Deliver materials to the project site in their original packages or containers bearing labels clearly identifying the manufacturer, brand name, and quality or grade.

Store materials in their original unbroken packages or containers in the area in which they will be installed. Unwrap, inspect, and place mats at indicated location. Remove all excess packing materials.

## PART 2 PRODUCTS

### 2.1 Entrance Floor Mats and Frames

Submit manufacturer's catalog data for recessed entrance mat. Submit sample of assembled sections of floor mat showing corners, intersections, and other details of construction. Submit samples of exposed floor mat, frame finish and accessories.

#### 2.1.1 Vinyl Mats

Mats 3/8 inches thick with square edges for recessed installations. Welded in a non-hinged, grille design with an embossed non skid surface. Soft grid shall be extruded PVC grid and shall be gray in color. Provide Manufacturer's Standard Color Charts for color selection.

#### **Performance Requirements**

1. ASTM C1028 Static Coefficient of Friction: Wet .54; Dry .66
2. ASTM E648 Critical Radiant Flux: Class 1
3. ASTM D3884 Abrasion Resistance: 0.4% loss after 1,000 cycles (Taber abrader)

#### 2.1.2 Recessed Frame

Aluminum - ASTM B221, alloys 6105-T5 for rail extrusions, mill finish 3/8 inch "R" frame.

## 2.2 ADHESIVES AND CONCRETE PRIMERS

Provide adhesives and concrete primers, where required, according to manufacturer's recommendations.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Comply with manufacturer's requirements of substrates and floor conditions affecting installation of floor mats and frames. Installation cannot occur until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

Install floor mats and frames according to manufacturer's instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action. Coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat. Coordinate recess frame installation with concrete construction to ensure frame anchorage is correct and that the base is level and flat. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

Provide manufacturer's protection, maintenance, and repair information.

-- End of Section --

## SECTION 21 13 13.00 20

## WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

04/08

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM D709 (2013) Laminated Thermosetting Materials

## FM GLOBAL (FM)

FM APP GUIDE (updated on-line) Approval Guide  
<http://www.approvalguide.com/>

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13 (2013; TIA 10-1; TIA 11-2; ERTA 2014; TIA 14-3) Standard for the Installation of Sprinkler Systems

NFPA 13R (2013) Standard for the Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height

NFPA 1963 (2014) Standard for Fire Hose Connections

NFPA 24 (2013) Standard for the Installation of Private Fire Service Mains and Their Appurtenances

## UNDERWRITERS LABORATORIES (UL)

UL 668 (2004; Reprint Dec 2012) Hose Valves for Fire-Protection Service

UL Fire Prot Dir (2012) Fire Protection Equipment Directory

## 1.2 SYSTEM DESCRIPTION

Design and provide new automatic wet pipe fire extinguishing sprinkler systems for complete fire protection coverage throughout BEQ 4200.

## 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 13R, 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. Hydraulic calculations shall include a 10% safety factor. 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 the hazards indicated on the contract drawings. Uniformly space sprinklers on the branch piping. Sprinklers shall provide coverage throughout 100 percent of the building. This includes, but is not limited to, telephone rooms, electrical equipment rooms, boiler rooms, switchgear rooms, transformer rooms, and other electrical and mechanical spaces.

#### 1.3.2 Water Distribution

Distribution shall be uniform throughout the area in which the sprinklers will open. Discharge from individual sprinklers in hydraulically most remote area shall be between 100 percent and 120 percent of the specified density.

#### 1.3.3 Density of Application of Water

Size pipe to provide the specified density when the system is discharging the specified total maximum required flow. Application to horizontal surfaces below the sprinklers shall be as indicated on the contract drawings.

#### 1.3.4 Sprinkler Discharge Area

Area shall be the hydraulically most remote 1,500 sq ft Area reductions and increases from NFPA 13 shall not be applied to this area.

#### 1.3.5 Outside Hose Allowances

Hydraulic calculations shall include a hose allowance of 250 gpm for outside hose streams

#### 1.3.6 Water Supply

Base hydraulic calculations on the water supply data shown on the fire protection contract drawings. The contractor shall perform a waterflow test to obtain updated water supply information. This test shall be conducted no more than 12 months prior to the sprinkler system shop drawing.

### 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; G

Prepare 24 by 36 inch detail working drawings of sprinklers and piping. Floor plans shall be drawn to a scale not less than 1/8" = 1'-0". Show data essential for proper installation of each system. Show details, plan view, elevations and sections of the systems supply and piping. Show piping schematic of systems supply, devices, valves, pipe and fittings. Show point to point electrical wiring diagrams. 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. Submit name of software program used.

## SD-06 Test Reports

## Request to Schedule Preliminary Tests

## Preliminary Test Report

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 System Technician or Fire Protection Engineer.

## Request to Schedule Final Acceptance Test

## Final Acceptance Test Report

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 System Technician or Fire Protection Engineer.

#### SD-07 Certificates

##### 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.

#### 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 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 Water-Based Fire Protection Systems Layout 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 Pipe

Pipe shall comply with NFPA 24. Minimum pipe size shall be 6 inches. Piping more than 5 feet outside the building walls shall comply with Section 33 11 00 WATER DISTRIBUTION.

#### 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 13R 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 40 for sizes less than 2 inches and Schedule 10 for sizes 2 inches or larger. Fittings into which sprinklers, sprinkler riser nipples, or drop nipples are threaded shall be welded, threaded, or grooved-end type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be permitted. Rubber gasketed grooved-end pipe and fittings with mechanical couplings shall be permitted in pipe sizes 1.5 inches and larger. Fittings, mechanical couplings, and rubber gaskets shall be supplied by the same manufacturer. Steel piping with wall thickness less than Schedule 30 shall not be threaded. Side outlet tees using rubber gasketed fittings shall not be permitted. Sprinkler pipe and fittings shall be metal.

#### 2.2.2 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, Upright, Sidewall, or Residential quick response sprinklers. Sprinklers shall have a polished chrome finish in finished areas and a brass finish in unfinished areas. 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 riser check valve. 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 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM. 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 and sprinkler wrench adjacent to each alarm valve. The number and types of extra sprinklers shall be as

specified in NFPA 13R.

#### 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 UNDERGROUND PIPING INSTALLATION

The methods of fabrication and installation of the underground piping shall fully comply with the requirements and recommended practices of NFPA 13R, NFPA 24 and the contract drawings.

#### 3.2 ABOVEGROUND PIPING INSTALLATION

The methods of fabrication and installation of the aboveground piping shall fully comply with the requirements and recommended practices of NFPA 13R and this specification section.

##### 3.2.1 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

##### 3.2.2 Pendent Sprinklers

Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling shall not extend more than 1 inch below the underside of the ceiling. Pendent sprinklers in suspended ceilings shall be a minimum of 6 inches from ceiling grids.

##### 3.2.3 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. Bushings are prohibited.

##### 3.2.4 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section 07 84 00 FIRESTOPPING. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but

pliable mass or with a mechanically adjustable segmented elastomer seal.

### 3.2.5 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.

### 3.2.6 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. 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."

### 3.2.7 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 13R.

### 3.2.8 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.

### 3.2.9 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 13R. 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 13R.

## 3.3 ELECTRICAL WORK

Except as supplemented and modified herein, electric equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with 28 31 76 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM.

## 3.4 PIPE PAINTING AND COLOR CODE MARKING

Paint and color code mark sprinkler piping system as specified in Section 09 90 00 PAINTS AND COATINGS.

## 3.5 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground

piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Submit request to schedule Preliminary Tests, no later than 14 days prior to the proposed start of the tests. Upon completion of specified tests, the Contractor shall submit for approval a Preliminary Test Report.

### 3.5.1 Underground Piping

#### 3.5.1.1 Flushing

Underground piping shall be flushed in accordance with NFPA 24.

#### 3.5.1.2 Hydrostatic Testing

New underground piping shall be hydrostatically tested in accordance with NFPA 24.

### 3.5.2 Aboveground Piping

#### 3.5.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13R.

#### 3.5.2.2 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.

### 3.6 FINAL ACCEPTANCE TEST

Final Acceptance Test shall begin only when the Preliminary Test Report has been approved. Submit request to schedule Final Acceptance Test, no later than 14 days prior to the proposed start of the tests. Notification shall include a copy of the Contractor's Material & Test Certificates. 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. The

Contractor shall submit the Final Acceptance Test Report as specified in the Submittals paragraph.

### 3.7 ON-SITE TRAINING

Submit request to schedule the On-site Training, at least 14 days prior to the start of related training but prior to the final inspections and tests. The sprinkler contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a 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 --

## SECTION 22 00 00

## PLUMBING, GENERAL PURPOSE

11/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 1010 (2002) Self-Contained, Mechanically Refrigerated Drinking-Water Coolers

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.22/CSA 4.4 (1999; Addenda A 2000, Addenda B 2001; R 2004) Relief Valves for Hot Water Supply Systems

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

ASHRAE 90.1 - IP (2013; INT 1 2013; Errata 1-3 2013; Errata 4-6 2014; Errata 7-8 2015; INT 2-3 2015) Energy Standard for Buildings Except Low-Rise Residential Buildings

## AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001 (2008) Performance Requirements for Atmospheric Type Vacuum Breakers (ANSI approved 2009)

ASSE 1010 (2004) Performance Requirements for Water Hammer Arresters (ANSI approved 2004)

ASSE 1011 (2004; Errata 2004) Performance Requirements for Hose Connection Vacuum Breakers (ANSI approved 2004)

ASSE 1012 (2009) Performance Requirements for Backflow Preventer with an Intermediate Atmospheric Vent - (ANSI approved 2009)

ASSE 1013 (2009) Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers - (ANSI approved 2010)

ASSE 1018 (2001) Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied (ANSI Approved 2002)

- ASSE 1019 (2004; Errata 2005) Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type (ANSI Approved 2004)
- ASSE 1020 (2004; Errata 2004; Errata 2004) Performance Requirements for Pressure Vacuum Breaker Assembly (ANSI Approved 2004)

## AMERICAN WATER WORKS ASSOCIATION (AWWA)

- AWWA B300 (2010; Addenda 2011) Hypochlorites
- AWWA B301 (2010) Liquid Chlorine
- AWWA C203 (2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
- AWWA C606 (2006) Grooved and Shouldered Joints
- AWWA C651 (2005; Errata 2005) Standard for Disinfecting Water Mains
- AWWA C652 (2002) Disinfection of Water-Storage Facilities

## AMERICAN WELDING SOCIETY (AWS)

- AWS A5.8/A5.8M (2004) Specification for Filler Metals for Brazing and Braze Welding
- AWS B2.2/B2.2M (2010) Specification for Brazing Procedure and Performance Qualification

## ASME INTERNATIONAL (ASME)

- ASME A112.1.2 (2004) Standard for Air Gaps in Plumbing Systems (For Plumbing Fixtures and Water-Connected Receptors)
- ASME A112.14.1 (2003; R 2008) Backwater Valves
- ASME A112.19.2/CSA B45.1 (2008; Update 2009) Standard for Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals
- ASME A112.19.3/CSA B45.4 (2008) Stainless Steel Plumbing Fixtures
- ASME A112.36.2M (1991; R 2008) Cleanouts
- ASME A112.6.1M (1997; R 2008) 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 B16.12  | (2009) Cast Iron Threaded Drainage Fittings  |
| ASME B16.15  | (2006) Cast Bronze Alloy Threaded Fittings Classes 125 and 250   |
| ASME B16.18  | (2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings  |
| ASME B16.21  | (2011) Nonmetallic Flat Gaskets for Pipe Flanges   |
| ASME B16.22  | (2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings             |
| ASME B16.23  | (2002; R 2006) Cast Copper Alloy Solder Joint Drainage Fittings - DWV                                  |
| ASME B16.24  | (2006) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500 |
| ASME B16.29  | (2007) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV                    |
| ASME B16.3   | (2010) Malleable Iron Threaded Fittings, Classes 150 and 300   |
| ASME B16.34  | (2013) Valves - Flanged, Threaded and Welding End  |
| ASME B16.4   | (2006) Standard for Gray Iron Threaded Fittings; Classes 125 and 250                                   |
| ASME B16.5   | (2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard                  |
| ASME B16.50  | (2001; R 2008) Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings                           |
| ASME B31.1   | (2014; INT 1-47) Power Piping  |
| ASME B31.5   | (2010) Refrigeration Piping and Heat Transfer Components   |
| ASME B40.100 | (2005) Pressure Gauges and Gauge Attachments   |

## ASTM INTERNATIONAL (ASTM)

|                 |   |
|-----------------|---|
| ASTM A105/A105M | (2011) Standard Specification for Carbon Steel Forgings for Piping Applications |
| ASTM A183       | (2003; R 2009) Standard Specification for Carbon Steel Track Bolts and Nuts     |

|                 |   |
|-----------------|---|
| ASTM A193/A193M | (2011) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications |
| ASTM A47/A47M   | (1999; R 2014) Standard Specification for Ferritic Malleable Iron Castings  |
| ASTM A515/A515M | (2003; R 2007) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service                        |
| ASTM A516/A516M | (2010) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service                                     |
| ASTM A518/A518M | (1999; R 2008) Standard Specification for Corrosion-Resistant High-Silicon Iron Castings  |
| ASTM A53/A53M   | (2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless   |
| ASTM A536       | (1984; R 2009) Standard Specification for Ductile Iron Castings   |
| ASTM A74        | (2009) Standard Specification for Cast Iron Soil Pipe and Fittings  |
| ASTM A888       | (2011) Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications            |
| ASTM B117       | (2011) Standard Practice for Operating Salt Spray (Fog) Apparatus   |
| ASTM B152/B152M | (2009) Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar  |
| ASTM B306       | (2009) Standard Specification for Copper Drainage Tube (DWV)  |
| ASTM B32        | (2008) Standard Specification for Solder Metal  |
| ASTM B370       | (2011) Standard Specification for Copper Sheet and Strip for Building Construction  |
| ASTM B42        | (2010) Standard Specification for Seamless Copper Pipe, Standard Sizes  |
| ASTM B43        | (2009) Standard Specification for Seamless Red Brass Pipe, Standard Sizes   |
| ASTM B584       | (2011) Standard Specification for Copper  |

|             |   |
|-------------|---|
|             | Alloy Sand Castings for General Applications  |
| ASTM B75    | (2002; R 2010) Standard Specification for Seamless Copper Tube  |
| ASTM B813   | (2010) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube                               |
| ASTM B88    | (2009) Standard Specification for Seamless Copper Water Tube  |
| ASTM C1053  | (2000; R 2010) Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications          |
| ASTM C564   | (2011) Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings   |
| ASTM C920   | (2011) Standard Specification for Elastomeric Joint Sealants  |
| ASTM D 2000 | (2008) Standard Classification System for Rubber Products in Automotive Applications  |
| ASTM D 2235 | (2004; R 2011) Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings          |
| ASTM D 2564 | (2004; R 2009e1) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems                     |
| ASTM D 2661 | (2011) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40, Plastic Drain, Waste, and Vent Pipe and Fittings |
| ASTM D 2665 | (2011) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings                         |
| ASTM D 2855 | (1996; R 2010) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings                 |
| ASTM D 2996 | (2001; R 2007e1) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe  |
| ASTM D 3122 | (1995; R 2009) Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings  |
| ASTM D 3138 | (2004; R 2011) Solvent Cements for  |

|                   |  |
|-------------------|--|
|                   | Transition Joints Between<br>Acrylonitrile-Butadiene-Styrene (ABS) and<br>Poly(Vinyl Chloride) (PVC) Non-Pressure<br>Piping Components |
| ASTM D 3139       | (1998; R 2005) Joints for Plastic Pressure<br>Pipes Using Flexible Elastomeric Seals   |
| ASTM D 3212       | (2007) Standard Specification for Joints<br>for Drain and Sewer Plastic Pipes Using<br>Flexible Elastomeric Seals                      |
| ASTM D 3311       | (2011) Drain, Waste, and Vent (DWV)<br>Plastic Fittings Patterns   |
| ASTM D 4101       | (2011) Standard Specification for<br>Polypropylene Injection and Extrusion<br>Materials  |
| ASTM D2822/D2822M | (2005e1; R 2011) Asphalt Roof Cement   |
| ASTM E 1          | (2007) Standard Specification for ASTM<br>Liquid-in-Glass Thermometers   |
| ASTM F 1760       | (2001; R 2011) Coextruded Poly(Vinyl<br>Chloride) (PVC) Non-Pressure Plastic Pipe<br>Having Reprocessed-Recycled Content               |
| ASTM F 2389       | (2010) Standard Specification for<br>Pressure-rated Polypropylene (PP) Piping<br>Systems   |
| ASTM F 477        | (2010) Standard Specification for<br>Elastomeric Seals (Gaskets) for Joining<br>Plastic Pipe   |
| ASTM F 493        | (2010) Solvent Cements for Chlorinated<br>Poly(Vinyl Chloride) (CPVC) Plastic Pipe<br>and Fittings                                     |
| ASTM F 628        | (2008) Acrylonitrile-Butadiene-Styrene<br>(ABS) Schedule 40 Plastic Drain, Waste,<br>and Vent Pipe with a Cellular Core                |
| ASTM F 891        | (2010) Coextruded Poly (Vinyl Chloride)<br>(PVC) Plastic Pipe with a Cellular Core   |

## CAST IRON SOIL PIPE INSTITUTE (CISPI)

|           |  |
|-----------|--|
| CISPI 301 | (2009) Hubless Cast Iron Soil Pipe and<br>Fittings for Sanitary and Storm Drain,<br>Waste, and Vent Piping Applications  |
| CISPI 310 | (2011) Coupling for Use in Connection with<br>Hubless Cast Iron Soil Pipe and Fittings<br>for Sanitary and Storm Drain, Waste, and<br>Vent Piping Applications |

## COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015 (1994; R 1995) Copper Tube Handbook

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS  
(IAPMO)

IAPMO PS 117 (2005b) Press Type Or Plain End Rub  
Gasketed W/ Nail CU & CU Alloy Fittings 4  
Install On CU Tubing

## INTERNATIONAL CODE COUNCIL (ICC)

ICC IPC (2009) International Plumbing Code

ICC/ANSI A117.1 (2009) Accessible and Usable Buildings and  
Facilities

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)

MSS SP-110 (2010) Ball Valves Threaded,  
Socket-Welding, Solder Joint, Grooved and  
Flared Ends

MSS SP-25 (2008) Standard Marking System for Valves,  
Fittings, Flanges and Unions

MSS SP-58 (2009) Pipe Hangers and Supports -  
Materials, Design and Manufacture,  
Selection, Application, and Installation

MSS SP-67 (2002a) Butterfly Valves

MSS SP-69 (2003) Pipe Hangers and Supports -  
Selection and Application (ANSI Approved  
American National Standard)

MSS SP-70 (2006) Gray Iron Gate Valves, Flanged and  
Threaded Ends

MSS SP-71 (2005) Gray Iron Swing Check Valves,  
Flanged and Threaded Ends

MSS SP-72 (2010) Ball Valves with Flanged or  
Butt-Welding Ends for General Service

MSS SP-78 (2005a) Cast Iron Plug Valves, Flanged and  
Threaded Ends

MSS SP-80 (2008) Bronze Gate, Globe, Angle and Check  
Valves

MSS SP-85 (2002) Gray Iron Globe & Angle Valves  
Flanged and Threaded Ends

## NACE INTERNATIONAL (NACE)

NACE SP0169 (1992; R 2007) Control of External

Corrosion on Underground or Submerged  
Metallic Piping Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2009) Motors and Generators  
NEMA MG 11 (1977; R 2007) Energy Management Guide for  
Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (2015) Standard for the Installation of  
Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF/ANSI 14 (2011a) Plastics Piping System Components  
and Related Materials  
NSF/ANSI 61 (2010a) Drinking Water System Components -  
Health Effects

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA Fire Man (2010) Firestopping: Plastic Pipe in Fire  
Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201 (2010) Water Hammer Arresters Standard

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1508 (2009) Hose Clamp Specifications

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SM 9223 (2004) Enzyme Substrate Coliform Test  
PL 93-523 (1974; A 1999) Safe Drinking Water Act

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

40 CFR 141.80 National Primary Drinking Water  
Regulations; Control of Lead and Copper;  
General Requirements  
PL 109-58 Energy Policy Act of 2005 (EPAct05)

1.2 SUBMITTALS

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

SD-02 Shop Drawings

Plumbing System;

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. 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

Wall hung lavatories

Undermount lavatories

Kitchen sinks

Service sinks

Drinking-water coolers

Shower pan

Water heaters

Backflow prevention assemblies;

A copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

##### Vibration-Absorbing Features;

Details of vibration-absorbing features, including arrangement, foundation plan, dimensions and specifications.

#### 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;.

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;.

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

#### 1.6 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with ICC IPC. Energy consuming products and systems shall be in accordance with PL 109-58 and ASHRAE 90.1 - IP

#### 1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

#### 1.8 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel

in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work.

Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the equipment or system.

When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

#### 1.9 ACCESSIBILITY OF EQUIPMENT

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

### PART 2 PRODUCTS

#### 2.1 Materials

Materials for various services shall be in accordance with TABLES I and II. PVC pipe shall contain a minimum of 25 percent recycled content in accordance with ASTM F 1760. HDPE pipe shall contain a minimum of 100 percent post-consumer recycled content. Steel pipe shall contain a minimum of 30 percent recycled content, with a minimum of 16 percent post-consumer recycled content. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF/ANSI 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Polypropylene pipe and fittings shall conform to dimensional requirements of Schedule 40, Iron Pipe size and shall comply with NSF/ANSI 14, NSF/ANSI 61 and ASTM F 2389. Polypropylene piping that will be exposed to UV light shall be provided with a Factory applied UV resistant coating. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. 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/ANSI 61, Section 8. End point devices such as drinking water fountains, lavatory faucets, kitchen and bar faucets, residential ice makers, supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF/ANSI 61, Section 9. Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors. Cast-iron pipe shall contain a minimum of 100 percent recycled content. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

## 2.1.1.1 Pipe Joint Materials

Grooved pipe and hubless cast-iron soil pipe shall not be used under ground. Solder containing lead shall not be used with copper pipe. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Institute. Joints and gasket materials shall conform to the following:

- a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A74, AWWA C606. For hubless type: CISPI 310
- b. Coupling for Steel Pipe: AWWA C606.
- c. Couplings for Grooved Pipe: Ductile Iron ASTM A536 (Grade 65-45-12).
- d. 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.
- e. Brazing Material: Brazing material shall conform to AWS A5.8/A5.8M, BCuP-5.
- f. 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.
- g. Solder Material: Solder metal shall conform to ASTM B32.
- h. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B813, Standard Test 1.
- i. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe.
- j. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C564.
- k. Rubber Gaskets for Grooved Pipe: ASTM D 2000, maximum temperature 230 degrees F.
- l. Flexible Elastomeric Seals: ASTM D 3139, ASTM D 3212 or ASTM F 477.
- m. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A183.
- n. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D 3138.
- o. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D 2235.
- p. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D 2564 and ASTM D 2855.

- q. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F 493.
- r. 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 A105/A105M. Blind flange material shall conform to ASTM A516/A516M cold service and ASTM A515/A515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A193/A193M.
- s. Plastic Solvent Cement for Styrene Rubber Plastic Pipe: ASTM D 3122.
- t. Press fittings for Copper Pipe and Tube: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for copper press fittings shall be EPDM, FKM or HNBR. Sealing elements shall be factory installed or an alternative supplied fitting manufacturer. Sealing element shall be selected based on manufacturer's approved application guidelines.
- u. Copper tubing shall conform to ASTM B88, Type K, L or M.
- v. Heat-fusion joints for polypropylene piping: ASTM F 2389.

#### 2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

- a. Water Hammer Arrestor: PDI WH 201. Water hammer arrester shall be piston type.
- b. Copper, Sheet and Strip for Building Construction: ASTM B370.
- c. Asphalt Roof Cement: ASTM D2822/D2822M.
- d. Hose Clamps: SAE J1508.
- e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.
- f. Metallic Cleanouts: ASME A112.36.2M.
- g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.
- h. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.
- i. Hypochlorites: AWWA B300.
- j. Liquid Chlorine: AWWA B301.
- k. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.
- 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. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

| Description   | Standard            |
|---|---------------------|
| Butterfly Valves  | MSS SP-67           |
| Cast-Iron Gate Valves, Flanged and Threaded Ends                            | MSS SP-70           |
| Cast-Iron Swing Check Valves, Flanged and Threaded Ends                     | MSS SP-71           |
| Ball Valves with Flanged Butt-Welding Ends for General Service              | MSS SP-72           |
| Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends | MSS SP-110          |
| Cast-Iron Plug Valves, Flanged and Threaded Ends                            | MSS SP-78           |
| Bronze Gate, Globe, Angle, and Check Valves                                 | MSS SP-80           |
| Steel Valves, Socket Welding and Threaded Ends                              | ASME B16.34         |
| Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends                 | MSS SP-85           |
| Backwater Valves  | ASME A112.14.1      |
| Vacuum Relief Valves  | ANSI Z21.22/CSA 4.4 |

|                         |           |
|-------------------------|-----------|
|                         |           |
|                         |           |
| Trap Seal Primer Valves | ASSE 1018 |
|                         |           |
|                         |           |

#### 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 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 3/4 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection. Faucet handle shall be securely attached to stem.

#### 2.3.3 Wall Hydrants (Frostproof)

ASSE 1019 with vacuum-breaker backflow preventer shall have a nickel-brass or nickel-bronze wall plate or flange with nozzle and detachable key handle. A brass or bronze operating rod shall be provided within a galvanized iron casing of sufficient length to extend through the wall so that the valve is inside the building, and the portion of the hydrant between the outlet and valve is self-draining. A brass or bronze valve with coupling and union elbow having metal-to-metal seat shall be provided. Valve rod and seat washer shall be removable through the face of the hydrant. The hydrant shall have 3/4 inch exposed hose thread on spout and 3/4 inch male pipe thread on inlet.

#### 2.3.4 Washer Box

Washer box shall be high impact polystyrene with support brackets, drain knockouts, 1/4 turn brass ball valves for hot and cold water, and a faceplate. Each washer box shall be provided with a washing machine discharge filter mounted on wall.

## 2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with ICC IPC. Fixtures for use by the physically handicapped shall be in accordance with ICC/ANSI 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 shall be copper alloy with all visible surfaces chrome plated. Plastic in contact with hot water shall be suitable for 180 degrees F water temperature.

### 2.4.1 Flush Valve Water Closets

ASME A112.19.2/CSA B45.1, white vitreous china, ASME A112.19.3/CSA B45.4 siphon jet, elongated bowl, floor-mounted, floor outlet. Top of toilet seat height above floor shall be 15 inches, except 17 inches for wheelchair water closets. Provide wax bowl ring including plastic sleeve. Provide white solid plastic elongated open-front seat.

Water flushing volume of the water closet and flush valve combination shall not exceed 1.28 gallons per flush.

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.

### 2.4.2 Wall Hung Lavatories

ASME A112.19.2/CSA B45.1, 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 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. Mount lavatory with the front rim 34 inches above floor and with 29 inches minimum clearance from bottom of the front rim to floor. Provide top mounted washerless centerset lavatory faucets.

### 2.4.3 Undermount Lavatories

Solid surface counter with undermount lavatory bowl. Bowl minimum dimensions of 19 inches wide by 17 inches front to rear, with supply openings for use with top mounted centerset faucets. 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.

#### 2.4.4 Kitchen Sinks

ASME A112.19.3/CSA B45.4, 20 gage stainless steel with integral mounting rim for flush installation, minimum dimensions of 33 inches wide by 21 inches front to rear, two compartments, with undersides fully sound deadened, with supply openings for use with top mounted washerless sink faucets with hose spray, and with 3.5 inch drain outlet. Water flow rate shall not exceed 2.2 gpm when measured at a flowing water pressure of 60 psi. Provide stainless steel drain outlets and stainless steel cup strainers. Provide separate 1.5 inch P-trap and drain piping to vertical vent piping from each compartment.

#### 2.4.5 Service Sinks

Single or Twin tub molded stone complete with white baked enamel legs and leveling feet. Provide deck mounted faucet. See drawings for bowl configurations

#### 2.4.6 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.

#### 2.4.7 Wheelchair Drinking Water cooler

AHRI 1010, bi-level wall-mounted bubbler style with ASME A112.6.1M concealed chair carrier, air-cooled condensing unit, 4.75 gph minimum capacity, stainless steel splash receptor, and all stainless steel cabinet, with 27 inch minimum knee clearance from front bottom of unit to floor and 32 inch spout height above floor for the low side and 38 inch maximum spout height on for the high side. 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. Provide bottle filler on high side of water cooler.

#### 2.4.8 Shower Pan

Reinforced solid surface single threshold shower floor with integrated drain. Pan shall be 34"x54" with pebbled, slip-resistant surface. Shower pan shall meet ANSI Z124.1.2-2005

### 2.5 BACKFLOW PREVENTERS

Backflow prevention devices must be approved by the State or local regulatory agencies. If there is no State or local regulatory agency requirements, the backflow prevention devices must be listed by the Foundation for Cross-Connection Control & Hydraulic Research, or any other approved testing laboratory having equivalent capabilities for both



laboratory and field evaluation of backflow prevention devices and assemblies.

The main building backflow preventer shall be a reduced pressure zone assembly conforming to ASSE 1013, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be meet the above requirements.

Backflow preventers with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure zone 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 C564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.6.3. Provide drain with trap primer connection, trap primer, and connection piping. Primer shall meet ASSE 1018.

### 2.6.2 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.

### 2.6.3 Boiler Room Drains

Boiler room drains shall have combined drain and trap, hinged grate, removable bucket, and threaded brass cleanout with brass backwater valve. The removable galvanized cast-iron sediment bucket shall have rounded corners to eliminate fouling and shall be equipped with hand grips. Drain shall have a minimum water seal of 4 inches. The grate area shall be not less than 100 square inches.

## 2.7 TRAPS

Unless otherwise specified, traps shall be copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout.

Tubes shall be copper alloy with walls not less than 0.032 inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

## 2.8 ELECTRICAL WORK

Provide electrical motor driven equipment specified complete with motors, motor starters, and controls as specified herein and in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, corresponding to the applications in accordance with NEMA MG 11. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor.

Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of the enclosure.

Controllers and contactors shall have auxiliary contacts for use with the controls provided. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers, including the required monitors and timed restart.

Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

## 2.9 MISCELLANEOUS PIPING ITEMS

### 2.9.1 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.

### 2.9.2 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Sleeves are not required where supply drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade, except where penetrating a membrane waterproof floor.

#### 2.9.2.1 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.

#### 2.9.2.2 Sleeves Not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

### 2.9.3 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.

### 2.9.4 Nameplates

Provide 0.125 inch thick melamine laminated plastic nameplates, black matte finish with white center core, for equipment, gages, thermometers, and valves; valves in supplies to faucets will not require nameplates. Accurately align lettering and engrave minimum of 0.25 inch high normal block lettering into the white core. Minimum size of nameplates shall be 1.0 by 2.5 inches. Key nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and schedule.

### 2.10 Water Heaters

Low pressure steam water heater, for use on 15 psig steam consisting of an integrally piped heat exchanger, mounted on a heavy-duty angle iron frame heater control package capable of supplying 72 GPM of hot water when heated from 40 deg. F to 140 deg. F without the use of thermostatic control devices or storage tanks. Heaters shall be capable of maintaining the +/- 3 deg. F over a flow range of a few percent to 100%. The water shall flow through the tubes and steam in the shell. Heater shall be supplied with main and drip trap, main and drip strainer, dial thermometer, and steam pressure gauge. The unit shall include connections in the manifolds to measure pressures and temperatures.

Steam fired water heater shall be factory piped with main and drip steam traps, main and drip strainers, dial thermometer, and steam pressure gauge. Heater and components shall be mounted on angle iron frame and shall be shipped complete from factory so owner need only connect steam,

condensate outlet, cold water inlet and hot water outlet pipes to the package.

Complete package to be pressure tested for leaks.

### PART 3 EXECUTION

#### 3.1 GENERAL INSTALLATION REQUIREMENTS

All Piping mains shall be run in the appropriate chase or plenums when required. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA Fire Man. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. A full port ball valve and drain shall be installed on the water service line inside the building approximately 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 12 inches below the average local frost depth 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 full port 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. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

#### 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 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

##### 3.1.2.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

##### 3.1.2.2 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.

##### 3.1.2.3 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

##### 3.1.2.4 Copper Tube and Pipe

- a. Brazed. Brazed joints shall be made in conformance with AWS B2.2/B2.2M, ASME B16.50, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.
- b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA A4015. Soldered joints shall not be used in compressed air piping between the air compressor and the receiver.

- c. Copper Tube Extracted Joint. Mechanically extracted joints shall be made in accordance with ICC IPC.
- d. Press connection. Copper press connections shall be made in **strict** accordance with the manufacturer's installation instructions for manufactured rated size. The joints shall be pressed using the tool(s) approved by the manufacturer **of that joint**. Minimum distance between fittings shall be in accordance with the manufacturer's requirements.

#### 3.1.2.5 Plastic Pipe

Acrylonitrile-Butadiene-Styrene (ABS) pipe shall have joints made with solvent cement. PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

#### 3.1.2.6 Other Joint Methods

#### 3.1.3 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

#### 3.1.4 Corrosion Protection for Buried Pipe and Fittings

Ductile iron, cast iron, and steel pipe, fittings, and joints shall have a protective coating. Additionally, ductile iron, cast iron, and steel pressure pipe shall have a cathodic protection system and joint bonding.

Coatings shall be selected, applied, and inspected in accordance with NACE SP0169 and as otherwise specified. The pipe shall be cleaned and the coating system applied prior to pipe tightness testing. Joints and fittings shall be cleaned and the coating system applied after pipe tightness testing. For tape coating systems, the tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer utilized with tape type coating systems shall be as recommended by the tape manufacturer.

#### 3.1.5 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

##### 3.1.5.1 Sleeve Requirements

Unless indicated otherwise, provide pipe sleeves meeting the following requirements:

Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors.

A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved.

Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor.

Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic.

Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C920 and with a primer, backstop material and surface preparation as specified in Section 07 92 00 JOINT SEALANTS. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated.

Sleeves through below-grade walls in contact with earth shall be recessed 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and 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 than 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.
- l. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.
- m. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.
- n. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

#### 3.1.7.3 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

#### 3.1.8 Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced

against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

### 3.1.9 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 18 inches of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron or plastic.

### 3.2 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.

#### 3.2.1 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.

### 3.2.2 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.

### 3.2.3 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 31 inches above finished floor. Wall-hung drinking fountains and water coolers shall be installed with rim 42 inches above floor. Wall-hung service sinks shall be mounted with rim 28 inches above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with ICC/ANSI A117.1.

### 3.2.4 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.

### 3.2.5 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.

#### 3.2.5.1 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.

#### 3.2.5.2 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.

#### 3.2.5.3 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.

#### 3.2.5.4 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.

#### 3.2.5.5 Wall-Mounted Water Closet Gaskets

Where wall-mounted water closets are provided, reinforced wax, treated felt, or neoprene gaskets shall be provided. The type of gasket furnished shall be as recommended by the chair-carrier manufacturer.

#### 3.2.6 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.

#### 3.2.7 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 2 inches above the flood rim of the funnel to provide an acceptable air gap.

#### 3.2.8 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D 3311. Traps for acid-resisting waste shall be of the same material as the pipe.

#### 3.2.9 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.

##### 3.2.9.1 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.

#### 3.2.9.2 Metal Shower Pans

When a shower pan of required size cannot be furnished in one piece, metal pieces shall be joined with a flintlock seam and soldered or burned. The corners shall be folded, not cut, and the corner seam shall be soldered or burned. Pans, including upstands, shall be coated on all surfaces with one brush coat of asphalt. Asphalt shall be applied evenly at not less than 1 gallon per 50 square feet. A layer of felt covered with building paper shall be placed between shower pans and wood floors. The joining surfaces of metal pan and drain shall be given a brush coat of asphalt after the pan is connected to the drain.

#### 3.2.9.3 Nonplasticized Chlorinated Polyethylene Shower Pans

Corners of nonplasticized chlorinated polyethylene shower pans shall be folded against the upstand by making a pig-ear fold. Hot-air gun or heat lamp shall be used in making corner folds. Each pig-ear corner fold shall be nailed or stapled 1/2 inch from the upper edge to hold it in place. Nails shall be galvanized large-head roofing nails. On metal framing or studs, approved duct tape shall be used to secure pig-ear fold and membrane. Where no backing is provided between the studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding 1/2 inch from upper edge. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it will be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane shall be pressed into place. Surfaces to be solvent-welded shall be clean. Surfaces to be joined with xylene shall be initially sprayed and vigorously cleaned with a cotton cloth, followed by final coating of xylene and the joining of the surfaces by roller or equivalent means. If ambient or membrane temperatures are below 40 degrees F the membrane and the joint shall be heated prior to application of xylene. Heat may be applied with hot-air gun or heat lamp, taking precautions not to scorch the membrane. Adequate ventilation and wearing of gloves are required when working with xylene. Membrane shall be pressed into position on the drain body, and shall be cut and fit to match so that membrane can be properly clamped and an effective gasket-type seal provided. On wood subflooring, two layers of 15 pound dry felt shall be installed prior to installation of shower pan to ensure a smooth surface for installation.

#### 3.2.9.4 Nonplasticized Polyvinyl Chloride (PVC) Shower Pans

Nonplasticized PVC shall be turned up behind walls or wall surfaces a distance of not less than 6 inches in room areas and 3 inches above curb level in curbed spaces with sufficient material to fold over and fasten to outside face of curb. Corners shall be pig-ear type and folded between pan and studs. Only top 1 inch of upstand shall be nailed to hold in place. Nails shall be galvanized large-head roofing type. Approved duct tape shall be used on metal framing or studs to secure pig-ear fold and membrane. Where no backing is provided between studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding at top inch of upstand. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it is to be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane shall be pressed into place. Trim for drain shall be exactly the size of drain opening. Bolt holes shall be pierced to accommodate

bolts with a tight fit. Adhesive shall be used between pan and subdrain. Clamping ring shall be bolted firmly. A small amount of gravel or porous materials shall be placed at weepholes so that holes remain clear when setting bed is poured. Membrane shall be solvent welded with PVC solvent cement. Surfaces to be solvent welded shall be clean (free of grease and grime). Sheets shall be laid on a flat surface with an overlap of about 2 inches. Top edge shall be folded back and surface primed with a PVC primer. PVC cement shall be applied and surfaces immediately placed together, while still wet. Joint shall be lightly rolled with a paint roller, then as the joint sets shall be rolled firmly but not so hard as to distort the material. In long lengths, about 2 or 3 feet at a time shall be welded. On wood subflooring, two layers of 15 pound felt shall be installed prior to installation of shower pan to ensure a smooth surface installation.

### 3.3 VIBRATION-ABSORBING FEATURES

Mechanical equipment, shall be isolated from the building structure by approved vibration-absorbing features, unless otherwise shown. Each foundation shall include an adequate number of standard isolation units. Each unit shall consist of machine and floor or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed load rating. Piping connected to mechanical equipment shall be provided with flexible connectors.

### 3.4 IDENTIFICATION SYSTEMS

#### 3.4.1 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.

#### 3.4.2 Pipe Color Code Marking

Color code marking of piping shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

#### 3.4.3 Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 3/8 inch in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 3 foot width, 30 inches height, and 1/2 inch



thickness. The board shall be made of wood fiberboard and framed under glass or 1/16 inch transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 3/4 inch in diameter and the related lettering in 1/2 inch high capital letters.

### 3.5 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.

### 3.6 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.

#### 3.6.1 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.

##### 3.6.1.1 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 B117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system shall be designed for the temperature service.

##### 3.6.1.2 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.

### 3.7 TESTS, FLUSHING AND DISINFECTION

#### 3.7.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with ICC, 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.

##### 3.7.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies.

Backflow prevention assembly test gauges shall be tested annually for accuracy in accordance with the requirements of State or local regulatory agencies. If there is no State or local regulatory agency requirements, gauges shall be tested annually for accuracy in accordance with the requirements of University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14), or any other approved testing laboratory having equivalent capabilities for both laboratory and field evaluation of backflow prevention assembly test gauges. Report form for each assembly shall include, as a minimum, the following:

|                  |                      |
|------------------|----------------------|
| Data on Device   | Data on Testing Firm |
| Type of Assembly | Name                 |
| Manufacturer     | Address              |

|                        |                                       |
|------------------------|---------------------------------------|
| Model Number           | Certified Tester                      |
| Serial Number          | Certified Tester No.                  |
| Size                   | Date of Test                          |
| Location               |                                       |
| Test Pressure Readings | Serial Number and Test Data of Gauges |

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

### 3.7.1.2 Shower Pans

After installation of the pan and finished floor, the drain shall be temporarily plugged below the weep holes. The floor area shall be flooded with water to a minimum depth of 1 inch for a period of 24 hours. Any drop in the water level during test, except for evaporation, will be reason for rejection, repair, and retest.

### 3.7.2 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.

### 3.7.3 System Flushing

#### 3.7.3.1 During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 4 fps through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. All faucets and drinking water fountains, to include any device considered as an end point device by NSF/ANSI 61, Section 9, shall be flushed a minimum of 0.25 gallons per 24 hour period, ten times over a 14 day period.

#### 3.7.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to

properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation according to manufacturer's instructions. Comply with ASHRAE 90.1 - IP for minimum efficiency requirements. Unless more stringent local requirements exist, lead levels shall not exceed limits established by 40 CFR 141.80 (c)(1). The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

#### 3.7.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory installation, connections, adjustments, and functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

- a. Time, date, and duration of test.
- b. Water pressures at the most remote and the highest fixtures.
- c. Operation of each fixture and fixture trim.
- d. Operation of each valve, hydrant, and faucet.
- e. Operation of each water meter.
- f. Operation of each backflow preventer.
- g. Operation of each floor and roof drain by flooding with water.
- h. Operation of each vacuum breaker and backflow preventer.

#### 3.7.5 Disinfection

After all system components are provided and operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. Before introducing disinfecting chlorination material, entire system shall be flushed with potable water until any entrained dirt and other foreign materials have been removed.

Water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652 as modified and supplemented by this specification. The chlorinating material shall be hypochlorites or liquid chlorine. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). Feed a properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or inject liquid chlorine into the system through a solution-feed chlorinator .

Test the chlorine residual level in the water at 6 hour intervals for a

continuous period of 24 hours. If at the end of a 6 hour interval, the chlorine residual has dropped to less than 25 ppm, flush the piping including tanks with potable water, and repeat the above chlorination procedures. During the chlorination period, each valve and faucet shall be opened and closed several times.

After the second 24 hour period, verify that no less than 25 ppm chlorine residual remains in the treated system. The 24 hour chlorination procedure must be repeated until no less than 25 ppm chlorine residual remains in the treated system.

Upon the specified verification, the system including tanks shall then be flushed with potable water until the residual chlorine level is reduced to less than one part per million. During the flushing period, each valve and faucet shall be opened and closed several times.

Take addition samples of water in disinfected containers, for bacterial examination, at locations specified by the Contracting Officer. Test these samples for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with EPA SM 9223. The testing method used shall be EPA approved for drinking water systems and shall comply with applicable local and state requirements.

Disinfection shall be repeated until bacterial tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

### 3.8 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.

### 3.9 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.

## 3.10 TABLES

| TABLE I   |  |              |              |              |              |              |              |
|---|--|--------------|--------------|--------------|--------------|--------------|--------------|
| PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, AND VENT PIPING SYSTEMS |  |              |              |              |              |              |              |
| Item #  | Pipe and Fitting Materials   | SERVICE<br>A | SERVICE<br>B | SERVICE<br>C | SERVICE<br>D | SERVICE<br>E | SERVICE<br>F |
| 1   | Cast iron soil pipe and fittings, hub and spigot, ASTM A74 with compression gaskets. Pipe and fittings shall be marked with the CISPI trademark. | X            | X            | X            | X            | X            |              |
| 2   | Cast iron soil pipe and fittings hubless, CISPI 301 and ASTM A888. Pipe and fittings shall be marked with the CISPI trademark.                   |              | X            | X            | X            | X            |              |
| 3   | Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10  | X            |              | X            | X            |              |              |
| 4   | Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10  |              |              |              | X            | X            |              |
| 5   | Grooved pipe couplings, ferrous and non-ferrous pipe ASTM A536 And ASTM A47/A47M   | X            | X            |              | X            | X            |              |
| 6   | Ductile iron grooved joint fittings for ferrous pipe ASTM A536 and ASTM A47/A47M for use with Item 5   | X            | X            |              | X            | X            |              |

| TABLE I   |  |           |           |           |           |           |           |
|---|--|-----------|-----------|-----------|-----------|-----------|-----------|
| PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, AND VENT PIPING SYSTEMS |  |           |           |           |           |           |           |
| Item #  | Pipe and Fitting Materials   | SERVICE A | SERVICE B | SERVICE C | SERVICE D | SERVICE E | SERVICE F |
| 7   | Bronze sand casting grooved joint pressure fittings for non-ferrous pipe ASTM B584, for use with Item 5  | X         | X         |           | X         | X         |           |
| 8   | Wrought copper grooved joint pressure pressure fittings for non-ferrous pipe ASTM B75 C12200, ASTM B152/B152M, C11000, ASME B16.22 ASME B16.22 for use with Item 5 | X         | X         |           |           |           |           |
| 9   | Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 10   |           |           |           | X         | X         |           |
| 10  | Steel pipe, seamless galvanized, ASTM A53/A53M Type S, Grade B   | X         |           |           | X         | X         |           |
| 11  | Seamless red brass pipe, ASTM B43  |           |           |           | X         | X         |           |
| 12  | Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14   |           |           |           | X         | X         |           |
| 13  | Cast copper alloy solder joint pressure fittings, ASME B16.18 for use with Item 14   |           |           |           | X         | X         |           |
| 14  | Seamless copper pipe, ASTM B42   |           |           |           |           |           | X         |
| 15  | Cast bronze threaded fittings, ASME B16.15   |           |           |           | X         | X         |           |

| TABLE I   |   |           |           |           |           |           |           |
|---|---|-----------|-----------|-----------|-----------|-----------|-----------|
| PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, AND VENT PIPING SYSTEMS |   |           |           |           |           |           |           |
| Item #  | Pipe and Fitting Materials  | SERVICE A | SERVICE B | SERVICE C | SERVICE D | SERVICE E | SERVICE F |
| 16  | Copper drainage tube, (DWV), ASTM B306  | X*        | X         | X*        | X         | X         |           |
| 17  | Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29                                      | X         | X         | X         | X         | X         |           |
| 18  | Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23  | X         | X         | X         | X         | X         |           |
| 19  | Acrylonitrile-Butadiene-S (ABS) plastic drain, waste, and vent pipe and fittings ASTM D 2661, ASTM F 628          | X         | X         | X         | X         | X         | X         |
| 20  | Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D 2665, ASTM F 891, (Sch 40) ASTM F 1760 | X         | X         | X         | X         | X         | X         |
| 21  | Process glass pipe and fittings, ASTM C1053   |           |           |           |           |           | X         |
| 22  | High-silicon content cast iron pipe and fittings (hub and spigot, and mechanical joint), ASTM A518/A518M          |           | X         |           |           | X         | X         |
| 23  | Polypropylene (PP) waste pipe and fittings, ASTM D 4101   |           |           |           |           |           | X         |
| 24  | Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D 2996  |           |           |           |           |           | X         |



| TABLE I   |                  |          |          |          |          |          |          |
|---|------------------|----------|----------|----------|----------|----------|----------|
| PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, AND VENT PIPING SYSTEMS   |                  |          |          |          |          |          |          |
| Item  | Pipe and Fitting | SERVIC   | SERVIC   | SERVICE  | SERVICE  | SERVICE  | SERVICE  |
| #   | Materials        | <u>A</u> | <u>B</u> | <u>C</u> | <u>D</u> | <u>E</u> | <u>F</u> |
| SERVICE:<br>A - Underground Building Soil, Waste and Storm Drain<br>B - Aboveground Soil, Waste, Drain In Buildings<br>C - Underground Vent<br>D - Aboveground Vent<br>E - Interior Rainwater Conductors Aboveground<br>F - Corrosive Waste And Vent Above And Belowground<br>* - Hard Temper |                  |          |          |          |          |          |          |

-- End of Section --

## SECTION 23 00 00

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS  
08/10

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

|          |   |
|----------|---|
| AMCA 201 | (2002) Fans and Systems   |
| AMCA 210 | (2007) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating                      |
| AMCA 300 | (2008) Reverberant Room Method for Sound Testing of Fans  |
| AMCA 301 | (2006; INT 2007; Errata 2008) Methods for Calculating Fan Sound Ratings from Laboratory Test Data |

## AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

|                  |   |
|------------------|---|
| AHRI 350         | (2008) Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment       |
| AHRI 430         | (2009) Central-Station Air-Handling Units                                 |
| AHRI 440         | (2008) Room Fan-Coils and Unit Ventilators                                |
| AHRI Guideline D | (1996) Application and Installation of Central Station Air-Handling Units |

## AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

|         |  |
|---------|--|
| ABMA 11 | (1990) Load Ratings and Fatigue Life for Roller Bearings       |
| ABMA 9  | (1990; R 2008) Load Ratings and Fatigue Life for Ball Bearings |

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

|             |   |
|-------------|---|
| ASHRAE 62.1 | (2010; Errata 2011) Ventilation for Acceptable Indoor Air Quality                     |
| ASHRAE 70   | (2006; R 2011) Method of Testing for Rating the Performance of Air Outlets and Inlets |

## ASTM INTERNATIONAL (ASTM)

|                 |  |
|-----------------|--|
| ASTM A123/A123M | (2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products                            |
| ASTM A167       | (2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip               |
| ASTM A53/A53M   | (2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless                      |
| ASTM A924/A924M | (2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process            |
| ASTM B117       | (2011) Standard Practice for Operating Salt Spray (Fog) Apparatus  |
| ASTM B152/B152M | (2009) Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar   |
| ASTM B209       | (2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate  |
| ASTM B766       | (1986; R 2008) Standard Specification for Electrodeposited Coatings of Cadmium   |
| ASTM C1071      | (2005e1) Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)            |
| ASTM C553       | (2011) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications      |
| ASTM D 1654     | (2008) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments                                       |
| ASTM D 3359     | (2009e2) Measuring Adhesion by Tape Test   |
| ASTM D 520      | (2000; R 2011) Zinc Dust Pigment   |
| ASTM E 2016     | (2006) Standard Specification for Industrial Woven Wire Cloth  |
| ASTM F 1040     | (1987; R 2007) Standard Specification for Filter Units, Air Conditioning, Viscous - Impingement and Dry Types, Replaceable |

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

|            |  |
|------------|--|
| NEMA MG 1  | (2009) Motors and Generators               |
| NEMA MG 10 | (2001; R 2007) Energy Management Guide for |

Selection and Use of Fixed Frequency  
Medium AC Squirrel-Cage Polyphase  
Induction Motors

NEMA MG 11 (1977; R 2007) Energy Management Guide for  
Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701 (2010) Standard Methods of Fire Tests for  
Flame Propagation of Textiles and Films

NFPA 90A (2015) Standard for the Installation of  
Air Conditioning and Ventilating Systems

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

SMACNA 1819 (2002) Fire, Smoke and Radiation Damper  
Installation Guide for HVAC Systems, 5th  
Edition

SMACNA 1966 (2005) HVAC Duct Construction Standards  
Metal and Flexible, 3rd Edition

SMACNA 1981 (2008) Seismic Restraint Manual Guidelines  
for Mechanical Systems, 3rd Edition

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

40 CFR 82 Protection of Stratospheric Ozone

UNDERWRITERS LABORATORIES (UL)

UL 181 (2005; Reprint Oct 2008) Factory-Made Air  
Ducts and Air Connectors

UL 1995 (2005; Reprint Jul 2009) Heating and  
Cooling Equipment

UL 555 (2006; Reprint May 2011) Standard for Fire  
Dampers

UL 6 (2007; Reprint Nov 2014) Electrical Rigid  
Metal Conduit-Steel

UL 705 (2004; Reprint Apr 2011) Standard for  
Power Ventilators

UL Bld Mat Dir (2011) Building Materials Directory

UL Electrical Constructn (2012) Electrical Construction Equipment  
Directory

UL Fire Resistance (2014) Fire Resistance Directory

## 1.2 SYSTEM DESCRIPTION

Furnish ductwork, piping offsets, fittings, and accessories as required to

provide a complete installation. Coordinate the work of the different trades to avoid interference between piping, equipment, structural, and electrical work. Provide complete, in place, all necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work as indicated and specified.

### 1.3 SUBMITTALS

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

#### SD-03 Product Data

Metallic Flexible Duct  
Insulated Nonmetallic Flexible Duct Runouts  
Duct Connectors  
Duct Access Doors  
Fire Dampers  
Manual Balancing Dampers  
Diffusers  
Registers and Grilles  
Louvers  
Air Vents, Penthouses, and Goosenecks

In-Line Centrifugal Fans

Air Handling Units  
Room Fan-Coil Units

Energy Recovery Devices  
Test Procedures

#### SD-08 Manufacturer's Instructions

Manufacturer's Installation Instructions

#### SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

Air Handling Units  
Room Fan-Coil Units

Energy Recovery Devices

### 1.4 QUALITY ASSURANCE

Except as otherwise specified, approval of materials and equipment is based on manufacturer's published data.

- a. Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories, the label of or listing with reexamination in UL Bld Mat Dir, and UL 6 is acceptable as sufficient

evidence that the items conform to Underwriters Laboratories requirements. In lieu of such label or listing, submit a written certificate from any nationally recognized testing agency, adequately equipped and competent to perform such services, stating that the items have been tested and that the units conform to the specified requirements. Outline methods of testing used by the specified agencies.

- b. Where materials or equipment are specified to be constructed or tested, or both, in accordance with the standards of the ASTM International (ASTM), the ASME International (ASME), or other standards, a manufacturer's certificate of compliance of each item is acceptable as proof of compliance.
- c. Conformance to such agency requirements does not relieve the item from compliance with other requirements of these specifications.

#### 1.4.1 Prevention of Corrosion

Protect metallic materials against corrosion. Manufacturer shall provide rust-inhibiting treatment and standard finish for the equipment enclosures. Do not use aluminum in contact with earth, and where connected to dissimilar metal. Protect aluminum by approved fittings, barrier material, or treatment. Ferrous parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A123/A123M for exterior locations and cadmium-plated in conformance with ASTM B766 for interior locations.

#### 1.4.2 Asbestos Prohibition

Do not use asbestos and asbestos-containing products.

#### 1.4.3 Ozone Depleting Substances Used as Refrigerants

Minimize releases of Ozone Depleting Substances (ODS) during repair, maintenance, servicing or disposal of appliances containing ODS's by complying with all applicable sections of 40 CFR 82 Part 82 Subpart F. Any person conducting repair, maintenance, servicing or disposal of appliances owned by government shall comply with the following:

- a. Do not knowingly vent or otherwise release into the environment, Class I or Class II substances used as a refrigerant.
- b. Do not open appliances without meeting the requirements of 40 CFR 82 Part 82.156 Subpart F, regarding required practices for evacuation and collection of refrigerant, and 40 CFR 82 Part 82.158 Subpart F, regarding standards of recycling and recovery equipment.
- c. Only persons who comply with 40 CFR 82 Part 82.161 Subpart F, regarding technician certification, can conduct work on appliances containing refrigerant.

In addition, provide copies of all applicable certifications to the Contracting Officer at least 14 calendar days prior to initiating maintenance, repair, servicing, dismantling or disposal of appliances, including:

- a. Proof of Technician Certification
- b. Proof of Equipment Certification for recovery or recycling equipment.
- c. Proof of availability of certified recovery or recycling equipment.

#### 1.4.4 Use of Ozone Depleting Substances, Other than Refrigerants

The use of Class I or Class II ODS's listed as nonessential in 40 CFR 82 Part 82.66 Subpart C is prohibited. These prohibited materials and uses include:

- a. Any plastic party spray streamer or noise horn which is propelled by a chlorofluorocarbon
- b. Any cleaning fluid for electronic and photographic equipment which contains a chlorofluorocarbon; including liquid packaging, solvent wipes, solvent sprays, and gas sprays.
- c. Any plastic flexible or packaging foam product which is manufactured with or contains a chlorofluorocarbon, including, open cell foam, open cell rigid polyurethane poured foam, closed cell extruded polystyrene sheet foam, closed cell polyethylene foam and closed cell polypropylene foam except for flexible or packaging foam used in coaxial cabling.
- d. Any aerosol product or other pressurized dispenser which contains a chlorofluorocarbon, except for those listed in 40 CFR 82 Part 82.66 Subpart C.

Request a waiver if a facility requirement dictates that a prohibited material is necessary to achieve project goals. Submit the waiver request in writing to the Contracting Officer. The waiver will be evaluated and dispositioned.

#### 1.4.5 Test Procedures

Submit proposed test procedures and test schedules for the performance tests of systems, at least 2 weeks prior to the start of related testing.

### 1.5 DELIVERY, STORAGE, AND HANDLING

Protect stored equipment at the jobsite from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, cap or plug all pipes until installed.

## PART 2 PRODUCTS

### 2.1 STANDARD PRODUCTS

Except for the fabricated duct, plenums and casings specified in paragraphs "Metal Ductwork" and "Plenums and Casings for Field-Fabricated Units", provide components and equipment that are standard products of manufacturers regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. This requirement applies to all equipment, including diffusers, registers, fire dampers, and balancing dampers.

- a. Standard products are defined as components and equipment that have been in satisfactory commercial or industrial use in similar applications of similar size for at least two years before bid opening.
- b. Prior to this two year period, these standard products shall have been sold on the commercial market using advertisements in manufacturers' catalogs or brochures. These manufacturers' catalogs, or brochures shall have been copyrighted documents or have been identified with a manufacturer's document number.
- c. Provide equipment items that are supported by a service organization. Where applicable, provide equipment that is an ENERGY STAR Qualified product or a Federal Energy Management Program (FEMP) designated product.

## 2.2 IDENTIFICATION PLATES

In addition to standard manufacturer's identification plates, provide engraved laminated phenolic identification plates for each piece of mechanical equipment. Identification plates are to designate the function of the equipment. Submit designation with the shop drawings. Identification plates shall be three layers, black-white-black, engraved to show white letters on black background. Letters shall be upper case. Identification plates 1-1/2-inches high and smaller shall be 1/16-inch thick, with engraved lettering 1/8-inch high; identification plates larger than 1-1/2-inches high shall be 1/8-inch thick, with engraved lettering of suitable height. Identification plates 1-1/2-inches high and larger shall have beveled edges. Install identification plates using a compatible adhesive.

## 2.3 EQUIPMENT GUARDS AND ACCESS

Fully enclose or guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact according to OSHA requirements. Properly guard or cover with insulation of a type specified, high temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard.

## 2.4 ELECTRICAL WORK

- a. Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide manual or automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown. For packaged equipment, include manufacturer provided controllers with the required monitors and timed restart.
- b. For single-phase motors, provide high-efficiency type, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11. Integral size motors shall be the premium efficiency type in accordance with NEMA MG 1.
- c. For polyphase motors, provide squirrel-cage medium induction motors, including motors that are part of a system, and that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1. Select premium efficiency polyphase motors in accordance



with NEMA MG 10.

- d. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor. Provide motors rated for continuous duty with the enclosure specified. Provide motor duty that allows for maximum frequency start-stop operation and minimum encountered interval between start and stop. Provide motor torque capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters complete with thermal overload protection and other necessary appurtenances. Fit motor bearings with grease supply fittings and grease relief to outside of the enclosure.

## 2.5 ANCHOR BOLTS

Provide anchor bolts for equipment placed on concrete equipment pads or on concrete slabs. Bolts to be of the size and number recommended by the equipment manufacturer and located by means of suitable templates. Installation of anchor bolts shall not degrade the surrounding concrete.

## 2.6 SEISMIC ANCHORAGE

Anchor equipment in accordance with applicable seismic criteria for the area and as defined in SMACNA 1981

## 2.7 PAINTING

Paint equipment units in accordance with approved equipment manufacturer's standards unless specified otherwise. Field retouch only if approved. Otherwise, return equipment to the factory for refinishing.

## 2.8 INDOOR AIR QUALITY

Provide equipment and components that comply with the requirements of ASHRAE 62.1 unless more stringent requirements are specified herein.

## 2.9 DUCT SYSTEMS

### 2.9.1 Metal Ductwork

Provide metal ductwork construction, including all fittings and components, that complies with SMACNA 1966, as supplemented and modified by this specification .

- a. Ductwork shall be constructed meeting the requirements for the duct system static pressure specified in APPENDIX D of Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.
- b. Provide radius type elbows with a centerline radius of 1.5 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes are allowed.

- d. Provide sealants that conform to fire hazard classification specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS and are suitable for the range of air distribution and ambient temperatures to which it is exposed. Do not use pressure sensitive tape as a sealant.
- e. Make spiral lock seam duct, and flat oval with duct sealant and lock with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA 1966. Apply the sealant to the exposed male part of the fitting collar so that the sealer is on the inside of the joint and fully protected by the metal of the duct fitting. Apply one brush coat of the sealant over the outside of the joint to at least 2 inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar are not acceptable. Fabricate outdoor air intake ducts and plenums with watertight soldered or brazed joints and seams.

#### 2.9.1.1 Metallic Flexible Duct

- a. Provide duct that conforms to UL 181 and NFPA 90A with factory-applied insulation, vapor barrier, and end connections. Provide duct assembly that does not exceed 25 for flame spread and 50 for smoke developed. Provide ducts designed for working pressures of two inches water gauge positive and 1.5 inches water gauge negative. Provide flexible round duct length that does not exceed five feet. Secure connections by applying adhesive for two inches over rigid duct, apply flexible duct two inches over rigid duct, apply metal clamp, and provide minimum of three No. 8 sheet metal screws through clamp and rigid duct.
- b. Inner duct core: Provide interlocking spiral or helically corrugated flexible core constructed of zinc-coated steel, aluminum, or stainless steel; or constructed of inner liner of continuous galvanized spring steel wire helix fused to continuous, fire-retardant, flexible vapor barrier film, inner duct core.
- c. Insulation: Provide inner duct core that is insulated with mineral fiber blanket type flexible insulation, minimum of one inch thick. Provide insulation covered on exterior with manufacturer's standard fire retardant vapor barrier jacket for flexible round duct.

#### 2.9.1.2 Insulated Nonmetallic Flexible Duct Runouts

Use flexible duct runouts only where indicated. Runout length is indicated on the drawings, and is not to exceed 5 feet. Provide runouts that are preinsulated, factory fabricated, and that comply with NFPA 90A and UL 181. Provide either field or factory applied vapor barrier. Provide not less than 20 ounce glass fabric duct connectors coated on both sides with neoprene. Where coil induction or high velocity units are supplied with vertical air inlets, use a streamlined, vaned and mitered elbow transition piece for connection to the flexible duct or hose. Provide a die-stamped elbow and not a flexible connector as the last elbow to these units other than the vertical air inlet type. Insulated flexible connectors are allowed as runouts. Provide insulated material and vapor barrier that conform to the requirements of Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Do not expose the insulation material surface to the air stream.

### 2.9.1.3 General Service Duct Connectors

Provide a flexible duct connector approximately 6 inches in width where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, secure the flexible material by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, install the flexible material locked to metal collars using normal duct construction methods. Provide a composite connector system that complies with NFPA 701 and is classified as "flame-retarded fabrics" in UL Bld Mat Dir.

### 2.9.1.4 Aluminum Ducts

ASTM B209, alloy 3003-H14 for aluminum sheet and alloy 6061-T6 or equivalent strength for aluminum connectors and bar stock.

### 2.9.1.5 Copper Sheets

ASTM B152/B152M, light cold rolled temper.

### 2.9.1.6 Corrosion Resisting (Stainless) Steel Sheets

ASTM A167

### 2.9.2 Duct Access Doors

Provide hinged access doors conforming to SMACNA 1966 in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system. Provide access doors upstream and downstream of air flow measuring primaries and heating and cooling coils. Provide doors that are a minimum 15 by 18 inches, unless otherwise shown. Where duct size does not accommodate this size door, make the doors as large as practicable. Equip doors 24 by 24 inches or larger with fasteners operable from inside and outside the duct. Use insulated type doors in insulated ducts.

### 2.9.3 Fire Dampers

Use 1.5 hour rated fire dampers unless otherwise indicated. Provide fire dampers that conform to the requirements of NFPA 90A and UL 555. Perform the fire damper test as outlined in NFPA 90A. Provide a pressure relief door upstream of the fire damper. If the ductwork connected to the fire damper is to be insulated then provide a factory installed pressure relief damper. Provide automatic operating fire dampers with a dynamic rating suitable for the maximum air velocity and pressure differential to which it is subjected. Provide fire dampers approved for the specific application, and install according to their listing. Equip fire dampers with a steel sleeve or adequately sized frame installed in such a manner that disruption of the attached ductwork, if any, does not impair the operation of the damper. Equip sleeves or frames with perimeter mounting angles attached on both sides of the wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce the ceiling of the assemblies in conformance with UL Fire Resistance. Provide curtain type with damper blades out of the air stream fire dampers. Install dampers that do not reduce the duct or the air transfer opening cross-sectional area. Install dampers so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness. Unless otherwise indicated, comply with the

installation details given in SMACNA 1819 and in manufacturer's instructions for fire dampers. Perform acceptance testing of fire dampers according to paragraph Fire Damper Acceptance Test and NFPA 90A.

#### 2.9.4 Manual Balancing Dampers

- a. Furnish manual balancing dampers with accessible operating mechanisms. Use chromium plated operators (with all exposed edges rounded) in finished portions of the building. Provide manual volume control dampers that are operated by locking-type quadrant operators.
- b. Unless otherwise indicated, provide opposed blade type multileaf dampers with maximum blade width of 12 inches. Provide access doors or panels for all concealed damper operators and locking setscrews. Provide access doors or panels in hard ceilings, partitions and walls for access to all concealed damper operators and damper locking setscrews. Coordinate location of doors or panels with other affected contractors.
- c. Provide stand-off mounting brackets, bases, or adapters not less than the thickness of the insulation when the locking-type quadrant operators for dampers are installed on ducts to be thermally insulated, to provide clearance between the duct surface and the operator. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

##### 2.9.4.1 Square or Rectangular Dampers

###### a. Duct Height 12 inches and Less

###### (1) Frames:

Maximum 19 inches in width, maximum 12 inches in height; minimum of 20 gauge galvanized steel, minimum of 3 inches long.

More than 19 inches in width, maximum 12 inches in height;  
Minimum of 16 gauge galvanized steel, minimum of 3 inches long.

###### (2) Single Leaf Blades:

Maximum 19 inches in width, maximum 12 inches in height; Minimum of 20 gauge galvanized steel, minimum of 3 inches long.

More than 19 inches in width, maximum 12 inches in height;  
Minimum of 16 gauge galvanized steel, minimum of 3 inches long.

###### (3) Blade Axles:

To support the blades of round dampers, provide galvanized steel shafts supporting the blade the entire duct diameter frame-to-frame. Axle shafts shall extend through standoff bracket and hand quadrant.

Maximum 19 inches in width, maximum 12 inches in height;  
Galvanized steel, minimum of 3/8 inch square shaft.

More than 19 inches in width, maximum 12 inches in height;  
Galvanized steel, minimum of 1/2 inch square shaft.

###### (4) Axle Bearings:

Support the shaft on each end at the frames with shaft bearings. Shaft bearings configuration shall be a pressed fit to provide a

tight joint between blade shaft and damper frame.

Maximum 19 inches in width, maximum 12 inches in height; solid nylon, or equivalent solid plastic, or oil-impregnated bronze bearings.

More than 19 inches in width, maximum 12 inches in height; oil-impregnated bronze bearings.

(5) Control Shaft/Hand Quadrant:

Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Stand-off distance shall be a minimum of 50 mm 2 inches off the metal duct surface. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

(6) Finish: Mill Galvanized

b. Duct Height Greater than 12 inches

Provide dampers with multi-leaf opposed-type blades.

(1) Frames:

Maximum 48 inches in height; maximum 48 inches in width; minimum of 16 gauge galvanized steel, minimum of 5.5 inches long.

(2) Blades:

Minimum of 16 gauge galvanized steel; 6 inch nominal width.

(3) Blade Axles:

To support the blades of round dampers, provide galvanized square steel shafts supporting the blade the entire duct diameter frame-to-frame. Axle shafts shall extend through standoff bracket and hand quadrant.

(4) Axle Bearings:

Support the shaft on each end at the frames with shaft bearings constructed of oil-impregnated bronze, or solid nylon, or a solid plastic equivalent to nylon. Shaft bearings configuration shall be a pressed fit to provide a tight joint between blade shaft and damper frame.

(5) Blade Actuator: Minimum 1/2 inch diameter galvanized steel.

(6) Blade Actuator Linkage: Mill Galvanized steel bar and crank plate with stainless steel pivots.

(7) Control Shaft/Hand Quadrant: Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Stand-off distance shall be a minimum of

50 mm 2 inches off the metal duct surface. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

(8) Finish: Mill Galvanized

#### 2.9.4.2 Round Dampers

##### a. Frames:

4 to 20 inches size: Minimum of 20 gauge galvanized steel, minimum of 10 inches long.

size: Minimum of 20 gauge galvanized steel, minimum of 10 inches long.

32 to 40 inches size: Minimum of 16 gauge galvanized steel, minimum of 10 inches long.

##### b. Blades:

4 to 20 inches size: Minimum of 20 gauge galvanized steel

22 to 30 inches size: Minimum of 16 gauge galvanized steel

32 to 40 inches size: Minimum of 10 gauge galvanized steel

##### c. Blade Axles

To support the blades of round dampers, provide galvanized steel shafts supporting the blade the entire duct diameter frame-to-frame. Axle shafts shall extend through standoff bracket and hand quadrant.

4 to 20 inches size: Minimum of 3/8 inch square shaft.

22 to 30 inches size: Minimum of 1/2 inch square shaft.

32 to 40 inches size: Minimum of 3/4 inch square shaft.

##### d. Axle Bearings:

Support the shaft on each end at the frames with shaft bearings constructed of oil-impregnated bronze, or solid nylon, or a solid plastic equivalent to nylon. Shaft bearings configuration shall be a pressed fit to provide a tight joint between blade shaft and damper frame.

4 to 20 inches size: solid nylon, or equivalent solid plastic, or oil-impregnated bronze.

22 to 30 inches size: solid nylon, or equivalent solid plastic, or oil-impregnated bronze.

32 to 40 inches size: oil-impregnated bronze, or stainless steel sleeve bearing

##### e. Control Shaft/Hand Quadrant:

Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be

thermally insulated. Stand-off distance shall be a minimum of 2 inches off the metal duct surface. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

f. Finish: Mill Galvanized

#### 2.9.5 Diffusers, Registers, and Grilles

Provide factory-fabricated units of aluminum that distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Provide outlets for diffusion, spread, throw, and noise level as required for specified performance. Certify performance according to ASHRAE 70. Provide sound rated and certified inlets and outlets according to ASHRAE 70. Provide sound power level as indicated. Provide diffusers and registers with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device is acceptable. Provide opposed blade type volume dampers for all diffusers and registers, except linear slot diffusers. Provide linear slot diffusers with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 7 feet above the floor, protect them by a grille or screen according to NFPA 90A.

##### 2.9.5.1 Diffusers

Provide diffuser types indicated. Furnish ceiling mounted units with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Provide diffusers with air deflectors of the type indicated. Provide air handling troffers or combination light and ceiling diffusers conforming to the requirements of UL Electrical Constructn for the interchangeable use as cooled or heated air supply diffusers or return air units. Install ceiling mounted units with rims tight against ceiling. Provide sponge rubber gaskets between ceiling and surface mounted diffusers for air leakage control. Provide suitable trim for flush mounted diffusers. For connecting the duct to diffuser, provide duct collar that is airtight and does not interfere with volume controller. Provide return or exhaust units that are similar to supply diffusers.

##### 2.9.5.2 Registers and Grilles

Provide units that are four-way directional-control type, except provide return and exhaust registers that are fixed horizontal or vertical louver type similar in appearance to the supply register face. Furnish registers with sponge-rubber gasket between flanges and wall or ceiling. Install wall supply registers at least 6 inches below the ceiling unless otherwise indicated. Locate return and exhaust registers 6 inches above the floor unless otherwise indicated. Achieve four-way directional control by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Provide grilles as specified for registers, without volume control damper.

##### 2.9.6 Louvers

Provide louvers for installation in exterior walls that are associated with the air supply and distribution system as specified.

### 2.9.7 Air Vents, Penthouses, and Goosenecks

Fabricate air vents, penthouses, and goosenecks from galvanized steel sheets with galvanized structural shapes. Provide sheet metal thickness, reinforcement, and fabrication that conform to SMACNA 1966. Accurately fit and secure louver blades to frames. Fold or bead edges of louver blades for rigidity and baffle these edges to exclude driving rain. Provide air vents, penthouses, and goosenecks with bird screen.

### 2.9.8 Bird Screens and Frames

Provide bird screens that conform to ASTM E 2016, No. 2 mesh, aluminum or stainless steel. Provide "medium-light" rated aluminum screens. Provide "light" rated stainless steel screens. Provide removable type frames fabricated from either stainless steel or extruded aluminum.

## 2.10 AIR SYSTEMS EQUIPMENT

### 2.10.1 Fans

Test and rate fans according to AMCA 210. Calculate system effect on air moving devices in accordance with AMCA 201 where installed ductwork differs from that indicated on drawings. Install air moving devices to minimize fan system effect. Where system effect is unavoidable, determine the most effective way to accommodate the inefficiencies caused by system effect on the installed air moving device. The sound power level of the fans shall not exceed 85 dBA when tested according to AMCA 300 and rated in accordance with AMCA 301. Provide all fans with an AMCA seal. Connect fans to the motors either directly or indirectly with V-belt drive. Use V-belt drives designed for not less than 150 percent of the connected driving capacity. Provide variable pitch motor sheaves for 15 hp and below, and fixed pitch as defined by AHRI Guideline D. Select variable pitch sheaves to drive the fan at a speed which can produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, provide a replaceable sheave when needed to achieve system air balance. Provide motors for V-belt drives with adjustable rails or bases. Provide removable metal guards for all exposed V-belt drives, and provide speed-test openings at the center of all rotating shafts. Provide fans with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Provide fan and motor assemblies with vibration-isolation supports or mountings as indicated. Use vibration-isolation units that are standard products with published loading ratings. Select each fan to produce the capacity required at the fan static pressure indicated. Provide sound power level as indicated. Obtain the sound power level values according to AMCA 300. Provide standard AMCA arrangement, rotation, and discharge as indicated. Provide power ventilators that conform to UL 705 and have a UL label.

#### 2.10.1.1 In-Line Centrifugal Fans

Provide in-line fans with centrifugal backward inclined blades, stationary discharge conversion vanes, internal and external belt guards, and adjustable motor mounts. Mount fans in a welded tubular casing. Provide a fan that axially flows the air in and out. Streamline inlets with conversion vanes to eliminate turbulence and provide smooth discharge air flow. Enclose and isolate fan bearings and drive shafts from the air stream. Provide precision, self aligning ball or roller type fan bearings that are sealed against dust and dirt and are permanently lubricated.



Provide L50 rated bearing life at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Provide motors with opendripproof

## 2.11 AIR HANDLING UNITS

### 2.11.1 Factory-Fabricated Air Handling Units

Provide single-zone draw-through type units as indicated. Provide vibration isolators as indicated. Physical dimensions of each air handling unit shall be suitable to fit space allotted to the unit with the capacity indicated. Provide air handling unit that is rated in accordance with AHRI 430 and AHRI certified for cooling.

#### 2.11.1.1 Casings

Provide the following:

- a. Inner casing of double-wall units that are a minimum 20 gauge solid galvanized steel or corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Design and construct casing with an integral insulated structural galvanized steel frame such that exterior panels are non-load bearing.
- b. Individually removable exterior panels with standard tools. Removal shall not affect the structural integrity of the unit. Furnish casings with access sections, according to paragraph AIR HANDLING UNITS, inspection doors, and access doors, all capable of opening a minimum of 90 degrees, as indicated.
- c. Insulated, fully gasketed, double-wall type inspection and access doors, of a minimum 18 gauge outer and 20 gauge inner panels made of either galvanized steel or corrosion-resisting sheet steel conforming to ASTM A167, Type 304. Doors shall be rigid and provided with heavy duty hinges and latches. Inspection doors shall be a minimum 12 inches wide by 12 inches high. Access doors shall be a minimum 24 inches wide, the full height of the unit casing or a minimum of 6 foot, whichever is less.
- d. Double-wall insulated type drain pan (thickness equal to exterior casing) constructed of 16 gauge corrosion resisting sheet steel conforming to ASTM A167, Type 304, conforming to ASHRAE 62.1. Construct drain pans water tight, treated to prevent corrosion, and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils shall not flow across the face of lower coils. Provide intermediate drain pans or condensate collection channels and downspouts, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Construct drain pan to allow for easy visual inspection, including underneath the coil without removal of the coil and to allow complete and easy physical cleaning of the pan underneath the coil without removal of the coil. Coils shall be individually removable from the casing.
- e. Casing insulation that conforms to NFPA 90A. Single-wall casing sections handling conditioned air shall be insulated with not less than 1 inch thick, 1-1/2 pound density coated fibrous glass material having a thermal conductivity not greater than 0.23 Btu/hr-sf-F. Double-wall casing sections handling conditioned air shall be insulated with not less than 2 inches of the same insulation specified for single-wall

casings. Foil-faced insulation is not an acceptable substitute for use with double wall casing. Double wall insulation shall be completely sealed by inner and outer panels.

- f. Factory applied fibrous glass insulation that conforms to ASTM C1071, except that the minimum thickness and density requirements do not apply, and that meets the requirements of NFPA 90A. Make air handling unit casing insulation uniform over the entire casing. Foil-faced insulation is not an acceptable substitute for use on double-wall access doors and inspections doors and casing sections.
- g. Duct liner material, coating, and adhesive that conforms to fire-hazard requirements specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Protect exposed insulation edges and joints where insulation panels are butted with a metal nosing strip or coat to meet erosion resistance requirements of ASTM C1071.

#### 2.11.1.2 Heating and Cooling Coils

Provide coils as specified in paragraph AIR SYSTEMS EQUIPMENT.

#### 2.11.1.3 Air Filters

Provide air filters as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

#### 2.11.1.4 Fans

Provide the following:

- a. Fans that are double-inlet, centrifugal type with each fan in a separate scroll. Dynamically balance fans and shafts prior to installation into air handling unit, then after it has been installed in the air handling unit, statically and dynamically balance the entire fan assembly. Mount fans on steel shafts, accurately ground and finished.
- b. Fan bearings that are sealed against dust and dirt and are precision self-aligning ball or roller type, with L50 rated bearing life at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Bearings shall be permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Support bearings by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Do not fasten bearings directly to the unit sheet metal casing. Furnish fans and scrolls with coating indicated.
- c. Fans that are driven by a unit-mounted, or a floor-mounted motor connected to fans by V-belt drive complete with belt guard for externally mounted motors. Furnish belt guards that are the three-sided enclosed type with solid or expanded metal face. Belt drives shall be designed for not less than a 1.3 service factor based on motor nameplate rating.

#### 2.11.1.5 Access Sections and Filter/Mixing Boxes

Provide access sections where indicated and furnish with access doors as

shown. Construct access sections and filter/mixing boxes in a manner identical to the remainder of the unit casing and equip with access doors. Design mixing boxes to minimize air stratification and to promote thorough mixing of the air streams.

## 2.12 TERMINAL UNITS

### 2.12.1 Room Fan-Coil Units

Provide base units that include galvanized coil casing, coil assembly drain pan valve and piping package, air filter, fans, motor, fan drive, motor switch, an enclosure for cabinet models and casing for concealed 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. Values obtained for the standard cabinet models are acceptable for concealed models without separate test provided there is no variation between models as to the coil configuration, blowers, motor speeds, or relative arrangement of parts. Provide automatic valves and controls as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS. Fasten each unit securely to the building structure. Provide units with capacity indicated. Provide room fan-coil units that are certified as complying with AHRI 440, and meet the requirements of UL 1995.

#### 2.12.1.1 Enclosures

Fabricate enclosures from not lighter than 18 gauge steel, reinforced and braced. Provide enclosures with front panels that are removable and have 1/4 inch closed cell insulation or 1/2 inch thick dual density foil faced fibrous glass insulation. Make the exposed side of a high density, erosion-proof material suitable for use in air streams with velocities up to 4,500 fpm. Provide galvanized or factory finished ferrous metal surfaces with corrosion resistant enamel, and access doors or removable panels for piping and control compartments, plus easy access for filter replacement. Provide duct discharge collar for concealed models.

#### 2.12.1.2 Fans

Provide steel or aluminum, multiblade, centrifugal type fans. In lieu of metal, fans and scrolls could be of non-metallic materials of suitably reinforced compounds with smooth surfaces. Dynamically and statically balance the fans. Provide accessible assemblies for maintenance. Disassemble and re-assemble by means of mechanical fastening devices and not by epoxies or cements.

#### 2.12.1.3 Coils

Fabricate coils from not less than 3/8 inch outside diameter seamless copper tubing, with copper or aluminum fins mechanically bonded or soldered to the tubes. Provide coils with not less than 1/2 inch outside diameter flare or sweat connectors, accessory piping package with thermal connections suitable for connection to the type of control valve supplied, and manual air vent. Test coils hydrostatically at 300 psi or under water at 250 psi air pressure. Provide coils suitable for 200 psi working pressure. Make provisions for coil removal.

#### 2.12.1.4 Drain Pans

Size and locate drain and drip pans to collect all water condensed on and dripping from any item within the unit enclosure or casing. Provide condensate drain pans designed for self-drainage to preclude the buildup of microbial slime and thermally insulated to prevent condensation and constructed of not lighter than 21 gauge type 304 stainless steel or noncorrosive ABS plastic. Provide insulation with a flame spread rating not over 25 without evidence of continued progressive combustion, a smoke developed rating no higher than 50, and of a waterproof type or coated with a waterproofing material. Design drain pans so as to allow no standing water and pitch to drain. Provide minimum 3/4 inch NPT or 5/8 inch OD drain connection in drain pan. Provide plastic or metal auxiliary drain pans to catch drips from control and piping packages, eliminating insulation of the packages; if metal, provide auxiliary pans that comply with the requirements specified above. Extend insulation at control and piping connections 1 inch minimum over the auxiliary drain pan.

#### 2.12.1.5 Manually Operated Outside Air Dampers

Provide manually operated outside air dampers according to the arrangement indicated, and parallel airfoil type dampers of galvanized construction. Provide blades that rotate on stainless steel or nylon sleeve bearings.

#### 2.12.1.6 Filters

Provide filters of the fiberglass disposable type, 1 inch thick, conforming to ASTM F 1040. Filters in each unit shall be removable without the use of tools.

#### 2.12.1.7 Motors

Provide motors of the permanent split-capacitor type with built-in thermal overload protection, directly connected to unit fans. Provide motor switch with two or three speeds and off, manually operated, and mounted on an identified plate.

### 2.13 ENERGY RECOVERY DEVICES

#### 2.13.1 Desiccant Wheel

Provide counterflow supply, regeneration airstreams, a rotary type dehumidifier designed for continuous operation, and extended surface type wheel structure in the axial flow direction with a geometry that allows for laminar flow over the operating range for minimum air pressure differentials. Provide the dehumidifier complete with a drive system utilizing a fractional-horsepower electric motor and speed reducer assembly driving the rotor. Include a slack-side tensioner for automatic take-up for belt-driven wheels. Provide an adsorbing type desiccant material. Apply the desiccant material to the wheel such that the entire surface is active as a desiccant and the desiccant material does not degrade or detach from the surface of the wheel which is fitted with full-face, low-friction contact seals on both sides to prevent cross leakage. Provide rotary structure that has underheat, overheat and rotation fault circuitry. The wheel assembly shall come with a warranty for a minimum of five years.

### 2.14 FACTORY PAINTING

Factory paint new equipment, which are not of galvanized construction.

Paint with a corrosion resisting paint finish according to ASTM A123/A123M or ASTM A924/A924M. Clean, phosphatize and coat internal and external ferrous metal surfaces with a paint finish which has been tested according to ASTM B117, ASTM D 1654, and ASTM D 3359. Submit evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors. Provide rating of failure at the scribe mark that is not less than 6, average creepage not greater than 1/8 inch. Provide rating of the inscribed area that is not less than 10, no failure. On units constructed of galvanized steel that have been welded, provide a final shop docket of zinc-rich protective paint on exterior surfaces of welds or welds that have burned through from the interior according to ASTM D 520 Type I.

Factory painting that has been damaged prior to acceptance by the Contracting Officer shall be field painted in compliance with the requirements of paragraph FIELD PAINTING OF MECHANICAL EQUIPMENT.

## 2.15 SUPPLEMENTAL COMPONENTS/SERVICES

### 2.15.1 Chilled, Condenser, or Dual Service Water Piping

The requirements for chilled, condenser, or dual service water piping and accessories are specified in Section 23 64 26 CHILLED, CHILLED-HOT, AND CONDENSER WATER PIPING SYSTEMS

### 2.15.2 Water or Steam Heating System Accessories

The requirements for water or steam heating accessories such as expansion tanks and steam traps are specified in Section 23 21 13.00 20 LOW TEMPERATURE WATER (LTW) HEATING SYSTEM

### 2.15.3 Condensate Drain Lines

Provide and install condensate drainage for each item of equipment that generates condensate in accordance with Section 23 64 26 CHILLED, CHILLED-HOT, AND CONDENSER WATER PIPING SYSTEMS except as modified herein. Provide condensate pumps at all first floor fan coil units and elsewhere as required.

### 2.15.4 Backflow Preventers

The requirements for backflow preventers are specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE.

### 2.15.5 Insulation

The requirements for shop and field applied insulation are specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

### 2.15.6 Controls

The requirements for controls are specified in ADJUSTING, AND BALANCING OF HVAC SYSTEMS and Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL FOR HVAC

## PART 3 EXECUTION

## 3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

## 3.1.1 EXISTING EQUIPMENT

Existing Chiller and Disconnect to be removed and returned to the Government.

## 3.2 INSTALLATION

- a. Install materials and equipment in accordance with the requirements of the contract drawings and approved manufacturer's installation instructions. Accomplish installation by workers skilled in this type of work. Perform installation so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors.
- b. No installation is permitted to block or otherwise impede access to any existing machine or system.
- c. Except as otherwise indicated, install emergency switches and alarms in conspicuous locations. Mount all indicators, to include gauges, meters, and alarms in order to be easily visible by people in the area.

## 3.2.1 Condensate Drain Lines

Provide water seals in the condensate drain from all units except room fan-coil units. Provide a depth of each seal of 2 inches plus the number of inches, measured in water gauge, of the total static pressure rating of the unit to which the drain is connected. Provide water seals that are constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Provide pipe cap or plug cleanouts where indicated. Connect drains indicated to connect to the sanitary waste system using an indirect waste fitting. Insulate air conditioner drain lines as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

## 3.2.2 Equipment and Installation

Provide frames and supports for tanks, compressors, pumps, valves, air handling units, fans, coils, dampers, and other similar items requiring supports. Floor mount or ceiling hang air handling units as indicated. Anchor and fasten as detailed. Set floor-mounted equipment on not less than 6 inch concrete pads or curbs doweled in place unless otherwise indicated. Make concrete foundations heavy enough to minimize the intensity of the vibrations transmitted to the piping, duct work and the surrounding structure, as recommended in writing by the equipment manufacturer. In lieu of a concrete pad foundation, build a concrete pedestal block with isolators placed between the pedestal block and the floor. Make the concrete foundation or concrete pedestal block a mass not less than three times the weight of the components to be supported. Provide the lines connected to the pump mounted on pedestal blocks with flexible connectors. Submit foundation drawings as specified in paragraph DETAIL DRAWINGS. Provide concrete for foundations as specified in Section 03 45 33 PRECAST STRUCTURAL CONCRETE.

### 3.2.3 Access Panels

Install access panels for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance of sufficient size, and locate them so that the concealed items are easily serviced and maintained or completely removed and replaced.

### 3.2.4 Flexible Duct

Install pre-insulated flexible duct in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Provide hangers, when required to suspend the duct, of the type recommended by the duct manufacturer and set at the intervals recommended.

### 3.2.5 Metal Ductwork

Install according to SMACNA 1966 unless otherwise indicated. Install duct supports for sheet metal ductwork according to SMACNA 1966, unless otherwise specified. Do not use friction beam clamps indicated in SMACNA 1966. Anchor risers on high velocity ducts in the center of the vertical run to allow ends of riser to move due to thermal expansion. Erect supports on the risers that allow free vertical movement of the duct. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, provide suitable intermediate metal framing. Where C-clamps are used, provide retainer clips.

### 3.2.6 Insulation

Provide thickness and application of insulation materials for ductwork, piping, and equipment according to Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Externally insulate outdoor air intake ducts and plenums up to the point where the outdoor air reaches the conditioning unit.

## 3.3 EQUIPMENT PADS

Provide equipment pads to the dimensions shown or, if not shown, to conform to the shape of each piece of equipment served with a minimum 3-inch margin around the equipment and supports. Allow equipment bases and foundations, when constructed of concrete or grout, to cure a minimum of 28 calendar days before being loaded.

## 3.4 CUTTING AND PATCHING

Install work in such a manner and at such time that a minimum of cutting and patching of the building structure is required. Make holes in exposed locations, in or through existing floors, by drilling and smooth by sanding. Use of a jackhammer is permitted only where specifically approved. Make holes through masonry walls to accommodate sleeves with an iron pipe masonry core saw.

## 3.5 CLEANING

Thoroughly clean surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction before such surfaces are prepared for final finish painting or are enclosed within the building structure. Before final acceptance, clean mechanical

equipment, including piping, ducting, and fixtures, and free from dirt, grease, and finger marks. When the work area is in an occupied space such as office, laboratory or warehouse protect all furniture and equipment from dirt and debris. Incorporate housekeeping for field construction work which leaves all furniture and equipment in the affected area free of construction generated dust and debris; and, all floor surfaces vacuum-swept clean.

### 3.6 PENETRATIONS

Provide sleeves and prepared openings for duct mains, branches, and other penetrating items, and install during the construction of the surface to be penetrated. Cut sleeves flush with each surface. Place sleeves for round duct 15 inches and smaller. Build framed, prepared openings for round duct larger than 15 inches and square, rectangular or oval ducts. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Provide one inch clearance between penetrating and penetrated surfaces except at grilles, registers, and diffusers. Pack spaces between sleeve or opening and duct or duct insulation with mineral fiber conforming with ASTM C553, Type 1, Class B-2.

- a. Sleeves: Fabricate sleeves, except as otherwise specified or indicated, from 20 gauge thick mill galvanized sheet metal. Where sleeves are installed in bearing walls or partitions, provide black steel pipe conforming with ASTM A53/A53M, Schedule 20.
- b. Framed Prepared Openings: Fabricate framed prepared openings from 20 gauge galvanized steel, unless otherwise indicated.
- c. Insulation: Provide duct insulation in accordance with Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS continuous through sleeves and prepared openings except firewall penetrations. Terminate duct insulation at fire dampers and flexible connections. For duct handling air at or below 60 degrees F, provide insulation continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air.
- d. Closure Collars: Provide closure collars of a minimum 4 inches wide, unless otherwise indicated, for exposed ducts and items on each side of penetrated surface, except where equipment is installed. Install collar tight against the surface and fit snugly around the duct or insulation. Grind sharp edges smooth to prevent damage to penetrating surface. Fabricate collars for round ducts 15 inches in diameter or less from 20 gauge galvanized steel. Fabricate collars for square and rectangular ducts, or round ducts with minimum dimension over 15 inches from 18 gauge galvanized steel. Fabricate collars for square and rectangular ducts with a maximum side of 15 inches or less from 20 gauge galvanized steel. Install collars with fasteners a maximum of 6 inches on center. Attach to collars a minimum of 4 fasteners where the opening is 12 inches in diameter or less, and a minimum of 8 fasteners where the opening is 20 inches in diameter or less.
- e. 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.

### 3.7 IDENTIFICATION SYSTEMS

Provide identification tags made of brass, engraved laminated plastic, or



engraved anodized aluminum, indicating service and item number on all valves and dampers. Provide tags that are 1-3/8 inch minimum diameter with stamped or engraved markings. Make indentations black for reading clarity. Attach tags to valves with No. 12 AWG 0.0808-inch diameter corrosion-resistant steel wire, copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.

### 3.8 DUCTWORK LEAK TESTS

The requirements for ductwork leak tests are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.

### 3.9 TESTING, ADJUSTING, AND BALANCING

The requirements for testing, adjusting, and balancing are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC. Begin testing, adjusting, and balancing only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

### 3.10 CLEANING AND ADJUSTING

Provide a temporary bypass for water coils to prevent flushing water from passing through coils. Inside of room fan-coil units thoroughly clean ducts, plenums, and casing of debris and blow free of small particles of rubbish and dust and then vacuum clean before installing outlet faces. Wipe equipment clean, with no traces of oil, dust, dirt, or paint spots. Provide temporary filters prior to startup of all fans that are operated during construction, and install new filters after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. Maintain system in this clean condition until final acceptance. Properly lubricate bearings with oil or grease as recommended by the manufacturer. Tighten belts to proper tension. Adjust control valves and other miscellaneous equipment requiring adjustment to setting indicated or directed. Adjust fans to the speed indicated by the manufacturer to meet specified conditions. Maintain all equipment installed under the contract until close out documentation is received, the project is completed and the building has been documented as beneficially occupied.

### 3.11 OPERATION AND MAINTENANCE

#### 3.11.1 Operation and Maintenance Manuals

Submit six manuals at least 2 weeks prior to field training. Submit data complying with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA. Submit Data Package 3 for the items/units listed under SD-10 Operation and Maintenance Data

#### 3.11.2 Operation And Maintenance Training

Conduct a training course for the members of the operating staff as designated by the Contracting Officer. Make the training period consist of a total of 8 hours of normal working time and start it after all work specified herein is functionally completed and the Performance Tests have been approved. Conduct field instruction that covers all of the items contained in the Operation and Maintenance Manuals as well as demonstrations of routine maintenance operations. Submit the proposed On-site Training schedule concurrently with the Operation and Maintenance

Manuals and at least 14 days prior to conducting the training course.

-- End of Section --

## SECTION 23 03 00.00 20

## BASIC MECHANICAL MATERIALS AND METHODS

08/10

## PART 1 GENERAL

## 1.1 REFERENCES

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

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2012; Errata 2012; INT 1-4 2012; INT 5-7 2013; INT 8-10 2014; INT 11 2015) National Electrical Safety Code

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2009) Motors and Generators

NEMA MG 10 (2001; R 2007) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors

NEMA MG 11 (1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code

## 1.2 RELATED REQUIREMENTS

This section applies to all sections of Divisions: 21, FIRE SUPPRESSION; 22, PLUMBING; and 23, HEATING, VENTILATING, AND AIR CONDITIONING of this project specification, unless specified otherwise in the individual section.

## 1.3 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 INSTALLATION REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

##### 1.5.1 New Work

Provide electrical components of mechanical equipment, such as motors, motor starters (except starters/controllers which are indicated as part of a motor control center), control or push-button stations, float or pressure switches, solenoid valves, integral disconnects, and other devices functioning to control mechanical equipment, as well as control wiring and conduit for circuits rated 100 volts or less, to conform with the requirements of the section covering the mechanical equipment. Extended voltage range motors shall not be permitted. The interconnecting power wiring and conduit, control wiring rated 120 volts (nominal) and conduit, and the electrical power circuits shall be provided under Division 26, except internal wiring for components of package equipment shall be provided as an integral part of the equipment. When motors and equipment furnished are larger than sizes indicated, provide any required changes to the electrical service as may be necessary and related work as a part of the work for the section specifying that motor or equipment.

##### 1.5.2 Modifications to Existing Systems

Where existing mechanical systems and motor-operated equipment require modifications, provide electrical components under Division 26.

##### 1.5.3 High Efficiency Motors

###### 1.5.3.1 High Efficiency Single-Phase Motors

Unless otherwise specified, single-phase fractional-horsepower alternating-current motors shall be high efficiency types corresponding to the applications listed in NEMA MG 11.

###### 1.5.3.2 High Efficiency Polyphase Motors

Unless otherwise specified, polyphase motors shall be selected based on high efficiency characteristics relative to the applications as listed in NEMA MG 10. Additionally, polyphase squirrel-cage medium induction motors with continuous ratings shall meet or exceed energy efficient ratings in accordance with Table 12-6C of NEMA MG 1.

##### 1.5.4 Three-Phase Motor Protection

Provide controllers for motors rated one 1 horsepower and larger 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.

#### 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.

#### PART 2 PRODUCTS

Not Used

#### PART 3 EXECUTION - NOT USED

-- End of Section --

## SECTION 23 05 15

## COMMON PIPING FOR HVAC

02/09

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 325 (2011) Steel Construction Manual

## AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M (2004) Specification for Filler Metals for Brazing and Braze Welding

AWS WHB-2.9 (2004) Welding Handbook; Volume 2, Welding Processes, Part 1

## ASME INTERNATIONAL (ASME)

ASME A112.18.1/CSA B125.1 (2011) Plumbing Supply Fittings

ASME A112.19.2/CSA B45.1 (2008; Update 2009) Standard for Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals

ASME B1.20.7 (1991; R 2008) Standard for Hose Coupling Screw Threads (Inch)

ASME B16.1 (2010) Gray Iron Threaded Fittings; Classes 25, 125 and 250

ASME B16.11 (2009) Forged Fittings, Socket-Welding and Threaded

ASME B16.22 (2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B16.3 (2010) Malleable Iron Threaded Fittings, Classes 150 and 300

ASME B16.39 (2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300

ASME B16.4 (2006) Standard for Gray Iron Threaded Fittings; Classes 125 and 250

ASME B16.5 (2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard

|                       |  |
|-----------------------|--|
| ASME B16.9            | (2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings  |
| ASME B31.3            | (2010) Process Piping  |
| ASME B36.10M          | (2004; R 2010) Standard for Welded and Seamless Wrought Steel Pipe   |
| ASME B40.100          | (2005) Pressure Gauges and Gauge Attachments   |
| ASME BPVC SEC IX      | (2010) BPVC Section IX-Welding and Brazing Qualifications  |
| ASME BPVC SEC VIII D1 | (2007; Addenda 2008; Addenda 2009) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1 |

## ASTM INTERNATIONAL (ASTM)

|                 |   |
|-----------------|---|
| ASTM A105/A105M | (2011) Standard Specification for Carbon Steel Forgings for Piping Applications   |
| ASTM A106/A106M | (2010) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service   |
| ASTM A126       | (2004; R 2014) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings   |
| ASTM A197/A197M | (2000; R 2006) Standard Specification for Cupola Malleable Iron   |
| ASTM A216/A216M | (2008) Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service                             |
| ASTM A234/A234M | (2011) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service             |
| ASTM A276       | (2010) Standard Specification for Stainless Steel Bars and Shapes   |
| ASTM A278/A278M | (2001; R 2006) Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650 degrees F (350 degrees C) |
| ASTM A307       | (2014) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength   |
| ASTM A312/A312M | (2011) Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes                                    |



|                 |   |
|-----------------|---|
| ASTM A53/A53M   | (2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless                     |
| ASTM A563       | (2015) Standard Specification for Carbon and Alloy Steel Nuts   |
| ASTM A6/A6M     | (2011) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling |
| ASTM B32        | (2008) Standard Specification for Solder Metal  |
| ASTM B370       | (2011) Standard Specification for Copper Sheet and Strip for Building Construction  |
| ASTM B62        | (2009) Standard Specification for Composition Bronze or Ounce Metal Castings  |
| ASTM B749       | (2003; R 2009) Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products                             |
| ASTM B88        | (2009) Standard Specification for Seamless Copper Water Tube  |
| ASTM C109/C109M | (2011) Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens)  |
| ASTM C404       | (2011) Standard Specification for Aggregates for Masonry Grout  |
| ASTM C476       | (2010) Standard Specification for Grout for Masonry   |
| ASTM C553       | (2011) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications     |
| ASTM C67        | (2011) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile                                      |
| ASTM C920       | (2011) Standard Specification for Elastomeric Joint Sealants  |
| ASTM D 2308     | (2007) Standard Specification for Thermoplastic Polyethylene Jacket for Electrical Wire and Cable                         |
| ASTM E 1        | (2007) Standard Specification for ASTM Liquid-in-Glass Thermometers   |
| ASTM E 814      | (2011a) Standard Test Method for Fire Tests of Through-Penetration Fire Stops   |

ASTM F 104 (2011) Standard Classification System for Nonmetallic Gasket Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 515 (2004) Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Heat Tracing for Industrial Applications

IEEE C2 (2012; Errata 2012; INT 1-4 2012; INT 5-7 2013; INT 8-10 2014; INT 11 2015) National Electrical Safety Code

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-125 (2010) Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves

MSS SP-58 (2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

MSS SP-67 (2002a) Butterfly Valves

MSS SP-69 (2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

MSS SP-70 (2006) Gray Iron Gate Valves, Flanged and Threaded Ends

MSS SP-71 (2005) Gray Iron Swing Check Valves, Flanged and Threaded Ends

MSS SP-72 (2010) Ball Valves with Flanged or Butt-Welding Ends for General Service

MSS SP-85 (2002) Gray Iron Globe & Angle Valves Flanged and Threaded Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2009) Motors and Generators

NEMA MG 10 (2001; R 2007) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors

NEMA MG 11 (1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National

## Electrical Code

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

MIL-C-18480 (1992; Rev B; Notice 2 2009) Coating Compound, Bituminous, Solvent, Coal-Tar Base

MIL-DTL-17813 (2009; Rev H; Supp 1 2009) Expansion Joints, Pipe, Metallic Bellows, General Specification for

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1922 (Rev A; Notice 2) Shield, Expansion (Caulking Anchors, Single Lead)

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)

CID A-A-1925 (Rev A; Notice 2) Shield Expansion (Nail Anchors)

CID A-A-55614 (Basic; Notice 2) Shield, Expansion (Non-Drilling Expansion Anchors)

CID A-A-55615 (Basic; Notice 2) Shield, Expansion (Wood Screw and Lag Bolt Self-Threading Anchors)

## UNDERWRITERS LABORATORIES (UL)

UL 1479 (2015) Fire Tests of Through-Penetration Firestops

## 1.2 GENERAL REQUIREMENTS

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS applies to work specified in this section.

Section 23 05 48.00 40 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT applies to work specified in this section.

Submit Records of Existing Conditions consisting of the results of Contractor's survey of work area conditions and features of existing structures and facilities within and adjacent to the jobsite. Commencement of work constitutes Contractor's acceptance of the existing conditions.

Include with Equipment Foundation Data for piping systems all plan dimensions of foundations and relative elevations, equipment weight and operating loads, horizontal and vertical loads, horizontal and vertical clearances for installation, and size and location of anchor bolts.

Submit Fabrication Drawings for pipes, valves and specialties consisting of fabrication and assembly details to be performed in the factory.

Submit Material, Equipment, and Fixture Lists for pipes, valves and specialties including manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information. Provide a complete list of construction equipment to be used.

Submit Manufacturer's Standard Color Charts for pipes, valves and specialties showing the manufacturer's recommended color and finish selections.

Include with Listing of Product Installations for piping systems identification of at least 5 units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. Include in the list purchaser, address of installation, service organization, and date of installation.

Submit Record Drawings for pipes, valves and accessories providing current factual information including deviations and amendments to the drawings, and concealed and visible changes in the work.

Submit Connection Diagrams for pipes, valves and specialties indicating the relations and connections of devices and apparatus by showing the general physical layout of all controls, the interconnection of one system (or portion of system) with another, and internal tubing, wiring, and other devices.

Submit Coordination Drawings for pipes, valves and specialties showing coordination of work between different trades and with the structural and architectural elements of work. Detail all drawings sufficiently to show overall dimensions of related items, clearances, and relative locations of work in allotted spaces. Indicate on drawings where conflicts or clearance problems exist between various trades.

### 1.3 SUBMITTALS

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

#### SD-01 Preconstruction Submittals

Submit Material, Equipment, and Fixture Lists for construction equipment to be used.

#### SD-02 Shop Drawings

Submit the following for pipes, valves and specialties showing conformance with the referenced standards contained within this section.

Record Drawings  
Connection Diagrams  
Coordination Drawings  
Fabrication Drawings

Submit Installation Drawings for pipes, valves and specialties in accordance with the paragraph entitled, "Pipe Installation," of

this section.

#### SD-03 Product Data

Submit equipment and performance data for the following items consisting of corrosion resistance, life expectancy, gage tolerances, and grade line analysis.

Submit Manufacturer's catalog data for the following items:

- Pipe and Fittings
- Piping Specialties
- Valves
- Miscellaneous Materials
- Supporting Elements

Equipment Foundation Data shall be in accordance with paragraph entitled, "General Requirements," of this section.

#### SD-04 Samples

Submit Manufacturer's Standard Color Charts in accordance with paragraph entitled, "General Requirements," of this section.

#### SD-06 Test Reports

Submit test reports on the following tests in accordance with paragraph entitled, "Piping Installation," of this section.

- Hydrostatic Tests
- Air Tests

#### SD-07 Certificates

Submit Listing of Product Installations for piping systems verifying proper qualifications.

Submit Records of Existing Conditions by the Contractor prior to start.

Submit Certificates for the following in accordance with paragraph entitled, "Pipe Installation," of this section.

- Surface Resistance
- Shear and Tensile Strengths
- Temperature Ratings
- Bending Tests
- Flattening Tests
- Transverse Guided Weld Bend Tests

#### SD-10 Operation and Maintenance Data

Submit Operation and Maintenance Manuals in accordance with paragraph entitled, "Operation and Maintenance," of this section.

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Material and Equipment Qualifications

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products 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.

##### 1.4.2 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

##### 1.4.3 Service Support

The equipment items 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.

##### 1.4.4 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.

##### 1.4.5 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.

###### 1.4.5.1 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."

###### 1.4.5.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative

requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

#### 1.6 ELECTRICAL INSTALLATION REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

##### 1.6.1 New Work

Provide electrical components of mechanical equipment, such as motors, motor starters, control or push-button stations, float or pressure switches, solenoid valves, integral disconnects, and other devices functioning to control mechanical equipment, as well as control wiring and conduit for circuits rated 100 volts or less, to conform with the requirements of the section covering the mechanical equipment. Extended voltage range motors are not permitted. The interconnecting power wiring and conduit, control wiring rated 120 volts (nominal) and conduit, and the electrical power circuits shall be provided under Division 26, except internal wiring for components of package equipment shall be provided as an integral part of the equipment. When motors and equipment furnished are larger than sizes indicated, provide any required changes to the electrical service as may be necessary and related work as a part of the work for the section specifying that motor or equipment.

##### 1.6.2 Modifications to Existing Systems

Where existing mechanical systems and motor-operated equipment require modifications, provide electrical components under Division 26.

##### 1.6.3 High Efficiency Motors

###### 1.6.3.1 High Efficiency Single-Phase Motors

Unless otherwise specified, single-phase fractional-horsepower alternating-current motors shall be high efficiency types corresponding to the applications listed in NEMA MG 11.

###### 1.6.3.2 High Efficiency Polyphase Motors

Unless otherwise specified, select polyphase motors based on high efficiency characteristics relative to the applications as listed in NEMA MG 10. Additionally, polyphase squirrel-cage medium induction motors with continuous ratings shall meet or exceed energy efficient ratings in accordance with Table 12-6C of NEMA MG 1.

#### 1.6.4 Three-Phase Motor Protection

Provide controllers for motors rated one one horsepower and larger 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.

#### 1.7 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and trained in operating theory as well as practical operation and maintenance work.

Give instruction 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.

#### 1.8 ACCESSIBILITY

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

### PART 2 PRODUCTS

#### 2.1 ELECTRICAL HEAT TRACING

Heat trace systems for pipes, valves, and fittings shall be in accordance with IEEE 515 and be UL listed. System shall include all necessary components, including heaters and controls to prevent freezing.

Provide self-regulating heaters consisting of two 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature along its length. Heater shall be able to be crossed over itself without overheating and be approved before used directly on plastic pipe. Heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket in accordance with ASTM D 2308.

For installation on plastic piping, apply the heater using aluminum tape. Heater shall have an outer braid of tinned-copper and an outer jacket of modified polyolefin in accordance with ASTM D 2308, to provide a good ground path and to enhance the heater's ruggedness.

Provide heater with self-regulating factor of at least 90 percent, in order to provide energy conservation and to prevent overheating.



Heater shall operate on line voltages of 120208 volts without the use of transformers.

Size Heater according to the following table:

| Pipe Size<br>(Inch, Diameter) | Minus 10 degrees F     | Minus 20 degrees F |
|-------------------------------|------------------------|--------------------|
| 3 inches or less              | 5 watts per foot (wpf) | 5 wpf              |
| 4 inch                        | 5 wpf                  | 8 wpf              |
| 6 inch                        | 8 wpf                  | 8 wpf              |
| 8 inch                        | 2 strips/5 wpf         | 2 strips/8 wpf     |
| 12 inch to 14 inch            | 2 strips/8 wpf         | 2 strips/8 wpf     |

System shall be controlled by an ambient sensing thermostat set at 40 degrees F either directly or through an appropriate contactor.

## 2.2 PIPE AND FITTINGS

### 2.2.1 Type BCS, Black Carbon Steel

Pipe 1/8 through 12 inches shall be Schedule 40 black carbon steel, conforming to ASTM A53/A53M.

Pipe 1/8 through 10 inches shall be Schedule 40 seamless or electric-resistance welded black carbon steel, conforming to ASTM A53/A53M, Grade A should be used for permissible field bending, in both cases.

Fittings 2 inches and under shall be 150-pounds per square inch, gage (psig) working steam pressure (wsp) banded black malleable iron screwed, conforming to ASTM A197/A197M and ASME B16.3.

Unions 2 inches and under shall be 250 pounds per square inch, wsp female, screwed, black malleable iron with brass-to-iron seat, and ground joint, conforming to ASME B16.39.

Fittings 2-1/2 inches and over shall be Steel butt weld, conforming to ASTM A234/A234M and ASME B16.9 to match pipe wall thickness.

Flanges 2-1/2 inches and over shall be 150-pound forged-steel conforming to ASME B16.5, welding neck to match pipe wall thickness.

### 2.2.2 Type BCS-125, 125-psi Service

Pipe 1/8 through 1-1/2 inches shall be Schedule 40 steam, Schedule 80 condensate, furnace butt weld, black carbon steel, conforming to ASTM A53/A53M, Type F (furnace butt welded, continuous welded) and ASME B36.10M.

Pipe 2 through 10 inches shall be Schedule 40 steam, Schedule 80 condensate, seamless or electric-resistance welded black carbon steel, conforming to ASTM A53/A53M Type S (seamless) and ASME B36.10M.

Fittings 2 inches and under shall be 125-psigwsp, cast iron, screwed end, conforming to ASTM A126 Class A and ASME B16.4.

Fittings 2-1/2 inches and over shall be wall thickness to match pipe, long radius butt weld, black carbon steel, conforming to ASTM A234/A234M, Grade WPB and ASME B16.9.

Couplings 2 inches and under shall be commercial standard weight for Schedule 40 pipe and commercial extra heavy weight for Schedule 80 pipe, black carbon steel where threaded, and 2,000-or 3,000-psi wog forged carbon steel, conforming to ASTM A105/A105M and ASME B16.11, where welded.

Flanges 2-1/2 inches and over shall be 150-pound, forged carbon-steel welding neck, with raised face or flat face and concentric serrated finish, conforming to ASTM A105/A105M and ASME B16.5.

### 2.2.3 Type CPR, Copper

#### 2.2.3.1 Type CPR-A, Copper Above Ground

Tubing 2 inches and under shall be seamless copper tubing, conforming to ASTM B88, Type L (hard-drawn for all horizontal and all exposed vertical lines, annealed for concealed vertical lines).

Fittings 2 inches and under shall be 150-psigwsp wrought-copper solder joint fittings conforming to ASME B16.22.

Unions 2 inches and under shall be 150-psig wsp wrought-copper solder joint, conforming to ASME B16.22.

Provide brazing rod with Classification BCuP-5, conforming to AWS A5.8/A5.8M.

Solder must be 60-40 tin-antimony, alloy Sb-5, conforming to ASTM B32.

### 2.3 PIPING SPECIALTIES

#### 2.3.1 Air Separator

Air separated from converter discharge water shall be ejected by a reduced-velocity device vented to the compression tank.

Air separator shall be carbon steel, designed, fabricated, tested, and stamped in conformance with ASME BPVC SEC VIII D1 for service pressures not less than 125 psi.

#### 2.3.2 Air Vents

Manual air vents shall be 3/8-inch globe valves.

Automatic air vents on pumps, mains, and where indicated shall be of ball-float construction. Vent inlet shall be not less than 3/4-inch ips and the outlet not less than 1/4-inch ips. Orifice shall be 1/8 inch. Provide corrosion-resistant steel trim conforming to ASTM A276. Vent shall be fitted with try-cock. Vent shall discharge air at any pressure up to 150 psi. Outlet shall be copper tube routed.

### 2.3.3 Compression Tank

Provide compression tank designed, fabricated, tested, and stamped for a working pressure of not less than 125 psi in accordance with ASME BPVC SEC VIII D1. Tank shall be hot-dip galvanized after fabrication to produce not less than 1.5 ounces of zinc coating per square foot of single-side surface.

Tank accessories shall include red-lined gage-glass complete with glass protectors and shutoff valves, air charger and drainer, and manual vent.

### 2.3.4 Dielectric Connections

Dissimilar pipe metals shall be electrically insulated from each other by couplings, unions, or flanges commercially manufactured for that purpose and rated for the service pressure and temperature.

### 2.3.5 Expansion Vibration Isolation Joints

Single or multiple arch-flanged expansion vibration isolation joints shall be constructed of steel-ring reinforced chloroprene-impregnated cloth materials. Design joint to absorb the movement of the pipe sections in which installed with no detrimental effect on the pipe or connected equipment. Back flanges with ferrous-metal backing rings. Provide control rod assemblies to restrict joint movement. All nonmetallic exterior surfaces of the joint shall be coated with chlorosulphinated polyethylene. Provide grommets in limit bolt hole to absorb noise transmitted through the bolts.

Joints shall be suitable for continuous-duty working temperature of at least 250 degrees F.

### 2.3.6 Flexible Pipe

Flexible pipe vibration and pipe-noise eliminators shall be constructed of wire-reinforced, rubber-impregnated cloth and cord materials and shall be flanged. Flanges shall be backed with ferrous-metal backing rings. Service pressure-rating shall be minimum 1.5 times actual service. Surge pressure shall be at 180 degrees F.

Flexible pipe vibration and pipe noise eliminators shall be constructed of wire-reinforced chloroprene-impregnated cloth and cord materials and they shall be flanged. Provide all flanges backed with ferrous-metal backing rings. Nonmetallic exterior surfaces of the flexible pipe shall be coated with an acid- and oxidation-resistant chlorosulphinated polyethylene. Flexible pipe shall be rated for continuous duty at 130 psi and 250 degrees F.

### 2.3.7 Flexible Metal Steam Hose

Hose shall be bellows type with wire braid cover and designed, constructed, and rated in accordance with the applicable requirements of ASME B31.3.

Working steam pressure rating shall be 125 psi at 500 degrees F.

Minimum burst pressure shall be nine times working steam pressure at 300 degrees F.

Bellows material shall be AISI Type 316L corrosion-resistant steel. Braid shall be AISI Type 300-series corrosion-resistant steel wire.

Welded end connections shall be Schedule 80 carbon steel pressure tube, conforming to ASTM A106/A106M, Grade B

Threaded end connections shall be hex-collared Schedule 40, AISI Type 316L corrosion-resistant steel, conforming to ASTM A312/A312M.

Flanged end connection rating and materials shall conform to specifications for system primary-pressure rating.

#### 2.3.8 Metallic Expansion Joints

Expansion joints shall be metallic-bellows-type, conforming to MIL-DTL-17813.

Design and construct joints to absorb all of the movements of the pipe sections in which installed, with no detrimental effect on pipe or supporting structure.

Rate, design, and construct joints for pressures to 125 psig and temperatures to 500 degrees F.

Joints shall have a designed bursting strength in excess of four times their rated pressure.

Joints shall be capable of withstanding a hydrostatic test of 1.5 times their rated pressure while held at their uncompressed length without leakage or distortion that may adversely affect their life cycle.

Life expectancy shall be not less than 10,000 cycles.

Movement capability of each joint shall exceed calculated movement of piping by 100 percent.

Bellows and internal sleeve material shall be AISI Type 304, 304L, or 321 corrosion-resistant steel.

End connections shall require no field preparation other than cleaning.

Flanges of flanged-end expansion joints shall conform to the same codes and standard requirements as are applicable to companion flanges specified for the given piping system at the indicated joint location.

Joints, 2-1/2 inches and smaller, shall have internal guides and limit stops.

Joints, 3 inches and larger, shall be provided with removable external covers, internal sleeves, and purging connection. Sleeves shall be sized to accommodate lateral clearance required, with minimum reduction of flow area, and with oversized bellows where necessary. When a sleeve requires a gasket as part of a locking arrangement, the gasket shall be provided by the manufacturer. Joints without purging connection may be provided; however, remove these from the line prior to, or not installed until, cleaning operations are complete.

Each expansion joint shall have adjustable clamps or yokes provided at quarter points, straddling the bellows. Overall joint length shall be set by the manufacturer to maintain joints in manufacturer's recommended position during installation.

Permanently and legibly mark each joint with the manufacturer's name or trademark and serial number; the size, series, or catalog number; bellows material; and directional-flow arrow.

#### 2.3.9 Hose Faucets

Construct hose faucets with 1/2 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection, conforming to ASME A112.18.1/CSA B125.1. Hose-coupling screw threads shall conform to ASME B1.20.7.

Vandalproof, atmospheric-type vacuum breaker shall be provided on the discharge of all potable water lines.

#### 2.3.10 Pressure Gages

Pressure gages shall conform to ASME B40.100 and to requirements specified herein. Pressure-gage size shall be 3-1/2 inches nominal diameter. Case shall be corrosion-resistant steel, conforming to any of the AISI 300 series of ASTM A6/A6M, with an ASM No. 4 standard commercial polish or better. Equip gages with adjustable red marking pointer and damper-screw adjustment in inlet connection. Service-pressure reading shall be at midpoint of gage range. All gages shall be Grade B or better and be equipped with gage isolators.

Fit steam gages with black steel syphons and steam service pressure-rated gage cocks or valves.

#### 2.3.11 Sight-Flow Indicators

Sight-flow indicators for pressure service on 3-inch ips and smaller shall be constructed of bronze with specially treated single- or double-glass sight windows and have a bronze, nylon, or tetrafluoroethylene rotating flow indicator mounted on an AISI Type 304 corrosion-resistant steel shaft. Body may have screwed or flanged end. Assembly shall be pressure- and temperature-rated for the applied service. Flapper flow-type indicators are not acceptable.

#### 2.3.12 Sleeve Couplings

Sleeve couplings for plain-end pipe shall consist of one steel middle ring, two steel followers, two chloroprene or Buna-N elastomer gaskets, and the necessary steel bolts and nuts.

#### 2.3.13 Thermometers

Thermometers shall conform to ASTM E 1, except for being filled with a red organic liquid. Thermometers shall be an industrial pattern armored glass model, (well-threaded and seal-welded). Thermometers installed 6 feet or higher above the floor shall have an adjustable angle body. Scale shall be not less than 7 inches long. Case face shall be manufactured from manufacturer's standard polished aluminum or AISI 300 series polished

corrosion-resistant steel. . Provide thermometers with nonferrous separable wells. Provide lagging extension to accommodate insulation thickness.

#### 2.3.14 Pump Suction Strainers

Strainer body shall be cast iron, rated for not less than 25 psig at 100 degrees F, with flanges conforming to ASME B16.1, Class 125. Strainer construction shall be such that there is a machined surface joint between body and basket that is normal to the centerline of the basket.

Minimum ratio of open area of each basket to pipe area shall be 3 to 1. Basket shall be AISI 300 series corrosion-resistant steel wire mesh with perforated backing.

Mesh shall be capable of retaining all particles larger than 1,000 micrometer, with a pressure drop across the strainer body of not more than 0.5 psi when the basket is two-thirds dirty at maximum system flow rate. Reducing fittings from strainer-flange size to pipe size shall be provided.

A differential-pressure gage fitted with a two-way brass cock shall be provided across the strainer.

Provide manual air vent cocks in cap of each strainer.

#### 2.3.15 Line Strainers, Water Service

Strainers shall be Y-type with removable basket. Strainers in sizes 2-inch ips and smaller shall have screwed ends. In sizes 2-1/2-inch ips and larger, strainers shall have flanged ends. Body working-pressure rating shall exceed maximum service pressure of system in which installed by at least 50 percent. Body shall have cast-in arrows to indicate direction of flow. All strainer bodies fitted with screwed screen retainers shall have straight threads and gasketed with nonferrous metal. Strainer bodies 2-1/2-inches and larger, fitted with bolted-on screen retainers, shall have offset blowdown holes. All strainers larger than 2-1/2-inches shall be fitted with manufacturer's standard ball-type blowdown valve. Body material shall be cast bronze conforming to ASTM B62. Where system material is nonferrous, metal strainer body material shall be nonferrous metal.

Minimum free-hole area of strainer element shall be equal to not less than 3.4 times the internal area of connecting piping. Strainer screens shall have perforations not to exceed 0.045-inch. Strainer screens shall have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material shall be AISI Type 304 corrosion-resistant steel.

#### 2.3.16 Line Strainers, Steam Service

Strainers shall be Y-type with removable strainer element.

Body end connections shall be flanged for all valves larger than 2 inches, unless butt weld ends are specified. Socket weld shall be used for sizes 2 inches and under to suit specified piping system end connection and maintenance requirements or be welded.

Strainers located in tunnels, trenches, manholes, and valve pits shall have welded end connections.

Body working steam pressure rating shall be the same as the primary valve rating for system in which strainer is installed, except where welded end materials requirements result in higher pressure ratings. Body shall have integral cast or forged arrows to indicate direction of flow. Provide strainer bodies with blowdown valves that have discharge end plugged with a solid metal plug. Make closure assembly with tetrafluoroethylene tape. Bodies fitted with bolted-on screen retainers shall have offset blowdown holes.

Body materials shall be cast steel conforming to ASTM A216/A216M, Grade WCB

Minimum free-hole area of strainer element shall be equal to not less than 3.4 times the internal area of connecting piping. Strainer screens shall have perforations not to exceed 0.020 inch or equivalent wire mesh. Strainer screens shall have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material shall be AISI Type 304 corrosion-resistant steel and fitted with backup screens where necessary to prevent collapse.

## 2.4 VALVES

### 2.4.1 Ball and Butterfly Valves

Ball valves shall conform to MSS SP-72 for Figure 1A and shall be rated for service at not less than 175 psig at 200 degrees F. Valve bodies in sizes 2 inches and smaller shall be screwed-end connection-type constructed of Class A copper alloy. Valve bodies in sizes 2-1/2 inches and larger shall be flanged-end connection type, constructed of Class D material. Balls and stems of valves 2 inches and smaller shall be manufacturer's standard with hard chrome plating finish. Balls and stems of valves 2-1/2 inches and larger shall be manufacturer's standard Class C corrosion-resistant steel alloy with hard chrome plating. Balls of valves 6 inches and larger may be Class D with 900 Brinell hard chrome plating. Valves shall be suitable for flow from either direction and shall seal equally tight in either direction. Valves with ball seals held in place by spring washers are not acceptable. All valves shall have adjustable packing glands. Seats and seals shall be tetrafluoroethylene.

Butterfly valves shall conform to MSS SP-67. Valves shall be wafer type for mounting between specified flanges and shall be rated for 150-psig shutoff and nonshock working pressure. Bodies shall be cast ferrous metal conforming to ASTM A126, Class B, and to ASME B16.1 for body wall thickness. Seats and seals shall be of the resilient elastomer type designed for field removal and replacement.

### 2.4.2 Drain, Vent, and Gage Cocks

Drain, vent, and gage cocks shall be T-head, ground key type, with washer and screw, constructed of polished ASTM B62 bronze, and rated 125-psi wsp. End connections shall be rated for specified service pressure.

Pump vent cocks, and where spray control is required, shall be UL umbrella-hood type, constructed of manufacturer's standard polished brass. Cocks shall be 1/2-inch ips male, end threaded, and rated at not less than 125 psi at 225 degrees F.

#### 2.4.3 Gate Valves (GAV)

Gate valves 2 inches and smaller shall conform to MSS SP-72. Valves located in tunnels, equipment rooms, factory-assembled equipment, and where indicated shall be union-ring bonnet, screwed-end type. Make packing of non-asbestos type materials. Valves shall be rising stem type.

Gate valves 2-1/2 inches and larger, shall be Type I, (solid wedge disc, tapered seats, steam rated); Class 125 (125-psig steam-working pressure at 353 degrees F saturation); and 200-psig, wog (nonshock), conforming to MSS SP-70 and to requirements specified herein. Valves shall be flanged, with bronze trim and outside screw and yoke (OS&Y) construction. Make packing of non-asbestos type materials.

#### 2.4.4 Globe and Angle Valves (GLV-ANV)

Globe and angle valves 2 inches and smaller, shall be 125-pound, 125-psi conforming to MSS SP-85 and to requirements specified herein. Valves located in tunnels, equipment rooms, factory-assembled equipment, and where indicated shall be union-ring bonnet, screwed-end type. Disc shall be free to swivel on the stem in all valve sizes. Composition seating-surface disc construction may be substituted for all metal-disc construction. Make packing of non-asbestos type materials. Disk and packing shall be suitable for pipe service installed.

Globe and angle valves 2-1/2 inches and larger, shall be cast iron with bronze trim. Valve bodies shall be cast iron conforming to ASTM A126, Class A, as specified for Class 1 valves under MSS SP-70. Valve ends shall be flanged in conformance with ASME B16.1. Valve construction shall be outside screw and yoke (OS&Y) type. Make packing of non-asbestos type materials.

#### 2.4.5 Standard Check Valves (SCV)

Standard check valves in sizes 2 inches and smaller shall be 125-psi swing check conforming to MSS SP-71, except as otherwise specified. Provide lift checks where indicated. Swing-check pins shall be nonferrous and suitably hard for the service. Discs shall be composition type. Swing-check angle of closure shall be manufacturer's standard unless a specific angle is needed.

Check valves in sizes 2-1/2 inches and larger shall be cast iron, bronze trim, swing type. Valve bodies shall be cast iron, conforming to ASTM A126, Class A. Valve ends shall be flanged in conformance with ASME B16.1. Swing-check pin shall be AISI Type or approved equal corrosion-resistant steel. Angle of closure shall be manufacturer's standard unless a specific angle is needed. Valves shall have bolted and gasketed covers.

Provide check valves with external spring-loaded, positive-closure devices and valve ends shall be flanged.

#### 2.4.6 Nonslam Check Valves (NSV)

Check valves at pump discharges in sizes 2 inches and larger shall be nonslam or silent-check type conforming to MSS SP-125. Valve disc or plate shall close before line flow can reverse to eliminate slam and water-hammer due to check-valve closure. Valve shall be Class 125 rated for 200-psi maximum, nonshock pressure at 150 degrees F in sizes to 12 inches. Valves shall be wafer type to fit between flanges conforming to ASME B16.1 .



Valve body may be cast iron, conforming to ASTM A278/A278M, Class 40 or equivalent strength ductile iron. Disks shall be manufacturer's standard bronze, aluminum bronze, or corrosion-resistant steel. Pins, springs, and miscellaneous trim shall be manufacturer's standard corrosion-resistant steel. Disk and shaft seals shall be Buna-N elastomer tetrafluoroethylene.

## 2.5 MISCELLANEOUS MATERIALS

### 2.5.1 Bituminous Coating

Bituminous coating shall be a solvent cutback, heavy-bodied material to produce not less than a 12-mil dry-film thickness in one coat, and shall be as recommended by the manufacturer to be compatible with factory-applied coating and rubber joints.

For previously coal-tar coated and uncoated ferrous surfaces underground, bituminous coating shall be solvent cutback coal-tar type, conforming to MIL-C-18480.

### 2.5.2 Bolting

Flange and general purpose bolting shall be hex-head and must conform to ASTM A307, Grade B (bolts, for flanged joints in piping systems where one or both flanges are cast iron). Heavy hex-nuts shall conform to ASTM A563. Square-head bolts and nuts are not acceptable. Threads shall be coarse-thread series.

### 2.5.3 Elastomer Caulk

Polysulfide- or polyurethane-base elastomer caulking material shall be two-component type, conforming to ASTM C920.

### 2.5.4 Escutcheons

Escutcheons shall be manufactured from nonferrous metals and chrome-plated except when AISI 300 series corrosion-resistant steel is provided. Metals and finish shall conform to ASME A112.19.2/CSA B45.1.

Escutcheons shall be one-piece type where mounted on chrome-plated pipe or tubing, and one-piece of split-pattern type elsewhere. All escutcheons shall have provisions consisting of internal spring-tension devices for maintaining a fixed position against a surface.

### 2.5.5 Flashing

Sheet lead shall conform to ASTM B749, UNS Alloy Number L50049

Sheet copper shall conform to ASTM B370 and be of not less than 16 ounces per square foot weight.

### 2.5.6 Flange Gaskets

Compressed non-asbestos sheet, conforming to ASTM F 104, coated on both sides with graphite or similar lubricant, with nitrile composition, binder rated to 750 degrees F.

### 2.5.7 Grout

Shrink-resistant grout shall be a premixed and packaged metallic-aggregate,

mortar-grouting compound conforming to ASTM C404 and ASTM C476.

Shrink-resistant grout shall be a combination of premeasured and packaged epoxy polyamide or amine resins and selected aggregate mortar grouting compound conforming to the following requirements:

|                      |                 |  |
|----------------------|-----------------|--|
| Tensile strength     |                 | 1,900 psi, minimum                           |
| Compressive strength | ASTM C109/C109M | 14,000 psi, minimum                          |
| Shrinkage, linear    |                 | 0.00012 inch per inch, maximum               |
| Water absorption     | ASTM C67        | 0.1 percent, maximum                         |
| Bond strength to     |                 | 1,000 psi, minimum steel in shear<br>minimum |

#### 2.5.8 Pipe Thread Compounds

Use tetrafluoroethylene tape not less than 2 to 3 mils thick in potable and process water and in chemical systems for pipe sizes to and including 1-inch ips. Tetrafluoroethylene dispersions and other suitable compounds shall be used for all other applications upon approval by the Contracting Officer; however, no lead-containing compounds shall be used in potable water systems.

#### 2.6 SUPPORTING ELEMENTS

Provide all necessary piping systems and equipment supporting elements, including but not limited to: building structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; guides; and spring-cushion, variable, or constant supports. All supporting elements shall be suitable for stresses imposed by systems pressures and temperatures and natural and other external forces normal to this facility without damage to supporting element system or to work being supported.

Supporting elements shall conform to requirements of ASME B31.3, MSS SP-58, and MSS SP-69 except as noted.

Attachments welded to pipe shall be made of materials identical to that of pipe or materials accepted as permissible raw materials by referenced code or standard specification.

Supporting elements exposed to weather shall be hot-dip galvanized or stainless steel. Materials shall be of such a nature that their apparent and latent-strength characteristics are not reduced due to galvanizing process. Supporting elements in contact with copper tubing shall be electroplated with copper.

Type designations specified herein are based on MSS SP-58 and MSS SP-69. Masonry anchor group-, type-, and style-combination designations shall be in accordance with CID A-A-1922, CID A-A-1923, CID A-A-1924, CID A-A-1925 , CID A-A-55614, and CID A-A-55615. Support elements, except for supplementary steel, shall be cataloged, load rated, commercially manufactured products.

## 2.6.1 Building Structure Attachments

### 2.6.1.1 Anchor Devices, Concrete and Masonry

Anchor devices shall conform to CID A-A-1922, CID A-A-1923, CID A-A-1924, CID A-A-1925 , CID A-A-55614, and CID A-A-55615

Cast-in, floor mounted, equipment anchor devices shall provide adjustable positions.

Powder-actuated anchoring devices shall not be used to support any mechanical systems components.

### 2.6.1.2 C-Clamps

Do not use C-clamps.

### 2.6.1.3 Inserts, Concrete

Concrete inserts shall be MSS SP-58 Type 18. When applied to piping in sizes 2 inches ips and larger and where otherwise required by imposed loads, insert and wire a 1-foot length of 1/2-inch reinforcing rod through wing slots. Submit proprietary-type continuous inserts for approval.

## 2.6.2 Horizontal Pipe Attachments

### 2.6.2.1 Single Pipes

Support piping in sizes to and including 2-inch ips by MSS SP-58 Type 6 solid malleable iron pipe rings, except that split-band-type rings shall be used in sizes up to 1-inch ips.

Support piping in sizes through 8-inch ips inclusive by MSS SP-58 Type 1 attachments.

MSS SP-58 Type 1 and Type 6 assemblies shall be used on vapor-sealed insulated piping and shall have an inside diameter larger than pipe being supported to provide adequate clearance during pipe movement.

Where thermal movement of a point in a piping system 4 inches and larger would cause a hanger rod to deflect more than 4 degrees from the vertical or where a horizontal point movement exceeds 1/2 inch, MSS SP-58 Type 41 pipe rolls shall be used.

MSS SP-58 Type 40 shields shall be used on all insulated piping. Area of the supporting surface shall be such that compression deformation of insulated surfaces does not occur. Longitudinal and transverse shield edges shall be rolled away from the insulation.

Provide insulated piping without vapor barrier on roll supports with MSS SP-58 Type 39 saddles.

Spring supports shall be as indicated.

#### 2.6.2.2 Parallel Pipes

Trapeze hangers fabricated from structural steel shapes, with U-bolts, shall be used in congested areas and where multiple pipe runs occur. Structural steel shapes shall conform to supplementary steel requirements

#### 2.6.3 Vertical Pipe Attachments

Vertical pipe attachments shall be MSS SP-58 Type 8.

Shop drawing data shall include complete fabrication and attachment details of any spring supports.

#### 2.6.4 Hanger Rods and Fixtures

Only circular cross section rod hangers shall be used to connect building structure attachments to pipe support devices. Pipe, straps, or bars of equivalent strength shall be used for hangers only where approved by the Contracting Officer.

Turnbuckles, swing eyes, and clevises shall be provided as required by support system to accommodate temperature change, pipe accessibility, and adjustment for load and pitch. Rod couplings are not acceptable.

#### 2.6.5 Supplementary Steel

Where it is necessary to frame structural members between existing members or where structural members are used in lieu of commercially rated supports, design and fabricate such supplementary steel in accordance with AISC 325.

### PART 3 EXECUTION

#### 3.1 PIPE INSTALLATION

Submit certificates for pipes, valves and specialties showing conformance with test requirements as contained in the reference standards contained in this section. Certificates shall verify Surface Resistance, Shear and Tensile Strengths, Temperature Ratings, Bending Tests, Flattening Tests and Transverse Guided Weld Bend Tests.

Test reports for Hydrostatic Tests, Air Tests, Valve-Operating Tests, Drainage Tests, and System Operation Tests shall be provided by the Contractor, in compliance with referenced standards contained within this section.

Fabricate and install piping systems in accordance with ASME B31.3, MSS SP-69, and AWS WHB-2.9.

Submit Installation Drawings for pipes, valves and specialties. Drawings shall include the manufacturer's design and construction calculations, forces required to obtain rated axial, lateral, or angular movements, installation criteria, anchor and guide requirements for equipment, and equipment room layout and design. Drawings shall specifically advise on procedures to be followed and provisions required to protect expansion joints during specified hydrostatic testing operations.

Connections between steel piping and copper piping shall be electrically isolated from each other with dielectric couplings (or unions) rated for

the service.

Make final connections to equipment with unions provided every 100 feet of straight run. Provide unions in the line downstream of screwed- and welded-end valves.

Ream all pipe ends before joint connections are made.

Screwed joints shall be made up with specified joint compound and not more than three threads shall show after joint is made up.

Apply joint compounds to the male thread only and exercise care to prevent compound from reaching the unthreaded interior of the pipe.

Provide screwed unions, welded unions, or bolted flanges wherever required to permit convenient removal of equipment, valves, and piping accessories from the piping system for maintenance.

Securely support piping systems with due allowance for thrust forces, thermal expansion and contraction, and shall not be subjected to mechanical, chemical, vibrational or other damage as specified in ASME B31.3.

Field welded joints shall conform to the requirements of the AWS WHB-2.9, ASME B31.3, and ASME BPVC SEC IX.

### 3.2 VALVES

Provide valves in piping mains and all branches and at equipment where indicated and as specified.

Provide valves to permit isolation of branch piping and each equipment item from the balance of the system.

Riser and downcomer drains above piping shutoff valves in piping 2-1/2 inches and larger shall be provided. Tap and fit shutoff valve body with a 1/2-inch plugged globe valve.

Valves unavoidably located in furred or other normally inaccessible places shall be provided with access panels adequately sized for the location and located so that concealed items may be serviced, maintained, or replaced.

### 3.3 SUPPORTING ELEMENTS INSTALLATION

Provide supporting elements in accordance with the referenced codes and standards.

Support piping from building structure. No piping shall be supported from roof deck or from other pipe.

Piping shall run parallel with the lines of the building. Space and install piping and components so that a threaded pipe fitting may be removed between adjacent pipes and so that there shall be no less than 1/2 inch of clear space between the finished surface and other work and between the finished surface of parallel adjacent piping. Hangers on different adjacent service lines running parallel with each other shall be arranged to be in line with each other and parallel to the lines of the building.

Install piping support elements at intervals specified hereinafter, at locations not more than 3 feet from the ends of each runout, and not over 1 foot from each change in direction of piping.

Load rating for all pipe-hanger supports shall be based on insulated weight of lines filled with water and forces imposed. Deflection per span shall not exceed slope gradient of pipe. Supports shall be in accordance with the following minimum rod size and maximum allowable hanger spacing for specified pipe. For concentrated loads such as valves, the allowable span must be reduced proportionately:

| PIPE SIZE<br><u>INCHES</u> | ROD SIZE<br><u>INCHES</u> | STEEL PIPE<br><u>FEET</u> | COPPER PIPE<br><u>FEET</u> |
|----------------------------|---------------------------|---------------------------|----------------------------|
| 1 and smaller              | 3/8                       | 8                         | 6                          |
| 1-1/4 to 1-1/2             | 3/8                       | 10                        | 8                          |
| 2                          | 3/8                       | 10                        | 8                          |
| 2-1/2 to 3-1/2             | 1/2                       | 12                        | 12                         |
| 4 to 5                     | 5/8                       | 16                        | 14                         |
| 6                          | 3/4                       | 16                        | 16                         |

Provide vibration isolation supports where needed. Refer to Section 23 05 48.00 40 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT where A/C equipment and piping is installed.

Vertical risers shall be supported independently of connected horizontal piping, whenever practicable, with fixed or spring supports at the base and at intervals to accommodate system range of thermal conditions. Risers shall be guided for lateral stability. For risers subject to expansion, provide only one rigid support at a point approximately one-third down from the top. Place clamps under fittings unless otherwise specified. Support carbon-steel pipe at each floor and at not more than 15-foot intervals for pipe 2 inches and smaller and at not more than 20-foot intervals for pipe 2-1/2 inches and larger.

### 3.4 PENETRATIONS

Effective sound stopping and adequate operating clearance shall be provided to prevent structure contact where piping penetrates walls, floors, or ceilings into occupied spaces adjacent to equipment rooms; where similar penetrations occur between occupied spaces; and where penetrations occur from pipe chases into occupied spaces. Occupied spaces shall include space above ceilings where no special acoustic treatment of ceiling is provided. Penetrations shall be finished to be compatible with surface being penetrated.

Sound stopping and vapor-barrier sealing of pipe shafts and large floor and wall openings shall be accomplished by packing to high density with properly supported fibrous-glass insulation or, where ambient or surface temperatures do not exceed 120 degrees F, by foaming-in-place with self-extinguishing, 2-pound density polyurethane foam to a depth not less than 6 inches. Foam shall be finished with a rasp. Vapor barrier shall be

not less than 1/8-inch thick vinyl coating applied to visible and accessible surfaces. Where high temperatures and fire stopping are a consideration, only mineral wool shall be used and openings must also be covered with 16-gage sheet metal.

### 3.5 SLEEVES

Provide sleeves where piping passes through roofs, masonry, concrete walls and floors.

Sleeves passing through steel decks shall be continuously brazed to the deck.

Sleeves that extend through floors, roofs, load bearing walls, and fire barriers shall be continuous and fabricated from Schedule 40 steel pipe, with welded anchor lugs. All other sleeves shall be formed by molded linear polyethylene liners or similar materials that are removable. Diameter of sleeves shall be large enough to accommodate pipe, insulation, and jacketing without touching the sleeve and shall provide a minimum 3/8-inch clearance. Sleeve size must accommodate mechanical and thermal motion of pipe to preclude transmission of vibration to walls and the generation of noise.

Space between a pipe, bare or insulated, and the inside of a pipe sleeve or a construction surface penetration shall be packed solid with a mineral fiber conforming to ASTM C553 Type V (flexible blanket), (to 1,000 degrees F). Provide this packing wherever the piping passes through firewalls, equipment room walls, floors, and ceilings connected to occupied spaces, and other locations where sleeves or construction-surface penetrations occur between occupied spaces. Where sleeves or construction surface penetrations occur between conditioned and unconditioned spaces, the space between a pipe, bare or insulated, and the inside of a pipe sleeve or construction surface penetration shall be filled with an elastomer caulk to a depth of 1/2 inch. All surfaces to be calked shall be oil- and grease-free.

Through-Penetration fire stop materials and methods shall be in accordance with ASTM E 814 and UL 1479.

Exterior wall sleeves shall be calked watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed metal components.

### 3.6 ESCUTCHEONS

Provide escutcheons at all penetrations of piping into finished areas. Where finished areas are separated by partitions through which piping passes, provide escutcheons on both sides of the partition. Where suspended ceilings are installed, provide plates at the underside only of such ceilings. For insulated pipes, the plates shall be large enough to fit around the insulation. Escutcheons shall be chrome-plated in all occupied spaces and of size sufficient to effectively conceal openings in building construction. Firmly attach escutcheons with setscrews.

### 3.7 FLASHINGS

Provide flashings at penetrations of building boundaries by mechanical

systems and related work.

### 3.8 UNDERGROUND PIPING INSTALLATION

Prior to being lowered into a trench, all piping shall be cleaned, visually inspected for apparent defects, and tapped with a hammer to audibly detect hidden defects.

Suspect cast-ferrous piping shall be further inspected by painting with kerosene on external surfaces to reveal cracks.

Distinctly mark defective materials found using a road-traffic quality yellow paint; promptly remove defective material from the site.

After conduit has been inspected, and not less than 48 hours prior to being lowered into a trench, all external surfaces of cast ferrous conduit shall be coated with a compatible bituminous coating for protection against brackish ground water. Application shall be single coat, in accordance with the manufacturer's instructions, to result in a dry-film thickness of not less than 12 mils.

Excavations shall be dry and clear of extraneous materials when pipe is being laid.

Cutting of piping shall be by wheel cutters or other machines designed specifically for that purpose. Electric-arc and oxyacetylene cutting will not be permitted.

Laying of pipe shall begin at the low point of a system. When in final acceptance position, it shall be true to the grades and alignment indicated, with unbroken continuity of invert. Blocking and wedging will not be permitted.

Bell or grooved ends of piping shall point upstream.

Make changes in direction with long sweep fittings.

Necessary socket clamping, piers, bases, anchors, and thrust blocking shall be provided. Protect rods, clamps, and bolting with a coating of bitumen.

Underground piping below supported or suspended slabs shall be supported from the slab with a minimum of two supports per length of pipe. Protect supports with a coating of bitumen.

On excavations that occur near and below building footings, the backfilling material shall consist of 2,000-psi cured compressive-strength concrete poured or pressure-grouted up to the level of the footing.

### 3.9 HEAT TRACE CABLE INSTALLATION

Heater tape shall be field applied and cut to fit as necessary, linearly along the length of pipe after piping has been pressure tested and approved by the Contracting Officer. Secure the heater to piping with cable ties. Thermal insulation shall be labeled on the outside, "Electrical Heat Trace."

Power connection, end seals, splice kits and tee kit components shall be installed in accordance with IEEE 515 to provide a complete workable



system. Connection to the thermostat and ends of the heat tape shall be terminated in a junction box. Cable and conduit connections shall be raintight.

### 3.10 HEAT TRACE CABLE TESTS

Test heat trace cable system in accordance with IEEE 515 after installation and before and after installation of the thermal insulation. Test heater cable using a 1000 vdc megger. Minimum insulation resistance shall be 20 to 1000 megohms regardless of cable length.

### 3.11 OPERATION AND MAINTENANCE

Operation and Maintenance Manuals shall be consistent with manufacturer's standard brochures, schematics, printed instructions, general operating procedures and safety precautions. Test data shall be clear and readily legible.

-- End of Section --

## SECTION 23 05 48.00 40

## VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

02/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S2.71 (1983; R 2006) Guide to the Evaluation of Human Exposure to Vibration in Buildings

## NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB PROCEDURAL STANDARDS (2005) Procedural Standards for TAB (Testing, Adjusting and Balancing) Environmental Systems

## 1.2 GENERAL REQUIREMENTS

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS applies to work specified in this section to the extent applicable.

Section 23 05 15 COMMON PIPING FOR HVAC applies to work specified in this section to the extent applicable.

All vibration-control apparatus must be the product of a single manufacturing source, where possible. Human exposure levels should be considered using ASA S2.71 and NEBB PROCEDURAL STANDARDS.

Scheduled isolation mounting is in inches and is a minimum static deflection.

Spans referred to in Part 2, "Vibration-Isolation Systems Application," must mean longest bay dimension.

Determine exact mounting sizes and number of isolators by the isolator manufacturer based on equipment that will be installed. Check equipment revolutions per minute (rpm) and spring deflections to verify that resonance cannot occur.

Five working days prior to commencement of installation, submit installation drawings for vibration isolator systems including equipment and performance requirements.

Indicate within outline drawings for vibration isolator systems, overall physical features, dimensions, ratings, service requirements, and weights of equipment.

Within ten working days of Contract Award, submit equipment and performance data for vibration isolator systems including equipment base design; inertia-block mass relative to support equipment weight; spring

loads and free, operating, and solid heights of spring; spring diameters; nonmetallic isolator loading and deflection; disturbing frequency; natural frequency of mounts; deflection of working member; and anticipated amount of physical movement at the reference points.

Ensure data includes the following:

- a. Mountings
- b. Bases
- c. Isolators
- d. Floor-Mounted Piping
- e. Vertical Piping

### 1.3 SUBMITTALS

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

SD-03 Product Data

Equipment and Performance Data

SD-06 Test Reports

Type of Isolator

Type of Base

Allowable Deflection

Measured Deflection

## PART 2 PRODUCTS

### 2.1 TYPE OF VIBRATION-ISOLATION PROVISIONS

Design for vibration isolation using NEBB PROCEDURAL STANDARDS as applicable to the following sections.

Submit test reports for testing vibration isolation for each type of isolator and each type of base, and meet referenced standards contained within this section. Include in test reports allowable deflection and measured deflection also meeting referenced standards within this section.

#### 2.1.1 Materials

Rubber must be natural rubber. Elastomer must be chloroprene. Shore A durometer measurement of both materials and range between 40 and 60.

Inorganic materials such as precompressed, high-density, fibrous glass encased in a resilient moisture-impervious membrane may be used in lieu of specified natural rubber and elastomers. Where this substitution is made, ensure specified deflections are modified by the manufacturing source to

accommodate physical characteristics of inorganic materials and to provide equal or better vibration isolation.

Ensure weather-exposed metal vibration-isolator parts are corrosion protected. Chloroprene coat springs.

### 2.1.2 Mountings

Provide the following mountings:

Type A: Composite pad, with 0.25-inch thick elastomer top and bottom layers, molded to contain a pattern with nonslip characteristics in all horizontal directions. Elastomer loading must not exceed 40 pounds per square inch (psi). Minimum overall thickness must be 1 inch. Maximum deflections up to 0.25-inch are allowed.

Type F: Combination elastomer-in-shearsteel framed for hanger-rod mounting. Minimum total static deflection must be 1 inch.

## 2.2 VIBRATION-ISOLATION SYSTEMS APPLICATION

Vibration isolation design per NEBB PROCEDURAL STANDARDS

### 2.2.1 Centrifugal Pump Locations

| TYPE<br>EQUIPMENT                       | BASEMENT<br>BELOW-GRADE<br>PROVISIONS* | ON GRADE<br>20-FOOT<br>FLOOR-SPAN | ON GRADE<br>30-FOOT<br>FLOOR-SPAN | ON GRADE<br>40-FOOT<br>FLOOR-SPAN |
|---|--|-----------------------------------|-----------------------------------|-----------------------------------|
|   |  | PROVISIONS*                       | PROVISIONS*                       | PROVISIONS*                       |
| Close-<br>couple<br>through<br>5 hp     | None                                   | -R-0.35                           | C-S-1.0                           | C-S-1.0                           |
| Bedplate-<br>mounted<br>through<br>5 hp | None                                   | C-CIB-1.0                         | C-CIB-1.5                         | C-CIB-1.75                        |
| 7-1/2 hp                                | None                                   | C-CIB-1.0                         | C-CIB-1.75                        | C-CIB-2.5                         |

\*TYPE OF MOUNTING, BASE, AND MINIMUM DEFLECTION IN INCHES

### 2.2.2 Low-Pressure Suspended Air-Handling Unit (AHU) Locations

Vibration-isolation provisions apply to ceiling-suspended Air Moving and Conditioning Association Class A packaged central-station units.

| TYPE EQUIPMENT                      | 20-FOOT<br>ROOF-SPAN | 30-FOOT<br>ROOF-SPAN | 40-FOOT<br>ROOF-SPAN |
|-------------------------------------|----------------------|----------------------|----------------------|
|                                     | PROVISIONS*          | PROVISIONS*          | PROVISIONS*          |
| Through 5 hp                        | F-U-1.0              | F-U-1.0              | F-U-1.0              |
| 7-1/2 hp and over<br>250 to 500 rpm | F-U-1.75             | F-U-1.75             | F-U-1.75             |

| <u>TYPE EQUIPMENT</u> | <u>20-FOOT<br/>ROOF-SPAN<br/>PROVISIONS*</u> | <u>30-FOOT<br/>ROOF-SPAN<br/>PROVISIONS*</u> | <u>40-FOOT<br/>ROOF-SPAN<br/>PROVISIONS*</u> |
|-----------------------|--|--|--|
| 500 rpm and over      | F-U-1.0                                      | F-U-1.25                                     | F-U-1.55                                     |

\*TYPE OF MOUNTING, BASE, AND MINIMUM DEFLECTION IN INCHES

### 2.2.3 Low-Pressure AHU Locations

Vibration-isolation provisions apply to floor-mounted Air Moving and Conditioning Association Class A packaged central-station units.

| <u>TYPE<br/>EQUIPMENT</u>                 | <u>BASEMENT<br/>BELOW-GRADE<br/>PROVISIONS*</u> | <u>ON GRADE<br/>20-FOOT<br/>FLOOR-SPAN<br/>PROVISIONS*</u> | <u>ON GRADE<br/>30-FOOT<br/>FLOOR-SPAN<br/>PROVISIONS*</u> | <u>ON GRADE<br/>40-FOOT<br/>FLOOR-SPAN<br/>PROVISIONS*</u> |
|---|---|--|--|--|
| Through<br>5 hp                           | B-U-0.35  | C-U-1.0  | C-U-1.0  | C-U-1.0  |
| 7-1/2 hp<br>and over<br>250 to<br>500 rpm | B-U-0.35  | C-U-1.75   | C-U-1.75   | C-U-1.75   |
| 500 rpm                                   | B-U-0.35  | C-U-1.0  | C-U-1.5  |  |

\*TYPE OF MOUNTING, BASE, AND MINIMUM DEFLECTION IN INCHES

## 2.3 PIPE AND DUCT VIBRATION ISOLATION

Type G: Provide isolators with in-series contained steel springs and preformed fibrous-glass or chloroprene-elastomer elements for connecting to building-structure attachments. Load devices by supported system during operating conditions to produce a minimum spring and elastomer static deflection of 1 inch and 3/8 inch, respectively.

### 2.3.1 Floor-Mounted Piping

Type K: Provide isolators with springs mounted on floor-supported columns or directly on the floor. Load devices by supported system during operating conditions to produce a minimum spring static deflection of 1 inch.

### 2.3.2 Vertical Piping

Type L: Provide isolators which are pipe base-support devices with one or more contained steel springs. Load devices by supported system during operating conditions to produce a minimum static deflection of 1 inch. Equip devices with precompression and vertical-limit features, as well as a minimum 1/4-inch thick elastomer sound pad and isolation washers, for mounting to floor.

Type M: Isolators must be elastomer mounted baseplate and riser pipe-guide devices. Elastomer elements must be contained double acting, and elastomers under rated load must have a minimum static

deflection of 3/8 inch. Size isolator to accommodate thermal insulation within the stationary guide ring.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Install equipment in accordance with manufacturer's recommendations.

#### 3.2 TESTS AND REPORTS

Ensure vibration-isolation devices are deflection tested. Submit test reports in accordance with paragraph entitled, "Submittal Procedures," substantiating that all equipment has been isolated as specified and that minimum specified deflections have been met. Make all measurements in the presence of the Contracting Officer.

-- End of Section --

## SECTION 23 05 93

## TESTING, ADJUSTING, AND BALANCING FOR HVAC

08/09

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S1.11 (2004; Errata 2005; R 2009) Specification for Octave- Band and Fractional-Octave-Band Analog and Digital Filters (ASA 65)

ASA S1.4 (1983; Amendment 1985; R 2006) Specification for Sound Level Meters (ASA 47)

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

ASHRAE HVAC APP IP HDBK (2011) HVAC Applications Handbook, I-P Edition

## ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 (2002; 6th ed) National Standards for Total System Balance

AABC MN-4 (1996) Test and Balance Procedures

## NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB MASV (2006) Procedural Standards for Measurements and Assessment of Sound and Vibration

NEBB PROCEDURAL STANDARDS (2005) Procedural Standards for TAB (Testing, Adjusting and Balancing) Environmental Systems

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

SMACNA 1143 (1985) HVAC Air Duct Leakage Test Manual, 1st Edition

SMACNA 1780 (2002) HVAC Systems - Testing, Adjusting and Balancing, 3rd Edition

SMACNA 1858 (2004) HVAC Sound And Vibration Manual - First Edition

## 1.2 DEFINITIONS

- a. AABC: Associated Air Balance Council.
- b. COTR: Contracting Officer's Technical Representative.
- c. DALT: Duct air leakage test
- d. DALT'd: Duct air leakage tested
- e. HVAC: Heating, ventilating, and air conditioning; or heating, ventilating, and cooling.
- f. NEBB: National Environmental Balancing Bureau
- g. Out-of-tolerance data: Pertains only to field acceptance testing of Final DALT or TAB report. When applied to DALT work, this phase means "a leakage rate measured during DALT field acceptance testing which exceeds the leakage rate allowed by Appendix D REQUIREMENTS FOR DUCT AIR LEAK TESTING." When applied to TAB work this phase means "a measurement taken during TAB field acceptance testing which does not fall within the range of plus 5 to minus 5 percent of the original measurement reported on the TAB Report for a specific parameter."
- h. Season of maximum heating load: The time of year when the outdoor temperature at the project site remains within plus or minus 30 degrees Fahrenheit of the project site's winter outdoor design temperature, throughout the period of TAB data recording.
- i. Season of maximum cooling load: The time of year when the outdoor temperature at the project site remains within plus or minus 5 degrees Fahrenheit of the project site's summer outdoor design temperature, throughout the period of TAB data recording.
- j. Season 1, Season 2: Depending upon when the project HVAC is completed and ready for TAB, Season 1 is defined, thereby defining Season 2. Season 1 could be the season of maximum heating load, or the season of maximum cooling load.
- k. Sound measurements terminology: Defined in AABC MN-1, NEBB MASV, or SMACNA 1858 (TABB).
- l. TAB: Testing, adjusting, and balancing (of HVAC systems).
- m. TAB'd: HVAC Testing/Adjusting/Balancing procedures performed.
- n. TAB Agency: TAB Firm
- o. TAB team field leader: TAB team field leader
- p. TAB team supervisor: TAB team engineer.
- q. TAB team technicians: TAB team assistants.
- r. TABB: Testing Adjusting and Balancing Bureau.



### 1.2.1 Similar Terms

In some instances, terminology differs between the Contract and the TAB Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results.

The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding AABC, NEBB, or TABB requirements where differences exist.

#### SIMILAR TERMS

| Contract Term                 | AABC<br>Term   | NEBB<br>Term   | TABB<br>Term   |
|-------------------------------|--|--|--|
| TAB Standard                  | National Standards<br>for<br>Testing and Balancing<br>Heating, Ventilating,<br>and Air Conditioning<br>Systems | Procedural Standards<br>for<br>Testing, Adjusting<br>and Balancing of<br>Environmental Systems | International<br>Standards for<br>Environmental<br>Systems Balance |
| TAB Specialist                | TAB Engineer   | TAB Supervisor   | TAB Supervisor   |
| Systems<br>Readiness<br>Check | Construction Phase<br>Inspection   | Field Readiness<br>Check & Preliminary<br>Field Procedures.                                    | Field<br>Readiness<br>Check &<br>Prelim.<br>Field<br>Procedures    |

### 1.3 WORK DESCRIPTION

The work includes testing, adjusting, and balancing (TAB) of new and existing heating, ventilating, and cooling (HVAC) air and water distribution systems including ducts, and piping which are located within, on, under, between, and adjacent to buildings.

Perform TAB in accordance with the requirements of the TAB procedural standard recommended by the TAB trade association that approved the TAB Firm's qualifications. Comply with requirements of AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 (TABB) as supplemented and modified by this specification section. All recommendations and suggested practices contained in the TAB procedural standards are considered mandatory.

Conduct TAB of the indicated existing systems and equipment and submit the specified DALT and TAB reports for approval. Conduct TAB work in accordance with the requirements of this section.

#### 1.3.1 Air Distribution Systems

Test, adjust, and balance systems (TAB) in compliance with this section. Obtain Contracting Officer's written approval before applying insulation to exterior of air distribution systems as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

### 1.3.2 Water Distribution Systems

TAB systems in compliance with this section. Obtain Contracting Officer's written approval before applying insulation to water distribution systems as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. At Contractor's option and with Contracting Officer's written approval, the piping systems may be insulated before systems are TAB'd.

Terminate piping insulation immediately adjacent to each flow control valve, automatic control valve, or device. Seal the ends of pipe insulation and the space between ends of pipe insulation and piping, with waterproof vapor barrier coating.

After completion of work under this section, insulate the flow control valves and devices as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

### 1.3.3 Related Requirements

## 1.4 SUBMITTALS

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

### SD-07 Certificates

Independent TAB agency and personnel qualifications

Advance Notice of Season 1 TAB Field Work

Completed Season 1 Pre-TAB Work Checklist

## 1.5 QUALITY ASSURANCE

### 1.5.1 Independent TAB Agency and Personnel Qualifications

To secure approval for the proposed agency, submit information certifying that the TAB agency is a first tier subcontractor who is not affiliated with any other company participating in work on this contract, including design, furnishing equipment, or construction. Further, submit the following, for the agency, to Contracting Officer for approval:

#### a. Independent AABC or NEBB or TABB TAB agency:

TAB agency: AABC registration number and expiration date of current certification; or NEBB certification number and expiration date of current certification; or TABB certification number and expiration date of current certification.

TAB team supervisor: Name and copy of AABC or NEBB or TABB TAB supervisor certificate and expiration date of current certification.

TAB team field leader: Name and documented evidence that the team field leader has satisfactorily performed full-time supervision of TAB work in the field for not less than 3 years immediately preceding this contract's bid opening date.

TAB team field technicians: Names and documented evidence that each field technician has satisfactorily assisted a TAB team field leader in performance of TAB work in the field for not less than one year immediately preceding this contract's bid opening date.

Current certificates: Registrations and certifications are current, and valid for the duration of this contract. Renew Certifications which expire prior to completion of the TAB work, in a timely manner so that there is no lapse in registration or certification. TAB agency or TAB team personnel without a current registration or current certification are not to perform TAB work on this contract.

- b. TAB Team Members: TAB team approved to accomplish work on this contract are full-time employees of the TAB agency. No other personnel is allowed to do TAB work on this contract.
- c. Replacement of TAB team members: Replacement of members may occur if each new member complies with the applicable personnel qualifications and each is approved by the Contracting Officer.

## 1.6 PROJECT/SITE CONDITIONS

### 1.6.1 TAB Services to Obtain Existing Conditions

Conduct TAB of the indicated existing systems and equipment and submit the specified TAB reports for approval. Conduct this TAB work in accordance with the requirements of this section.

## 1.7 SEQUENCING AND SCHEDULING

### 1.7.1 TAB Submittal and Work Schedule

Comply with additional requirements specified in Appendix C: TAB SUBMITTAL AND WORK SCHEDULE included at the end of this section

### 1.7.2 TAB Submittal and Work Schedule

Submit this schedule, and TAB Schematic Drawings, adapted for this particular contract, to the Contracting Officer (CO) for review and approval. Include with the submittal the planned calendar dates for each submittal or work item. Resubmit an updated version for CO approval every 90 calendar days. Compliance with the following schedule is the Contractor's responsibility.

Qualify TAB Personnel: Within 45 calendar days after date of contract award, submit TAB agency and personnel qualifications.

PreTAB Meeting: Within 30calendar days after the date of approval of the TAB agency and personnel, meet with the COTR.

Design Review Report: Within 60 calendar days after the date of the TAB agency personnel qualifications approval, submit design review report.

Pre-Field TAB Engineering Report: Within 30 calendar days after approval of the TAB agency Personnel Qualifications, submit the Pre-Field TAB Engineering Report.

Prerequisite HVAC Work Check Out List For Season 1 and Advanced Notice For Season 1 TAB Field Work: At a minimum of 115 calendar days prior to CCD, submit Season 1 prerequisite HVAC work check out list certified as complete, and submit advance notice of commencement of Season 1 TAB field work.

Season 1 TAB Field Work: At a minimum of 90 calendar days prior to CCD, and when the ambient temperature is within Season 1 limits, accomplish Season 1 TAB field work.

Submit Season 1 TAB Report: Within 15 calendar days after completion of Season 1 TAB field work, submit Season 1 TAB report.

Season 1 TAB Field Check: 30 calendar days after Season 1 TAB report is approved by the Contracting Officer, conduct Season 1 field check.

Complete Season 1 TAB Work: Prior to CCD, complete all TAB work

#### 1.7.2.1 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.

#### 1.7.2.2 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.

## 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 PRETAB MEETING

Meet with the Contracting Officer's technical representative (COTR) and the designing engineer of the HVAC systems to develop a mutual understanding relative to the details of the 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 TAB PROCEDURES

#### 3.3.1 TAB Field Work

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 10 percent of the design flow rates as specified or indicated on the contract documents.

That is, comply with the the requirements of AABC MN-1 , or SMACNA 1780 (TABB) and SMACNA 1858 (TABB), except as supplemented and modified by this section.

Provide instruments and consumables required to accomplish the TAB work. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 10 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.

#### 3.3.2 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.

#### 3.3.3 TAB Air Distribution Systems

##### 3.3.3.1 Units With Coils

Report heating and cooling performance capacity tests for hot water, chilled water, DX and steam coils for the purpose of verifying that the coils meet the indicated design capacity. Submit the following data and calculations with the coil test reports:

- a. For air handlers with capacities greater than 7.5 tons (90,000 Btu) cooling, such as factory manufactured units, central built-up units and rooftop units, conduct capacity tests in accordance with AABC MN-4, procedure 3.5, "Coil Capacity Testing."

Do not determine entering and leaving wet and dry bulb temperatures by single point measurement, but by the average of multiple readings in compliance with paragraph 3.5-5, "Procedures", (in subparagraph d.) of AABC MN-4, Procedure 3.5, "Coil Capacity Testing."

Submit part-load coil performance data from the coil manufacturer converting test conditions to design conditions; use the data for the purpose of verifying that the coils meet the indicated design capacity in compliance with AABC MN-4, Procedure 3.5, "Coil Capacity Testing," paragraph 3.5.7, "Actual Capacity Vs. Design Capacity" (in subparagraph c.).

- b. For units with capacities of 7.5 tons (90,000 Btu) or less, such as fan

coil units, duct mounted reheat coils associated with VAV terminal units, and unitary units, such as through-the-wall heat pumps:

Determine the apparent coil capacity by calculations using single point measurement of entering and leaving wet and dry bulb temperatures; submit the calculations with the coil reports.

### 3.3.3.2 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.

### 3.3.3.3 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.

### 3.3.3.4 Fan Coils

Fan coil unit systems including fans, coils, ducts, plenums, and air distribution devices for supply air, return air, and outside air.

### 3.3.3.5 Exhaust Fans

Exhaust fan systems including fans, ducts, plenums, grilles, and hoods for exhaust air.

## 3.3.4 TAB Water Distribution Systems

### 3.3.4.1 Chilled Water

Chilled water systems including chillers, condensers, cooling towers, pumps, coils, system balance valves and flow measuring devices.

For water chillers, report data as required by AABC, NEBB and TABB standard procedures, including refrigeration operational data.

### 3.3.4.2 Heating Hot Water

Heating hot water systems including boilers, hot water converters (e.g., heat exchangers), pumps, coils, system balancing valves and flow measuring devices.

## 3.3.5 Sound Measurement Work

### 3.3.5.1 Areas To Be Sound Measured

In the following spaces, measure and record the sound power level for each octave band listed in ASHRAE HVAC APP IP HDBK Noise Criteria:

- a. All HVAC mechanical rooms, including machinery spaces and other spaces containing HVAC power drivers and power driven equipment.
- b. All spaces sharing a common barrier with each mechanical room, including rooms overhead, rooms on the other side of side walls, and rooms beneath the mechanical room floor.

### 3.3.5.2 Procedure

Measure sound levels in each room, when unoccupied except for the TAB team, with all HVAC systems that would cause sound readings in the room operating in their noisiest mode. Record the sound level in each octave band. Attempt to mitigate the sound level and bring the level to within the specified ASHRAE HVAC APP IP HDBK noise criteria goals, if such mitigation is within the TAB team's control. State in the report the ASHRAE HVAC APP IP HDBK noise criteria goals. If sound level cannot be brought into compliance, provide written notice of the deficiency to the Contractor for resolution or correction.

### 3.3.5.3 Timing

Measure sound levels at times prescribed by AABC or NEBB or TABB.

### 3.3.5.4 Meters

Measure sound levels with a sound meter complying with ASA S1.4, Type 1 or 2, and an octave band filter set complying with ASA S1.11. Use measurement methods for overall sound levels and for octave band sound levels as prescribed by NEBB.

### 3.3.5.5 Calibration

Calibrate sound levels as prescribed by AABC or NEBB or TABB, except that calibrators emitting a sound pressure level tone of 94 dB at 1000 hertz (Hz) are also acceptable.

### 3.3.5.6 Background Noise Correction

Determine background noise component of room sound (noise) levels for each (of eight) octave bands as prescribed by AABC or NEBB or TABB.

## 3.3.6 TAB Work on Performance Tests Without Seasonal Limitations

### 3.3.6.1 Performance Tests

In addition to the TAB proportionate balancing work on the air distribution systems and the water distribution systems, accomplish TAB work on the HVAC systems which directly transfer thermal energy. TAB the operational performance of the heating systems and cooling systems.

### 3.3.6.2 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.

### 3.3.7 Workmanship

Conduct TAB work on the HVAC systems until measured flow rates are within plus or minus 10 percent of the design flow rates as specified or indicated on the contract documents. 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 and water 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.

### 3.3.8 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.

### 3.3.9 TAB Reports

Additional requirements for TAB Reports are specified in Appendix B REPORTS - DALT and TAB

### 3.3.10 Quality Assurance - COTR TAB Field Acceptance Testing

#### 3.3.10.1 TAB Field Acceptance Testing

During the field acceptance testing, verify, in the presence of the COTR, random selections of data (water, air quantities, air motion, sound level readings) recorded in the TAB Report. Points and areas for field acceptance testing are to be selected by the COTR. Measurement and test procedures are the same as approved for TAB work for the TAB Report.

Field acceptance testing includes verification of TAB Report data recorded for the following equipment groups:

Group 1: All chillers, boilers, return fans, computer room units, and air handling units (rooftop and central stations).

Group 2: 25 percent of the VAV terminal boxes and associated diffusers and registers.

Group 3: 25 percent of the supply diffusers, registers, grilles associated with constant volume air handling units.

Group 4: 25 percent of the return grilles, return registers, exhaust grilles and exhaust registers.

Group 5: 25 percent of the supply fans, exhaust fans, and pumps.

Further, if any data on the TAB Report for Groups 2 through 5 is found not to fall within the range of plus 5 to minus 5 percent of the TAB Report data, additional group data verification is required in the presence of the COTR. Verify TAB Report data for one additional piece of equipment in that group. Continue this additional group data verification until out-of-tolerance data ceases to be found.

### 3.3.10.2 Additional COTR TAB Field Acceptance Testing

If any of the acceptance testing measurements for a given equipment group is found not to fall within the range of plus 5 to minus 5 percent of the TAB Report data, terminate data verification for all affected data for that group. The affected data for the given group will be disapproved. Make the necessary corrections and prepare a revised TAB Report. Reschedule acceptance testing of the revised report data with the COTR.

### 3.3.10.3 Prerequisite for Approval

Compliance with the field acceptance testing requirements of this section is a prerequisite for the final Contracting Officer approval of the TAB Report submitted.

## 3.4 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.

## 3.5 MARKING OF TEST PORTS

The TAB team is to permanently and legibly mark and identify the location points of the duct test ports. If the ducts have exterior insulation, make these markings on the exterior side of the duct insulation. Show the location of test ports on the as-built mechanical drawings with dimensions given where the test port is covered by exterior insulation.

## 3.6 APPENDICES

Appendix A WORK DESCRIPTIONS OF PARTICIPANTS  
Appendix B REPORTS - DALT and TAB  
Appendix C DALT AND TAB SUBMITTAL AND WORK SCHEDULE  
Appendix D REQUIREMENTS FOR DUCT AIR LEAK TESTING

## Appendix A

## WORK DESCRIPTIONS OF PARTICIPANTS

The Contractor is responsible for ensuring compliance with all requirements of this specification section. However, the following delineation of specific work items is provided to facilitate and co-ordinate execution of the various work efforts by personnel from separate organizations.

## 1. Contractor

- a. HVAC documentation: Provide pertinent contract documentation to the TAB Firm, to include the following: the contract drawings and specifications; copies of the approved submittal data for all HVAC equipment, air distribution devices, and air/water measuring/balancing devices; the construction work schedule; and other applicable documents requested by the TAB Firm. Provide the TAB Firm copies of contract revisions and modifications as they occur.
- b. Schedules: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.
- c. Pre-DALT and TAB meeting: Arrange and conduct the Pre-DALT and TAB meeting. Ensure that a representative is present for the sheet metal contractor, the mechanical contractor, the electrical contractor, and the automatic temperature controls contractor.
- d. Coordinate Support: Provide and coordinate support personnel required by the TAB Firm in order to accomplish the DALT and TAB field work. Support personnel may include factory representatives, HVAC controls installers, HVAC equipment mechanics, sheet metal workers, pipe fitters, and insulators. Ensure support personnel are present at the work site at the times required.
- e. Correct Deficiencies: Ensure the notifications of Construction Deficiencies are provided as specified herein. Refer to the paragraph entitled "Construction Deficiencies." Correct each deficiency as soon as practical with the Contracting Officer, and submit revised schedules and other required documentation.
- f. Pre-TAB Work Checklists: Complete check out and debugging of HVAC equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating malfunctioning elements in the HVAC system installations, and verifying all adjustable devices are functioning as designed. Include as pre-TAB work checklist items, the deficiencies pointed out by the TAB team supervisor in the design review report.

Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's DALT and TAB Work Procedures Summary. Do not allow the TAB team to commence TAB field work until all of the following are completed.

- g. Give Notice of Testing: Submit advance notice of TAB field work accompanied by completed prerequisite HVAC Work List
- h. Insulation work: Ensure that no insulation is shall not be installed on ducts to be DALT'd until DALT work on the subject ducts is complete.

Ensure the duct and piping systems are properly insulated and vapor sealed upon the successful completion and acceptance of the DALT and TAB work.

2. TAB Team Supervisor

- a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical DALT and TAB procedures and TAB team field work.
- b. Schedule: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.
- c. Submittals: Provide the submittals specified herein.
- d. Pre-DALT/TAB meeting: Attend meeting with Contractor. Ensure TAB personnel that will be involved in the TAB work under this contract attend the meeting.
- e. Design Review Report: Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.
- f. Support required: Specify the technical support personnel required from the Contractor other than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the DALT and TAB Procedures Summary, the during the DALT or TAB field work.

Ensure the Contractor is properly notified and aware of all support personnel needed to perform the TAB work. Maintain communication with the Contractor regarding support personnel throughout the duration of the TAB field work, including the TAB field acceptance testing checking.

Ensure all inspections and verifications for the Pre-Final DALT and Pre-TAB Checklists are completely and successfully conducted before DALT and TAB field work is performed.

- g. Advance Notice: Monitor the completion of the duct system installations and provide the Advance Notice for Pre-Final DALT field work as specified herein.
- h. Technical Assistance: Provide technical assistance to the DALT and TAB field work.
- i. Deficiencies Notification: Ensure the notifications of Construction Deficiencies are provided as specified herein. Comply with requirements of the paragraph entitled "Construction Deficiencies." Resolve each deficiency as soon as practical and submit revised schedules and other required documentation.
- j. Procedures: Develop the required TAB procedures for systems or system components not covered in the TAB Standard.

3. TAB Team Field Leader

- a. Field manager: Manage, in the field, the accomplishment of the work specified in Part 3, "Execution."
- b. Full time: Be present at the contract site when DALT field work or TAB field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.
- c. Prerequisite HVAC work: Do not bring the TAB team to the contract site until a copy of the prerequisite HVAC work list, with all work items certified by the Contractor to be working as designed, reaches the office of the TAB Agency.

## Appendix B

## REPORTS - DALT and TAB

All submitted documentation must be typed, neat, and organized. All reports must have a waterproof front and back cover, a title page, a certification page, sequentially numbered pages throughout, and a table of contents. Tables, lists, and diagrams must be titled. Generate and submit for approval the following documentation:

1. DALT and TAB Work Execution Schedule

Submit a detailed schedule indicating the anticipated calendar date for each submittal and each portion of work required under this section. For each work entry, indicate the support personnel (such as controls provider, HVAC mechanic, etc.) that are needed to accomplish the work. Arrange schedule entries chronologically.

2. DALT and TAB Procedures Summary

Submit a detailed narrative describing all aspects of the DALT and TAB field work to be performed. Clearly distinguish between DALT information and TAB information. Include the following:

- a. A list of the intended procedural steps for the DALT and TAB field work from start to finish. Indicate how each type of data measurement will be obtained. Include what Contractor support personnel are required for each step, and the tasks they need to perform.
- b. A list of the project's submittals that are needed by the TAB Firm in order to meet this Contract's requirements.
- c. The schematic drawings to be used in the required reports, which may include building floor plans, mechanical room plans, duct system plans, and equipment elevations. Indicate intended TAB measurement locations, including where test ports need to be provided by the Contractor.
- d. The data presentation forms to be used in the report, with the preliminary information and initial design values filled in.
- e. A list of DALT and TAB instruments to be used, edited for this project, to include the instrument name and description, manufacturer, model number, scale range, published accuracy, most recent calibration date, and what the instrument will be used for on this project.
- f. A thorough checklist of the work items and inspections that need to be accomplished before DALT field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Pre-Final DALT Work Checklist before DALT field work can be accomplished.
- g. A thorough checklist of the work items and inspections that need to be accomplished before the Season 1 TAB field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Season 1 Pre-TAB Work Checklist before the Season 1 TAB field work can be accomplished.

- i. The checklists specified above shall be individually developed and tailored specifically for the work under this contract. Refer to NEBB PROCEDURAL STANDARDS, Section III, "Preliminary TAB Procedures" under the paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection" for examples of items to include in the checklists.

### 3. Design Review Report

Submit report containing the following information:

- a. Review the contract specifications and drawings to verify that the TAB work can be successfully accomplished in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices needed, including gauge cocks, thermometer wells, flow control devices, circuit setters, balancing valves, and manual volume dampers.
- b. Submit a typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the DALT work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. If no deficiencies are evident, state so in the report.

### 4. Pre-Final DALT Report for COTR DALT Field Checks

Report the data for the Pre-Final DALT Report meeting the following requirements:

- a. Submit a copy of the approved DALT and TAB Procedures Summary: Provide notations describing how actual field procedures differed from the procedures listed.
- b. Report format: Submit a comprehensive report for the DALT field work data using data presentation forms equivalent to the "Air Duct Leakage Test Summary Report Forms" located in the SMACNA 1143. In addition, submit in the report, a marked duct shop drawing which identifies each section of duct tested with assigned node numbers for each section. Node numbers shall be included in the completed report forms to identify each duct section.
- c. Calculations: Include a copy of all calculations prepared in determining the duct surface area of each duct test section. Include in the DALT reports copy(s) of the calibration curve for each of the DALT test orifices used for testing.
- d. Instruments: List the types of instruments actually used to measure the data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date. Instruments are to be calibrated within one year of the date of use in the field; instrument calibration is to be traceable to the measuring standards of the National Institute of Standards and Technology.
- e. TAB Supervisor Approval: Include on the submitted report the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

## 5. Final DALT Report

On successful completion of all COTR field checks of the Pre-final DALT Report data for all systems, the TABS Supervisor shall assemble, review, sign and submit the Final DALT Report to the Contracting Officer for approval.

## 6. TAB Reports: Submit TAB Report for Season 1 and in the following manner:

- a. Procedure Summary: Submit a copy of the approved DALT and TAB Procedures Summary. When applicable, provide notations describing how actual field procedures differed from the procedures listed.
- b. Report format: Submit the completed data forms approved in the pre-field TAB Engineering Report completed by TAB field team, reviewed, approved and signed by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data shall be typewritten. Handwritten report forms or report data are not acceptable.
- c. Temperatures: On each TAB report form reporting TAB work accomplished on HVAC thermal energy transfer equipment, include the indoor and outdoor dry bulb temperature range and indoor and outdoor wet bulb temperature range within which the TAB data was recorded. Include in the TAB report continuous time versus temperature recording data of wet and dry bulb temperatures for the rooms, or zones, as designated in the following list:
  - (1) Data shall be measured and compiled on a continuous basis for the period in which TAB work affecting those rooms is being done.
  - (2) Data shall be measured/recorded only after the HVAC systems installations are complete, the systems fully balanced and the HVAC systems controls operating in fully automatic mode. Provide a detailed explanation wherever a final measurement did not achieve the required value.
  - (3) Data may be compiled using direct digital controls trend logging where available. Otherwise, the Contractor shall temporarily install calibrated time versus temperature/humidity recorders for this purpose. The HVAC systems and controls shall have been fully operational a minimum of 24 hours in advance of commencing data compilation. The specified data shall be included in the Season I TAB Report.
- d. Air System Diagrams: Provided updated diagrams with final installed locations of all terminals and devices, any numbering changes, and actual test locations.
- e. Air Static Pressure Profiles: Report static pressure profiles for air duct systems including: DOAS-1,2. 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 chilled water coils, DX coils, hot water coils, steam coils, electric resistance heating coils and heat reclaim devices installed in unit cabinetry or the system ductwork.
- (3) Report static pressure drop across outside air, return air, and supply air automatic control dampers, both proportional and two-position, installed in unit cabinetry.
- (4) Report static pressure drop across air filters, acoustic silencers, moisture eliminators, air flow straighteners, air flow measuring stations or other pressure drop producing specialty items installed in unit cabinetry, or in the system ductwork. Examples of these specialty items are smoke detectors, white sound generators, RF shielding, wave guides, security bars, blast valves, small pipes passing through ductwork, and duct mounted humidifiers.

Do not report static pressure drop across duct fittings provided for the sole purpose of conveying air, such as elbows, transitions, offsets, plenums, manual dampers, and branch takes-offs.

- (5) Report static pressure drop across outside air and relief/exhaust air louvers.
- (6) Report static pressure readings of supply air, return air, exhaust/relief air, and outside air in duct at the point where these ducts connect to each air moving unit.

- g. Instruments: List the types of instruments actually used to measure the tab data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

Instrumentation, used for taking wet bulb temperature readings shall provide accuracy of plus or minus 5 percent at the measured face velocities. Submit instrument manufacturer's literature to document instrument accuracy performance is in compliance with that specified.

- h. Performance Curves: The TAB Supervisor shall include, in the TAB Reports, factory pump curves and fan curves for pumps and fans TAB'd on the job.
- i. Calibration Curves: The TAB Supervisor shall include, in the TAB Reports, a factory calibration curve for installed flow control balancing valves, flow venturis and flow orifices TAB'd on the job.
- j. Data From TAB Field Work: After completion of the TAB field work, prepare the TAB field data for TAB supervisor's review and approval signature, using the reporting forms approved in the pre-field engineering report. Data required by those approved data report forms shall be furnished by the TAB team. Except as approved otherwise in writing by the Contracting Officer, the TAB work and thereby the TAB

report shall be considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph entitled "Workmanship."

## Appendix C

## DALT AND TAB SUBMITTAL AND WORK SCHEDULE

Perform the following items of work in the order listed adhering to the dates schedule specified below.

Submit TAB Agency and TAB Personnel Qualifications: Within 42calendar days after date of contract award.

Submit the DALT and TAB Work Execution Schedule: within 14 days after receipt of the TAB agency and TAB personnel qualifications approval. Revise and re-submit this schedule 28 days prior to commencement of DALT work and 28 days prior to the commencement of TAB Season 1 work and TAB Season 2 work.

Submit the DALT and TAB Work Procedures Summary: within 14days after receipt of the initial approved DALT and TAB Work Execution Schedule.

Meet with the COTR at the Pre-DALT/TAB Meeting: Within 28 calendar days after receipt of the approved initial DALT/TAB Execution Schedule.

Submit Design Review Report: Within 56 calendar days after the receipt of the approved initial DALT and TAB Work Execution Schedule.

Conduct measurements and submit the Record of Existing Facility Conditions: within 28 days after receipt of approved DALT and TAB Work Procedures Summary.

Advance Notice of Season 1 TAB Field Work: At a minimum of 14 calendar days prior to Season 1 TAB Field Work, submit advance notice of TAB field work accompanied by completed Season 1 Pre-TAB Work Checklist.

-- End of Section --

## SECTION 23 07 00

THERMAL INSULATION FOR MECHANICAL SYSTEMS  
02/13

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. At the discretion of the Government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

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

ASHRAE 90.1 - IP (2013; INT 1 2013; Errata 1-3 2013; Errata 4-6 2014; Errata 7-8 2015; INT 2-3 2015)  
Energy Standard for Buildings Except  
Low-Rise Residential Buildings

## ASTM INTERNATIONAL (ASTM)

|                 |  |
|-----------------|--|
| ASTM A167       | (2011) Standard Specification for<br>Stainless and Heat-Resisting<br>Chromium-Nickel Steel Plate, Sheet, and<br>Strip  |
| ASTM A580/A580M | (2012a) Standard Specification for<br>Stainless Steel Wire   |
| ASTM B209       | (2010) Standard Specification for Aluminum<br>and Aluminum-Alloy Sheet and Plate                                       |
| ASTM C1136      | (2010) Standard Specification for<br>Flexible, Low Permeance Vapor Retarders<br>for Thermal Insulation                 |
| ASTM C1710      | (2011) Standard Guide for Installation of<br>Flexible Closed Cell Preformed Insulation<br>in Tube and Sheet Form       |
| ASTM C195       | (2007) Standard Specification for Mineral<br>Fiber Thermal Insulating Cement   |
| ASTM C450       | (2008) Standard Practice for Fabrication<br>of Thermal Insulating Fitting Covers for<br>NPS Piping, and Vessel Lagging |
| ASTM C647       | (2008) Properties and Tests of Mastics and<br>Coating Finishes for Thermal Insulation                                  |
| ASTM C795       | (2008) Standard Specification for Thermal<br>Insulation for Use in Contact with  |

## Austenitic Stainless Steel

|               |   |
|---------------|---|
| ASTM C916     | (1985; R 2007) Standard Specification for Adhesives for Duct Thermal Insulation   |
| ASTM C920     | (2011) Standard Specification for Elastomeric Joint Sealants  |
| ASTM C921     | (2010) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation   |
| ASTM D2863    | (2012) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)  |
| ASTM D5590    | (2000; R 2010; E 2012) Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay |
| ASTM D882     | (2012) Tensile Properties of Thin Plastic Sheeting  |
| ASTM E2231    | (2009) Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics  |
| ASTM E84      | (2015a) Standard Test Method for Surface Burning Characteristics of Building Materials  |
| ASTM E96/E96M | (2014) Standard Test Methods for Water Vapor Transmission of Materials  |

## FM GLOBAL (FM)

|              |   |
|--------------|---|
| FM APP GUIDE | (updated on-line) Approval Guide<br><a href="http://www.approvalguide.com/">http://www.approvalguide.com/</a> |
|--------------|---|

## MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

|                      |  |
|----------------------|--|
| MICA Insulation Stds | (1999) National Commercial & Industrial Insulation Standards |
|----------------------|--|

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

|          |   |
|----------|---|
| NFPA 90A | (2015) Standard for the Installation of Air Conditioning and Ventilating Systems      |
| NFPA 90B | (2012) Standard for the Installation of Warm Air Heating and Air Conditioning Systems |

## TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

|               |                                   |
|---------------|-----------------------------------|
| TAPPI T403 OM | (2010) Bursting Strength of Paper |
|---------------|-----------------------------------|

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

|               |   |
|---------------|---|
| MIL-A-24179   | (1969; Rev A; Am 2 1980; Notice 1 1987)<br>Adhesive, Flexible Unicellular-Plastic<br>Thermal Insulation |
| MIL-A-3316    | (1987; Rev C; Am 2 1990) Adhesives,<br>Fire-Resistant, Thermal Insulation                               |
| MIL-PRF-19565 | (1988; Rev C) Coating Compounds, Thermal<br>Insulation, Fire- and Water-Resistant,<br>Vapor-Barrier     |

## UNDERWRITERS LABORATORIES (UL)

|        |  |
|--------|--|
| UL 723 | (2008; Reprint Aug 2013) Test for Surface<br>Burning Characteristics of Building<br>Materials                                  |
| UL 94  | (1996; Reprint Jan 2012) Standard for<br>Tests for Flammability of Plastic<br>Materials for Parts in Devices and<br>Appliances |

## 1.2 SYSTEM DESCRIPTION

## 1.2.1 General

Provide field-applied insulation and accessories on mechanical systems as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated. Field applied insulation materials required for use on Government-furnished items as listed in the SPECIAL CONTRACT REQUIREMENTS shall be furnished and installed by the Contractor.

## 1.2.2 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the materials meet all other requirements of this section. The minimum recycled material content of the following insulation are:

|            |                                      |
|------------|--------------------------------------|
| Rock Wool  | 75 percent slag of weight            |
| Fiberglass | 20-25 percent glass cullet by weight |
| Rigid Foam | 9 percent recovered material         |

## 1.3 SUBMITTALS

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

Submit the three SD types, SD-02 Shop Drawings, SD-03 Product Data, and SD-08 Manufacturer's Instructions at the same time for each system.

SD-03 Product Data

Pipe Insulation Systems  
Duct Insulation Systems

#### SD-08 Manufacturer's Instructions

Pipe Insulation Systems  
Duct Insulation Systems

### 1.4 QUALITY ASSURANCE

#### 1.4.1 Installer Qualification

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

### 1.5 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants. The Contracting Officer may reject insulation material and supplies that become dirty, dusty, wet, or contaminated by some other means. Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material, date codes, and approximate shelf life (if applicable). Insulation packages and containers shall be asbestos free.

## PART 2 PRODUCTS

### 2.1 STANDARD PRODUCTS

Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Submit a complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories including adhesives, sealants and jackets for each mechanical system requiring insulation shall be included. The product data must be copyrighted, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation. Materials furnished under this section shall be submitted together in a booklet.

#### 2.1.1 Insulation System

Provide insulation systems in accordance with the approved MICA National Insulation Standards plates as supplemented by this specification. Provide field-applied insulation for heating, ventilating, and cooling (HVAC) air distribution systems and piping systems that are located within, on, under, and adjacent to buildings; and for plumbing systems. Insulation shall be CFC and HCFC free.



### 2.1.2 Surface Burning Characteristics

Unless otherwise specified, insulation shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flame spread, and smoke developed indexes, shall be determined by ASTM E84 or UL 723. Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Test specimens shall be prepared and mounted according to ASTM E2231.

## 2.2 MATERIALS

Provide insulation that meets or exceeds the requirements of ASHRAE 90.1 - IP. Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling. Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C795 requirements. Calcium silicate shall not be used on chilled or cold water systems. Materials shall be asbestos free. Provide product recognized under UL 94 (if containing plastic) and listed in FM APP GUIDE.

### 2.2.1 Adhesives

#### 2.2.1.1 Acoustical Lining Insulation Adhesive

Adhesive shall be a nonflammable, fire-resistant adhesive conforming to ASTM C916, Type I.

#### 2.2.1.2 Mineral Fiber Insulation Cement

Cement shall be in accordance with ASTM C195.

#### 2.2.1.3 Lagging Adhesive

Lagging is the material used for thermal insulation, especially around a cylindrical object. This may include the insulation as well as the cloth/material covering the insulation. To resist mold/mildew, lagging adhesive shall meet ASTM D5590 with 0 growth rating. Lagging adhesives shall be nonflammable and fire-resistant and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Adhesive shall be MIL-A-3316, Class 1, pigmented white and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bonding glass tape to joints of fibrous glass board; for bonding lagging cloth to thermal insulation; or Class 2 for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations for pipe and duct insulation.

#### 2.2.1.4 Contact Adhesive

Adhesives may be any of, but not limited to, the neoprene based, rubber based, or elastomeric type that have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable

odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not emit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 212 degrees F. The dried adhesive shall be nonflammable and fire resistant. Flexible Elastomeric Adhesive: Comply with MIL-A-24179, Type II, Class I. Provide product listed in FM APP GUIDE.

#### 2.2.2 Caulking

ASTM C920, Type S, Grade NS, Class 25, Use A.

#### 2.2.3 Corner Angles

Nominal 0.016 inch aluminum 1 by 1 inch with factory applied kraft backing. Aluminum shall be ASTM B209, Alloy 3003, 3105, or 5005.

#### 2.2.4 Fittings

Fabricated Fittings are the prefabricated fittings for flexible elastomeric pipe insulation systems in accordance with ASTM C1710. Together with the flexible elastomeric tubes, they provide complete system integrity for retarding heat gain and controlling condensation drip from chilled-water and refrigeration systems. Flexible elastomeric, fabricated fittings provide thermal protection (0.25 k) and condensation resistance (0.05 Water Vapor Transmission factor). For satisfactory performance, properly installed protective vapor retarder/barriers and vapor stops shall be used on high relative humidity and below ambient temperature applications to reduce movement of moisture through or around the insulation to the colder interior surface.

#### 2.2.5 Finishing Cement

ASTM C450: Mineral fiber hydraulic-setting thermal insulating and finishing cement. All cements that may come in contact with Austenitic stainless steel must comply with ASTM C795.

#### 2.2.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth, with 20X20 maximum mesh size, and glass tape shall have maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Tape shall be 4 inch wide rolls. Class 3 tape shall be 4.5 ounces/square yard. Elastomeric Foam Tape: Black vapor-retarder foam tape with acrylic adhesive containing an anti-microbial additive.

#### 2.2.7 Staples

Outward clinching type ASTM A167, Type 304 or 316 stainless steel.

#### 2.2.8 Jackets

##### 2.2.8.1 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.016 inch nominal thickness; ASTM B209, Temper H14, Temper H16, Alloy 3003, 5005, or 3105. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket circumferential seam bands shall be 2 by 0.016 inch aluminum matching jacket material. Bands for insulation below ground shall be 3/4 by 0.020 inch thick stainless steel, or fiberglass reinforced tape. The

jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburgh or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

#### 2.2.8.2 Polyvinyl Chloride (PVC) Jackets

Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, ultraviolet (UV) resistant rating or treatment and moderate chemical resistance with minimum thickness 0.030 inch.

#### 2.2.8.3 Vapor Barrier/Weatherproofing Jacket

Vapor barrier/weatherproofing jacket shall be laminated self-adhesive, greater than 3 plies standard grade, silver, white, black and embossed or greater than 8 ply (minimum 2.9 mils adhesive); with 0.0000 permeability when tested in accordance with ASTM E96/E96M, using the water transmission rate test method; heavy duty, white or natural; and UV resistant. Flexible Elastomeric exterior foam with factory applied, UV Jacket made with a cold weather acrylic adhesive. Construction of laminate designed to provide UV resistance, high puncture, tear resistance and excellent Water Vapor Transmission (WVT) rate.

#### 2.2.8.4 Vapor Barrier/Vapor Retarder

Apply the following criteria to determine which system is required.

- a. On ducts, piping and equipment operating below 50 degrees F or located outside shall be equipped with a vapor barrier.

#### 2.2.9 Vapor Retarder Required

ASTM C921, Type I, minimum puncture resistance 50 Beach units on all surfaces where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 35 pounds/inch width. ASTM C921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 20 pounds/inch width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing. Based on the application, insulation materials that require manufacturer or fabricator applied pipe insulation jackets are cellular glass, when all joints are sealed with a vapor barrier mastic, and mineral fiber. All non-metallic jackets shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flexible elastomerics require (in addition to vapor barrier skin) vapor retarder jacketing for high relative humidity and below ambient temperature applications.

##### 2.2.9.1 White Vapor Retarder All Service Jacket (ASJ)

ASJ is for use on hot/cold pipes, ducts, or equipment indoors or outdoors if covered by a suitable protective jacket. The product shall meet all physical property and performance requirements of ASTM C1136, Type I, except the burst strength shall be a minimum of 85 psi. ASTM D2863 Limited Oxygen Index (LOI) shall be a minimum of 31.

In addition, neither the outer exposed surface nor the inner-most surface contacting the insulation shall be paper or other moisture-sensitive

material. The outer exposed surface shall be white and have an emittance of not less than 0.80. The outer exposed surface shall be paintable.

#### 2.2.9.2 Vapor Retarder/Vapor Barrier Mastic Coatings

- a. The vapor barrier shall be self adhesive (minimum 2 mils adhesive, 3 mils embossed) greater than 3 plies standard grade, silver, white, black and embossed white jacket for use on hot/cold pipes. Permeability shall be less than 0.02 when tested in accordance with ASTM E96/E96M. Products shall meet UL 723 or ASTM E84 flame and smoke requirements and shall be UV resistant.
- b. 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.

#### 2.2.9.3 Laminated Film Vapor Retarder

ASTM C1136, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork; where Type II, maximum moisture vapor transmission 0.02 perms, a minimum puncture resistance of 25 Beach units is acceptable. Vapor retarder shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flexible Elastomeric exterior foam with factory applied UV Jacket. Construction of laminate designed to provide UV resistance, high puncture, tear resistance and an excellent WVT rate.

#### 2.2.9.4 Polyvinylidene Chloride (PVDC) Film Vapor Retarder

The PVDC film vapor retarder shall have a maximum moisture vapor transmission of 0.02 perms, minimum puncture resistance of 150 Beach units, a minimum tensile strength in any direction of 30 lb/inch when tested in accordance with ASTM D882, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

#### 2.2.9.5 Polyvinylidene Chloride Vapor Retarder Adhesive Tape

Requirements must meet the same as specified for Laminated Film Vapor Retarder above.

#### 2.2.9.6 Vapor Barrier/Weather Barrier

The vapor barrier shall be greater than 3 ply self adhesive laminate -white vapor barrier jacket- superior performance (less than 0.0000 permeability when tested in accordance with ASTM E96/E96M). Vapor barrier shall meet UL 723 or ASTM E84 25 flame and 50 smoke requirements; and UV resistant. Minimum burst strength 185 psi in accordance with TAPPI T403 OM. Tensile strength 68 lb/inch width (PSTC-1000). Tape shall be as specified for laminated film vapor barrier above.

### 2.2.10 Vapor Retarder Not Required

ASTM C921, Type II, Class D, minimum puncture resistance 50 Beach units on all surfaces except ductwork, where Type IV, maximum moisture vapor transmission 0.10, a minimum puncture resistance of 25 Beach units is acceptable. Jacket shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

### 2.2.11 Wire

Soft annealed ASTM A580/A580M Type 302, 304 or 316 stainless steel, 16 or 18 gauge.

### 2.2.12 Insulation Bands

Insulation bands shall be 1/2 inch wide; 26 gauge stainless steel.

### 2.2.13 Sealants

Sealants shall be chosen from the butyl polymer type, the styrene-butadiene rubber type, or the butyl type of sealants. Sealants shall have a maximum permeance of 0.02 perms based on Procedure B for ASTM E96/E96M, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

## PART 3 EXECUTION

### 3.1 APPLICATION - GENERAL

Insulation shall only be applied to unheated and uncooled piping and equipment. Flexible elastomeric cellular insulation shall not be compressed at joists, studs, columns, ducts, hangers, etc. The insulation shall not pull apart after a one hour period; any insulation found to pull apart after one hour, shall be replaced.

#### 3.1.1 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests and heat tracing specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA Insulation Stds plates except where modified herein or on the drawings.

#### 3.1.2 Firestopping

Where and pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in Section 07 84 00 FIRESTOPPING. The

protection of ducts at point of passage through firewalls must be in accordance with NFPA 90A and/or NFPA 90B. All other penetrations, such as piping, conduit, and wiring, through firewalls must be protected with a material or system of the same hourly rating that is listed by UL, FM, or a NRTL.

### 3.1.3 Painting and Finishing

Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

### 3.1.4 Installation of Flexible Elastomeric Cellular Insulation

Install flexible elastomeric cellular insulation with seams and joints sealed with rubberized contact adhesive. Flexible elastomeric cellular insulation shall not be used on surfaces greater than 220 degrees F. Stagger seams when applying multiple layers of insulation. Protect insulation exposed to weather and not shown to have vapor barrier weatherproof jacketing with two coats of UV resistant finish or PVC or metal jacketing as recommended by the manufacturer after the adhesive is dry and cured.

#### 3.1.4.1 Adhesive Application

Apply a brush coating of adhesive to both butt ends to be joined and to both slit surfaces to be sealed. Allow the adhesive to set until dry to touch but tacky under slight pressure before joining the surfaces. Insulation seals at seams and joints shall not be capable of being pulled apart one hour after application. Insulation that can be pulled apart one hour after installation shall be replaced.

#### 3.1.4.2 Adhesive Safety Precautions

Use natural cross-ventilation, local (mechanical) pickup, and/or general area (mechanical) ventilation to prevent an accumulation of solvent vapors, keeping in mind the ventilation pattern must remove any heavier-than-air solvent vapors from lower levels of the workspaces. Gloves and spectacle-type safety glasses are recommended in accordance with safe installation practices.

### 3.1.5 Welding

No welding shall be done on or without written approval of the Contracting Officer. .

### 3.1.6 That Require Insulation

Insulation is required on all or except for omitted items as specified.

-- End of Section --

## SECTION 23 09 13.34 40

## CONTROL VALVES, SELF-CONTAINED

02/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003 (2009) Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI approved 2010)

## ASME INTERNATIONAL (ASME)

ASME B16.1 (2010) Gray Iron Threaded Fittings; Classes 25, 125 and 250

ASME BPVC SEC VI (2010) BPVC Section VI-Recommended Rules for the Care and Operation of Heating Boilers

## ASTM INTERNATIONAL (ASTM)

ASTM A48/A48M (2003; R 2012) Standard Specification for Gray Iron Castings

## MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-86 (2009; Errata 2011) Guidelines for Metric Data in Standards for Valves, Flanges, Fittings and Actuators

## 1.2 SUBMITTALS

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

## SD-03 Product Data

Self-Contained Temperature Control Valves

Rate-of-Flow Controller

Water Pressure Regulating Valve

Water Pressure Relief Valve

Pilot-Operated Pressure-Relief Valve

Sample Warranty

SD-07 Certificates

Listing of Product Installation

Certificates of Conformance

Manufacturer's Warranty

### 1.3 GENERAL REQUIREMENTS

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS applies to work specified in this section.

Submit listing of product installation for self-contained control and relief valves, identifying a minimum of five installed units, similar to those proposed for use, that have been in successful service for a minimum period of five years.

### 1.4 QUALITY ASSURANCE

Submit certificates of conformance for the following items showing conformance with the referenced standards contained in this section:

- a. Self-Contained Temperature Control Valves
- b. Self-Contained Temperature-Regulator Valves
- c. Rate-of-Flow Controller
- d. Water Pressure Regulating Valve
- e. Water Pressure Relief Valve
- f. Pilot-Operated Pressure-Relief Valve

Submit copy of manufacturer's sample warranty, to the Contracting Officer for review.

## PART 2 PRODUCTS

### 2.1 SELF-CONTAINED TEMPERATURE CONTROL VALVES

Provide self-contained temperature-control valves conforming to MSS SP-86 and the following requirements:.

- a. Type I, Class II (integral temperature-sensing units for very hot



water).

Mount set-point adjustment on the cabinet of the convector; ensure the control knob is accessible on the cabinet surface.

Wall-mount set-point adjustment and thermostat for finned-tube radiation. Provide nickel-plated brass thermostat surfaces.

Provide with armored capillary tubing, with remote element not be less than 18 inches long and contained within a guard.

Provide with renewable valve disks.

## 2.2 RATE-OF-FLOW CONTROLLER

Provide a hydraulically operated, pilot-controlled diaphragm-type globe valve for a rate of flow controller, with pilot control configured to actuate by differential pressure produced across an orifice installed at the inlet. Adjust rate of flow by varying spring loading on the pilot. Provide with cast iron valve body conforming to ASTM A48/A48M, with 125-pound ASME B16.1 flanges. Ensure valve trim is manufacturer's standard bronze or AISI 18-8 corrosion-resistant steel, orifice plate of AISI Type 303 corrosion-resistant steel, and diaphragm and seal are Buna-N. Ensure maximum-service-pressure rating is not less than 175 psi at 180 degrees F.

## 2.3 WATER PRESSURE-REGULATING VALVE

Provide direct acting pressure-regulating valve conforming to ASSE 1003.

Ensure pressure-regulating valve does not stick or allow pressure to build up on the low side. Set valve to maintain a terminal pressure of approximately 5 psi in excess of the static head on the system and operate within a 2-pound maximum variation regardless of initial pressure fluctuation, and without objectionable noise under any condition of operation.

## 2.4 WATER PRESSURE-RELIEF VALVE

Construct, label, and install pressure-relief valve in accordance with ASME BPVC SEC VI. Ensure relieving capacity is as specified by the referenced publication, with valves of nonferrous construction, complete with test lever.

## 2.5 PILOT-OPERATED PRESSURE-RELIEF VALVE

Provide pilot-operated pressure-relief valve, hydraulically operated, pilot-controlled modulating, with adjustable set point over the indicated range. Provide with cast iron valve body conforming to ASTM A48/A48M, with 125-psi ASME B16.1 flanges. Include with manufacturer's standard brass, bronze, or corrosion-resistant steel valve trim. Provide pilot control with AISI Type 303 or 304 corrosion-resistant steel trim with Buna-N diaphragm and seal material. Ensure maximum service-pressure rating is not less than 175 psi at 180 degrees F.

# PART 3 EXECUTION

## 3.1 INSTALLATION

Submit installation drawings for self-contained control and relief valves,

and install valves and specify in accordance with the manufacturer's recommendations, and Section 23 05 15 COMMON PIPING FOR HVAC.

### 3.2 TEST REPORTS

Upon completion of the installation, test the system components and submit 3 copies of the test reports to the Contracting Officer. Remove and replace any defective components at no cost to the Government. Retest and submit reports to the Contracting Officer.

### 3.3 WARRANTY

Submit 3 copies of the manufacturer's warranty, signed by the Authority Having Jurisdiction (AHJ), assigned to the Government, to the Contracting Officer prior to project closeout.

-- End of Section --

\*\*\*\*\*  
This specification section applies to MCB Camp Lejeune, MCAS New River, and  
MCAS Cherry Point projects only.  
\*\*\*\*\*

## SECTION 23 09 23.13 22

BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC  
10/15

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D (2012) Laboratory Methods of Testing  
Dampers for Rating

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

ASHRAE 135 (2012; Addenda AR 2013; Errata 1 2013; INT  
1-9 2013; Errata 2 2013; INT 10-12 2014;  
Errata 3-4 2014; Addenda AI-AY 2014; INT  
13-17 2015; Errata 5 2015) BACnet-A Data  
Communication Protocol for Building  
Automation and Control Networks

## ASME INTERNATIONAL (ASME)

ASME B16.34 (2013) Valves - Flanged, Threaded and  
Welding End

ASME B16.5 (2013) Pipe Flanges and Flanged Fittings:  
NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B31.1 (2014; INT 1-47) Power Piping

## ASTM INTERNATIONAL (ASTM)

ASTM A126 (2004; R 2014) Standard Specification for  
Gray Iron Castings for Valves, Flanges,  
and Pipe Fittings

ASTM B117 (2011) Standard Practice for Operating  
Salt Spray (Fog) Apparatus

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1 (2002; R 2008) Guide on the Surges  
Environment in Low-Voltage (1000 V and  
Less) AC Power Circuits

IEEE C62.41.2 (2002) Recommended Practice on

Characterization of Surges in Low-Voltage  
(1000 V and Less) AC Power Circuits

IEEE C62.45

(2002; R 2008) Recommended Practice on  
Surge Testing for Equipment Connected to  
Low-Voltage (1000v and less)AC Power  
Circuits

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 8802-3

(2000) Information Technology -  
Telecommunications and Information  
Exchange Between Systems - Local and  
Metropolitan Area Networks - Specific  
Requirements - Part 3: Carrier Sense  
Multiple Access with Collision Detection  
(CSMA/CD)Access Method and Physical Layer  
Specifications

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70

(2014; AMD 1 2013; Errata 1 2013; AMD 2  
2013; Errata 2 2013; AMD 3 2014; Errata  
3-4 2014; AMD 4-6 2014) National  
Electrical Code

NFPA 72

(2013) National Fire Alarm and Signaling  
Code

NFPA 90A

(2015) Standard for the Installation of  
Air Conditioning and Ventilating Systems

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

SMACNA 1966

(2005) HVAC Duct Construction Standards  
Metal and Flexible, 3rd Edition

UNDERWRITERS LABORATORIES (UL)

UL 1449

(2014;Reprint Mar 2015) Surge Protective  
Devices

UL 506

(2008; Reprint Oct 2013) Specialty  
Transformers

UL 508A

(2013; Reprint Jan 2014) Industrial  
Control Panels

UL 916

(2007; Reprint Aug 2014) Standard for  
Energy Management Equipment

1.2 DEFINITIONS

1.2.1 ANSI/ASHRAE Standard 135

ANSI/ASHRAE Standard 135: BACnet - A Data Communication Protocol for  
Building Automation and Control Networks, referred to as "BACnet". ASHRAE  
developed BACnet to provide a method for diverse building automation

devices to communicate and share data over a network.

#### 1.2.2 BACnet

Building Automation and Control Network; the common name for the communication standard ASHRAE 135. The standard defines methods and protocol for cooperating building automation devices to communicate over a variety of LAN technologies.

#### 1.2.3 BACnet/IP

An extension of BACnet, Annex J, defines this mechanism using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number. See also "BACnet Broadcast Management Device".

#### 1.2.4 BACnet Internetwork

Two or more BACnet networks, possibly using different LAN technologies, connected with routers. In a BACnet internetwork, there exists only one message path between devices.

#### 1.2.5 BACnet Network

One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.

#### 1.2.6 BACnet Segment

One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

#### 1.2.7 BBMD

BACnet Broadcast Management Device (BBMD). A communications device, typically combined with a BACnet router. A BBMD forwards BACnet broadcast messages to BACnet/IP devices and other BBMDs connected to the same BACnet/IP network. Every IP subnetwork that is part of a BACnet/IP network must have only one BBMD. See also "BACnet/IP".

#### 1.2.8 BAS

Building Automation Systems, including DDC (Direct Digital Controls) used for facility automation and energy management.

#### 1.2.9 BIBBs

BACnet Interoperability Building Blocks. A collection of BACnet services used to describe supported tasks. BIBBs are often described in terms of "A" (client) and "B" (server) devices. The "A" device uses data provided by the "B" device, or requests an action from the "B" device.

#### 1.2.10 BI

BACnet International, formerly two organizations: the BACnet Manufacturers Association (BMA) and the BACnet Interest Group - North America (BIG-NA).

#### 1.2.11 BI/BTL

BACnet International/BACnet Testing Laboratories (Formerly BMA/BTL). The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.

#### 1.2.12 Bridge

Network hardware that connects two or more network (or BACnet internetwork) segments at the physical and data link layers. A bridge may also filter messages.

#### 1.2.13 Broadcast

A message sent to all devices on a network segment.

#### 1.2.14 DADMS

DON Application and Database Management System, (DADMS) is a listing of digital applications approved for purchase and use.

#### 1.2.15 Device

Any control system component, usually a digital controller, that contains a BACnet Device Object and uses BACnet to communicate with other devices. See also "Digital Controller".

#### 1.2.16 Device Object

Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet internetwork. This number is often referred to as the device instance.

#### 1.2.17 Device Profile

A collection of BIBBs determining minimum BACnet capabilities of a device, defined in ASHRAE 135, Annex L. Standard device profiles include BACnet Operator Workstations (B-OWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator (B-SA), and BACnet Smart Sensor (B-SS). Each device used in new construction is required to have a PICS statement listing BIBBs supported and must be tested and listed by BACnet Testing Laboratory (BTL).

#### 1.2.18 Digital Controller

An electronic controller, usually with internal programming logic and digital and analog input/output capability, which performs control functions. In most cases, synonymous with a BACnet device described in this specification. See also "Device". There are different levels of controllers, with varying levels of complexity and flexibility.

##### 1.2.18.1 Terminal Device Controllers

Terminal device controllers typically are controllers with less control features, may have integrated actuators, and may be mounted directly on equipment (with enclosures).

#### 1.2.18.2 Field Controllers

Field controllers typically have a greater capability for input/output and customization, do not have integral actuators, are mounted in an enclosure not on the equipment and are used for equipment such as VAV air handlers.

#### 1.2.18.3 Plant Controllers

Plant Controllers are typically used to control various equipment in mechanical rooms such as pumps, heat exchangers, and chillers.

#### 1.2.18.4 Supervisory Controllers

Supervisory Controller is used to coordinate all equipment in a building, input scheduling, and is often used as a connection point for transferring configuration files to the other controllers.

#### 1.2.18.5 Supervisory Building Controller (SBC)

Supervisory Building Controller (SBC) is used to connect the building's DDC system (MS/TP) to Cherry Point's EMCS (TC/IP). Depending on approvals and capabilities, the SBC and supervisory controller may be combined into the same piece of hardware.

#### 1.2.19 Direct Digital Control (DDC)

Digital controllers performing control logic. Usually the controller directly senses physical values, makes control decisions with internal programs, and outputs control signals to directly operate switches, valves, dampers, and motor controllers.

#### 1.2.20 DDC System

A distribution network of digital controllers, communication architecture, and user interfaces. A DDC system may include programming, sensors, actuators, switches, relays, factory controls, operator workstations, and various other devices, components, and attributes.

#### 1.2.21 DITSCAP

Department of Defense Information Technology Security Certification and Accreditation Process (DITSCAP). DISCAP and DIACAP are processes that approve IP base equipment that is connected and communicates on the base Ethernet network. All devices using TCP/IP or Ethernet connectivity require prior approval to be listed in the DITSCAP and SSA document.

#### 1.2.22 EMCS

Energy Management & Control System. The EMCS at Cherry Point is an enterprise system that actively receives energy and building condition information from multiple sources and provides load shedding, electric metering, alarming, trending, scheduling, set point adjustment and device status of all supervisory building controllers for maintenance personnel. The EMCS receives real time electrical utility pricing data and automatically manages to Cherry Point's energy target. The existing Cherry Point EMCS is manufactured by Johnson Controls and incorporates the Metasys extended architecture system that communicates over the MRAN.

#### 1.2.23 EMCS Owner

The regional or local user responsible for managing all aspects of the BAS operation, including: network connections, workstation management, submittal review, technical support, control parameters, and daily operation. The BAS Owner for this project is Utility Monitoring & Control (UMAC) Director. The point of contact for existing DDC and EMCS systems at MCAS Cherry Point, FRC East is James Fulcher or Lester Wardlow. Telephone: (252) 464-7598 or (252) 464 5205.

#### 1.2.24 Ethernet

A family of local-area-network technologies providing high-speed networking features over various media. Base Telephone manages all Ethernet connections to the IP networks.

#### 1.2.25 Firmware

Software programmed into read only memory (ROM), flash memory, electrically erasable programmable read only memory (EEPROM), or erasable programmable read only memory (EPROM) chips.

#### 1.2.26 Gateway

Communication hardware connecting two or more different protocols, similar to human language translators. The Gateway translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a gateway has BACnet on one side and non-BACnet (usually proprietary) protocols on the other side.

#### 1.2.27 Half Router

A device that participates as one partner in a BACnet point-to-point (PTP) connection. Two half-routers in an active PTP connection combine to form a single router.

#### 1.2.28 Hub

A common connection point for devices on a network.

#### 1.2.29 Internet Protocol (IP, TCP/IP, UDP/IP)

A communication method, the most common use is the World Wide Web. At the lowest level, it is based on Internet Protocol (IP), a method for conveying and routing packets of information over various LAN media. Two common protocols using IP are User Datagram Protocol (UDP) and Transmission Control Protocol (TCP). UDP conveys information to well-known "sockets" without confirmation of receipt. TCP establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

#### 1.2.30 Input/Output (I/O)

Physical inputs and outputs to and from a device, although the term sometimes describes software, or "virtual" I/O. See also "Points".

#### 1.2.31 I/O Expansion Unit

An I/O expansion unit provides additional point capacity to a digital controller.



### 1.2.32 IP subnet

Internet protocol (IP) identifies individual devices with a 32-bit number divided into four groups from 0 to 255. Devices are often grouped and share some portion of this number. For example, one device has IP address 209.185.47.68 and another device has IP address 209.185.47.82. These two devices share Class C subnet 209.185.47.00

### 1.2.33 Local-Area Network (LAN)

A communication network that spans a limited geographic area and uses the same basic communication technology throughout.

### 1.2.34 MAC Address

Media Access Control address. The physical node address that identifies a device on a Local Area Network.

### 1.2.35 Master-Slave/Token-Passing (MS/TP)

ISO 8802-3. The standard LAN for BACnet. MSTP uses twisted-pair wiring for relatively low speed and low cost communication (up to 4,000 ft at 76.8K bps).

### 1.2.36 Native BACnet Device

A device that uses BACnet as its primary, if not only, method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.

### 1.2.37 Network

Communication technology for building network data communications. BACnet approved network types are Point to Point (PTP) Ethernet, and MS/TP. BACnet over Internet Protocol is not an approved method for building level controls.

### 1.2.38 Network Number

A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.

### 1.2.39 Object

The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

### 1.2.40 Object Identifier

An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.

### 1.2.41 Object Properties

Attributes of an object. Examples include present value and high limit

properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object properties.

#### 1.2.42 Peer-to-Peer

Peer-to-peer refers to devices where any device can initiate and respond to communication with other devices.

#### 1.2.43 Performance Verification Test (PVT)

The procedure for determining if the installed BAS meets design criteria prior to final acceptance. The PVT is performed after installation, testing, and balancing of mechanical systems. Typically the PVT is performed by the Contractor in the presence of the Government.

#### 1.2.44 PID

Proportional, integral, and derivative control; three parameters used to control modulating equipment to maintain a setpoint. Derivative control is often not required for HVAC systems (leaving "PI" control).

#### 1.2.45 PICS

Protocol Implementation Conformance Statement (PICS), describing the BACnet capabilities of a device. See BACnet, Annex A for the standard format and content of a PICS statement.

#### 1.2.46 Points

Physical and virtual inputs and outputs. See also "Input/Output".

#### 1.2.47 PTP

Point-to-Point protocol connects individual BACnet devices or networks using serial connections.

#### 1.2.48 Repeater

A network component that connects two or more physical segments at the physical layer.

#### 1.2.49 Router

A BACnet router is a component that joins together two or more networks using different LAN technologies. Examples include joining a BACnet Ethernet LAN to a BACnet MS/TP LAN.

#### 1.2.50 Stand-Alone Control

Refers to devices performing equipment-specific and small system control without communication to other devices or computers for physical I/O, excluding outside air and other common shared conditions. Devices are located near controlled equipment, with physical input and output points limited to 64 or less per device, except for complex individual equipment or systems. Failure of any single device will not cause other network devices to fail. BACnet "Smart" actuators (B-SA profile) and sensors (B-SS profile) communicating on a network with a parent device are exempt from stand-alone requirements.

#### 1.2.51 SSAA

System Security Authorization Agreement. The SSAA is a local document authorizing the use of the IP networks on Cherry Point.

#### 1.2.52 Supervisory Controller

Supervisory Controller is the upper level controller on the building's MS/TP bus. It provides building wide points, scheduling, and interface with programming tools.

#### 1.2.53 Supervisory Building Controller (SBC)

The Supervisory Building Controller is the point of connection between the Cherry Point EMCS network (IP) and the building level control network (MS/TP). The hardware at this location, that provides the connection is referred to as the SBC. Since the EMCS network uses the Marine Air-Ground Task Force Regional Area Network (MRAM) Ethernet network using TCP/IP, any equipment connecting to the Cherry Point EMCS must be listed in the approved DITSCAP or DIACAP equipment list and must be Marine Corps DADMS listed and approved.

### 1.3 SUBCONTRACTOR SPECIAL REQUIREMENTS

Perform all work in this section in accordance with the paragraph entitled "Subcontractor Special Requirements" in Section 01 30 00 ADMINISTRATIVE REQUIREMENTS. The paragraph specifies that all contract requirements of this section shall be accomplished directly by a first tier subcontractor. No work required shall be accomplished by a second tier subcontractor.

- a. The controls sub-contractor for this project shall be regularly engaged in the design and installation of BACnet DDC systems (for building HVAC systems) similar to the size and scope of this project, shall have been a representative of the proposed control system manufacturer for a minimum of two years, have a staffed office within a 50-mile radius of the project location, and shall have performed design and installation of DDC systems for a minimum of 5 years.
- b. The controls sub-contractor shall ensure that their installing electricians have a copy of, read, and understand the mechanical sheets of the contract's design construction drawings, in addition to the control drawings prepared by the sub-contractor. Provide the DDC programming and graphics using Standard English units of measure, not metric.

### 1.4 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC DESCRIPTION

- a. Provide new DDC systems including associated equipment and accessories. Manufacturer's products, including design materials, fabrication, assembly, erection, examination, inspections, and testing shall be in accordance with ASME B31.1 and NFPA 70, except as modified herein or indicated otherwise. The new DDC system shall interface and communicate with the existing Energy Management and Control System (EMCS) at MCAS Cherry Point, Building 137. The new DDC system shall use Cherry Point's Point Naming Nomenclature and Graphical Standards attached at the end of this section. The new DDC system via the site building controller shall be capable of upload/download from the

central service at Building 137. All DDC points whether physical or pseudo, shall be exposed as BACnet objects and accessible by the Metasys server in Building 137 for purposes of monitoring status, controlling operation, or modifying values. The new DDC system shall have the capability of managing its loads using the existing EMCS Johnson Control load management programming.

- b. The Energy Management and Control System (EMCS) at MCAS Cherry Point is an enterprise system that actively receives energy and building condition information from multiple sources and provides load shedding, electric metering, alarming, trending, scheduling, set point adjusting, device communications status of all SBC and TCU for maintenance personnel. The existing EMCS system is Johnson Controls and incorporates the Metasys System that communicates over the Ethernet communications network to the site building controllers. The existing EMCS central server is located at Building 137.
- c. Provide a site building controller (SBC) for the new DDC system. Provide all necessary hardware, drivers, software, material, and equipment, which shall allow communication between the SBC and the existing EMCS system via the UMAC Ethernet network. The SBC shall act as the interface between the existing EMCS system and the new DDC system. The SBC shall perform closed-loop, modulating control of building equipment, provide all programming and communication with the DDC system such that it shall maintain stable temperature control and all other conditions as indicated. The end-to-end accuracy of the system, including temperature sensor error, wiring error, A/D conversion, and display, shall be 1 degree F or less.
- d. Provide a complete fully BACnet Open Protocol compatible Direct Digital Control (DDC) system. The system shall have stand-alone digital controllers that are connected to the SBC. All BACnet devices shall be BACnet Testing Laboratories (BTL) certified and listed. The DDC system shall be capable of controlling and monitoring all spaces and all HVAC systems. The manufacturer's control system shall have a successful, proven, in use history of at least 2 years. The DDC control system object configuration and communication - shall be totally native BACnet Open protocol with no other programming language protocol, interface, or gateways utilized, except as required by the Project documents.
- e. The contractor shall update the existing Johnson Controls server, ADX-1, located in Building 137 to incorporate and integrate the new DDC system. The update requirements include, but are not limited to the EMCS server database, graphics for the new DDC system and programming of all load management functions.
- f. The contractor shall fully test and verify all levels of control and communication of all the DDC system controllers from the existing Johnson Controls ECMS server in Building 137. The contractor shall also test and verify all levels of control and communication of the new DDC system.

#### 1.4.1 Design Requirements

##### 1.4.1.1 Control System Drawings Title Sheet

Provide a title sheet for the control system drawing set. Include the project title, project location, contract number, the controls contractor preparing the drawings, an index of the control drawings in the set, and a

legend of the symbols and abbreviations used throughout the control system drawings.

#### 1.4.1.2 List of I/O Points

Also known as a Point Schedule, provide for each input and output point physically connected to a digital controller: point name, point description, point type (Analog Output (AO), Analog Input (AI), Binary Output (BO), Binary Input (BI)), point sensor range, point actuator range, point address, BACnet object, associated BIBBS (where applicable), and point connection terminal number. Typical schedules for multiple identical equipment are allowed unless otherwise requested in design or contract criteria. All points shall adhere to the Cherry Point standard naming conventions.

#### 1.4.1.3 Control System Components List

Provide a complete list of control system components installed on this project. Include for each controller and device: control system schematic name, control system schematic designation, device description, manufacturer, and manufacturer part number. For sensors, include point name, sensor range, and operating limits. For valves, include body style, Cv, design flow rate, pressure drop, valve characteristic (linear or equal percentage), and pipe connection size. For actuators, include point name, spring or non-spring return, modulating or two-position action, normal (power fail) position, nominal control signal operating range (0-10 volts DC or 4-20 milliamps), and operating limits.

#### 1.4.1.4 Control System Schematics

Provide control system schematics. Typical schematics for multiple identical equipment are allowed unless otherwise requested in design or contract criteria. Include the following:

- a. Location of each input and output device
- b. Flow diagram for each piece of HVAC equipment
- c. Name or symbol for each control system component, such as V-1 for a valve
- d. Setpoints, with differential or proportional band values
- e. Written sequence of operation for the HVAC equipment
- f. Valve and Damper Schedules, with normal (power fail) position

#### 1.4.1.5 HVAC Equipment Electrical Ladder Diagrams

Provide HVAC equipment electrical ladder diagrams. Indicate required electrical interlocks.

#### 1.4.1.6 Component Wiring Diagrams

Provide a wiring diagram for each type of input device and output device. Indicate how each device is wired and powered; showing typical connections at the digital controller and power supply. Show for all field connected devices such as control relays, motor starters, actuators, sensors, and transmitters.

#### 1.4.1.7 Terminal Strip Diagrams

Provide a diagram of each terminal strip. Indicate the terminal strip location, termination numbers, and associated point names.

#### 1.4.1.8 BACnet Communication Architecture Schematic

Provide a schematic showing the project's entire BACnet communication network, including addressing used for LANs, LAN devices including routers and bridges, gateways, controllers, workstations, and field interface devices. If applicable, show connection to existing networks. Show bus routing and component locations on a separate floor plan.

### 1.5 SUBMITTALS

Submit detailed and annotated manufacturer's data, drawings, and specification sheets for each item listed, that clearly show compliance with the project specifications.

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

#### SD-02 Shop Drawings

Include the following in the project's control system drawing set:

Control system drawings title sheet

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

Sensors and Input Hardware

Output Hardware

Surge and transient protection

Duct smoke detectors

Variable frequency (motor) drives

SD-05 Design Data

Performance Verification Testing Plan

Pre-Performance Verification Testing Checklist

SD-06 Test Reports

Performance Verification Testing 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

VFD Service Manuals, Data Package 4

SD-11 Closeout Submittals

DDC Software

Training documentation

1.6 QUALITY ASSURANCE

1.6.1 Standard Products

Provide material and equipment that are standard manufacturer's products  
currently in production and supported by a local service organization.

1.6.2 Delivery, Storage, and Handling

Handle, store, and protect equipment and materials to prevent damage before  
and during installation according to manufacturer's recommendations, and as

approved by the Contracting Officer. Replace damaged or defective items.

#### 1.6.3 Operating Environment

Protect components from humidity and temperature variation, dust, and contaminants. If components are stored before installation, keep them within the manufacturer's limits.

#### 1.6.4 Finish of New Equipment

New equipment finishing shall be factory provided. Manufacturer's standard factory finishing shall be proven to withstand 125 hours in a salt-spray fog test. Equipment located outdoors shall be proven to withstand 3000 hours in a salt-spray fog test.

Salt-spray fog test shall be according to ASTM B117, with acceptance criteria as follows: immediately after completion of the test, the finish shall show no signs of degradation or loss of adhesion beyond 0.125 inch on either side of the scratch mark.

#### 1.6.5 Verification of Dimensions

The contractor shall verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing work.

#### 1.6.6 Contractor's Qualifications

Submit documentation certifying the controls Contractor performing the work has completed at least three DDC systems installations of a similar design to this project, and programmed similar sequences of operation for at least two years. Submit the name of the technician proposed to make additions/alterations to the EMCS servers. Submit supporting documentation demonstrating their qualifications.

#### 1.6.7 Modification of References

The advisory provisions in ASME B31.1 and NFPA 70 are mandatory. Substitute "shall" for "should" wherever it appears and interpret all references to the "authority having jurisdiction" and "owner" to mean the Contracting Officer.

#### 1.6.8 Project Sequence

The control system work for this project shall proceed in the following order:

- a. Submit and receive approval on the Shop Drawings, Product Data, and Certificates specified under the paragraph entitled "SUBMITTALS."
- b. Perform the control system installation work, including all field check-outs and tuning.
- c. Provide support to TAB personnel as specified under the paragraph "TEST AND BALANCE SUPPORT."
- d. Submit and receive approval of the Controls System Operators Manual specified under the paragraph "CONTROLS SYSTEM OPERATORS MANUALS."
- e. Submit and receive approval of the Performance Verification Testing



Plan and the Pre-PVT Checklist specified under the paragraph "PERFORMANCE VERIFICATION TESTING."

- f. Perform the Performance Verification Testing.
- g. Submit and receive approval on the PVT Report.
- h. Submit and receive approval on the Training Documentation specified under the paragraph "INSTRUCTION TO GOVERNMENT PERSONNEL" and "VFD Service Support". Submit at least 30 days before training.
- i. Deliver the final Controls System Operators Manuals and VFD Service Manuals.
- j. Conduct the Phase I Training and VFD on-site/hands-on training.
- k. Conduct the Phase II Training.
- l. Submit and receive approval of Closeout Submittals.

## PART 2 PRODUCTS

### 2.1 DDC SYSTEM

Provide a networked DDC system for stand-alone control in compliance with the latest revision of the ASHRAE 135 BACnet standard. Include all programming, objects, and services required to meet the sequence of control. Provide BACnet MSTP communications between the DDC system and native BACnet devices furnished with HVAC equipment, and plant equipment such as boilers, and chillers when provided with BACnet MSTP communications. DDC controllers provided shall be certified in the BACnet Testing Laboratories (BTL) Product Listing. BACnet over IP is not permitted.

#### 2.1.1 Supervisory Building Controller (SBC)

Provide an SBC that communicates between the DDC system and the Cherry Point EMCS server. Provide all necessary hardware, drivers, software, material and equipment which shall allow communication and control between the SBC and the field DDC controllers using BACnet on the MS/TP bus. The SBC shall be capable of upload/download to and from the EMCS server. All SBC information shall transfer back to the EMCS system via the Ethernet TCP/IP level 1 network. All IP addresses and network drops shall be furnished by base telephone. Supervisory Building Controllers (SBC) must be listed and approved on the Marine Corps DADMS and listed in the sites DITSCAP SSAA documents. When the SBC is disconnected from the enterprise system for maintenance, access to the SBC shall be via a laptop computer with Internet Explorer and not require any proprietary licensed software or license key.

#### 2.1.2 Direct Digital Controllers

Where there is an existing Johnson Controls N2 system in place, reuse the existing N2 bus and equipment, unless there is a compelling reason not to do so. All new direct digital controllers shall be native BACnet and UL 916 rated.

##### 2.1.2.1 I/O Point Limitation

The total number of I/O hardware points used by a single stand-alone

digital controller, including I/O expansion units, shall not exceed 64. Place I/O expansion units in the same cabinet as the digital controller.

#### 2.1.2.2 Environmental Limits

Controllers shall be suitable for, or placed in protective enclosures suitable for the environment (temperature, humidity, dust, and vibration) where they are located.

#### 2.1.2.3 Stand-Alone Control

Provide stand-alone digital controllers capable of meeting the complete sequence of operation with and without network connectivity (being connected to the EMCS).

#### 2.1.2.4 Internal Clock

Provide internal clocks for all BACnet Building Controllers (B-BC) and BACnet Advanced Application Controllers (B-AAC) using BACnet time synchronization services. Automatically synchronize system clocks daily from an operator-designated controller. The system shall automatically adjust for daylight saving time.

#### 2.1.2.5 Memory

Provide sufficient memory for each controller to support the required control, communication, trends, alarms, and messages. Protect programs residing in memory with EEPROM, flash memory, or by an uninterruptible power source (battery or uninterruptible power supply). The backup power source shall have capacity to maintain the memory during a 72-hour continuous power outage. Rechargeable power sources shall be constantly charged while the controller is operating under normal line power. Batteries shall be replaceable without soldering. Trend and alarm history collected during normal operation shall not be lost during power outages less than 72 hours long.

#### 2.1.2.6 Immunity to Power Fluctuations

Controllers shall operate at 90 percent to 110 percent nominal voltage rating.

#### 2.1.2.7 Transformer

The controller power supply shall be fused or current limiting and rated at 125 percent power consumption.

#### 2.1.2.8 Wiring Terminations

Use screw terminal wiring terminations for all field-installed controllers. Provide field-removable modular terminal strip or a termination card connected by a ribbon cable for all controllers other than terminal units.

#### 2.1.2.9 Input and Output Interface

Provide hard-wired input and output interface for all controllers as follows:

- a. Protection: Shorting an input or output point to itself, to another

point, or to ground shall cause no controller damage. Input or output point contact with sources up to 24 volts AC or DC for any duration shall cause no controller damage.

- b. Binary Inputs: Binary inputs shall monitor two state devices.
- c. Pulse Accumulation Inputs: Pulse accumulation inputs shall conform to binary input requirements and accumulate pulses at a resolution suitable to the application.
- d. Analog Inputs: Analog inputs shall monitor low-voltage (0-10 VDC), current (4-20 mA), or resistance (thermistor or RTD) signals.
- e. Binary Outputs: Binary outputs shall have a toggle switch and send a pulsed 24 VDC low-voltage signal for modulation control, or provide a maintained open-closed position for on-off control. For HVAC equipment and plant controllers, provide for manual overrides, either with three-position (on-off-auto) override switches and status lights, or with an adjacent operator display and interface. Where appropriate, provide a method to select normally open or normally closed operation.
- f. Analog Outputs: Analog outputs shall send modulating 0-10 VDC or 4-20 mA signals to control output devices.
- g. Tri-State Outputs: Tri-State outputs shall provide three-point floating control of terminal unit electronic actuators.

#### 2.1.2.10 Digital Controller Cabinet

Provide each digital controller as factory mounted or in a factory fabricated cabinet enclosure. Cabinets located indoors shall protect against dust and have a minimum NEMA 1 rating, except where indicated otherwise. Cabinets located outdoors or in damp environments shall protect against all outdoor conditions and have a minimum NEMA 4 rating. Mechanical rooms that contain steam service or equipment are considered damp environments. Outdoor control panels and controllers must be able to withstand extreme ambient conditions, without malfunction or failure, whether or not the controlled equipment is running. If necessary, provide a thermostatically controlled panel heater in freezing locations, and an internal ventilating fan in locations exposed to direct sunlight. Cabinets shall have a hinged lockable door and an offset removable metal back plate, except controllers integral with terminal units, like those mounted on VAV boxes. Provide like-keyed locks for all hinged panels provided and a set of two keys at each panel, with one key inserted in the lock.

#### 2.1.2.11 Main Power Switch and Receptacle

Provide each control cabinet with a main external power on/off switch located inside the cabinet. Also provide each cabinet with a separate 120 VAC duplex receptacle.

#### 2.1.2.12 DSL Modems

DSL modems and Rate Adaptive Asymmetric Digital Subscriber Line (RADSL) modems are provided by the government. Telephone modems are not permitted for any other communication with the DDC system.

#### 2.1.2.13 BACnet Gateways

Provide gateways to connect BACnet to legacy systems, existing non-BACnet devices, and existing non-BACnet DDC controlled plant equipment, only when specifically requested and approved by the Government, and shown on the Government approved BACnet Communication Architecture Schematic. Communication shall be MS/TP. Communication using IP is not permitted. Provide with each gateway an interoperability schedule, showing each point or event on the legacy side that the BACnet "client" will read, and each parameter that the BACnet network will write to. Describe this interoperability in terms of BACnet services, or Interoperability Building Blocks (BIBBS), defined in ASHRAE 135 Annex K. Provide two-year minimum warranty for each gateway, including parts and labor.

The following minimum capabilities are required:

- a. Gateways shall be able to read and view all readable object properties listed in the interoperability schedule on the non-BACnet network to the BACnet network and vice versa where applicable.
- b. Gateways shall be able to write to all writeable object properties listed in the interoperability schedule on the non-BACnet network from the BACnet network and vice versa where applicable.
- c. Gateways shall provide single-pass (only one protocol to BACnet without intermediary protocols) translation from the non-BACnet protocol to BACnet and vice versa.
- d. Gateways shall meet the requirements of Data Sharing Read Property (DS-RP-B), Data Sharing Write Property (DS-WP-B), Device Management Dynamic Device Binding-B (DM-DDB-B), and Device Management Communication Control (DM-DCC-B) BIBBs, in accordance with ASHRAE 135.
- e. Gateways shall include all hardware, software, software licenses, and configuration tools for operator-to-gateway communications. Provide backup programming and parameters on CD media and the ability to modify, download, backup, and restore gateway configuration.

#### 2.1.3 Notebook Computer

Provide a notebook computer, complete with the project's installed DDC software, configuration files and, applications database, to fully troubleshoot and program the project's devices. Provide the notebook computer with ballistic nylon carrying case with shoulder strap with all necessary cables and interface hardware needed for setup and communication with the controllers and control system components.

At a minimum the notebook computer shall include: Common Access Card reader, a Microsoft Windows 7 operating system, processor with capability and speed required by application software, 40 giga-byte hard drive, 512 mega-byte RAM, 2 USB 2.0 ports, 10/100 network interface card, internal V.92 modem, 15-inch display, keyboard, 3-hour battery with charger, 52X internal CD-RW drive with CD creator software, and Microsoft Office bundled software. Provide all original licenses, installation media, documentation, and recovery CDs capable of restoring the original configuration. Provide the manufacturer's 3-year next business day on-site warranty with the Government listed as the warranty owner. Provide a CAC card access port.

#### 2.1.4 2.1.4 Interface to Base EMCS System

All interface to the DDC system shall be provided through the existing EMCS workstation at Building 137. Workstation interface shall consist of monitoring, troubleshooting, and making adjustments to the program or operating parameters of all DDC controllers, including TCU's. The workstation at Building 137 shall also be capable of programming all controllers, including TCU's. The contractor shall provide a temporary workstation for system interface and start-up until the connection to the EMCS at Building 137 is completed, tested, and verified.

The building DDC system shall routinely operate continuously without connection to the workstation. Information at the workstation is not required for day to day operations of the direct digital controllers.

##### 2.1.4.1 2.1.4.1 Software

Modify and update the existing workstation associated with the existing EMCS at Building 137 as necessary for proper interface with the new DDC system. Workstation software shall be configured to operate according to the DDC system manufacturer's specifications. Software shall be installed in the workstation computer and permit monitoring and troubleshooting of the DDC system. Workstation software permits modification of controller parameters and control for all controllers, both high level and low level application specific. Operations shall be menu selected. Menu selections shall be made with a mouse.

- a. Menu System: Menu system shall allow an operator to select a particular function or access a particular screen through successive menu penetration.
- b. Controller Parameter Modification: The workstation software shall be an interface for performance specified in paragraph entitled "Parameter Modification" and available through direct connection of a computer to a digital controller. Parameter modification shall require only that an operator "fill in the blank" for a parameter on a screen requesting the information in plain language. Parameter modifications shall download to the appropriate controllers at the operator request.
- c. Program modification: For systems using a line-by-line programming language, provide an off-line text editor, similar to a BASIC program editor, permitting modification of controller resident control programs. For systems using block programming languages provide a capability for linking blocks together to create new programs or modify existing.

##### 2.1.4.2 2.1.4.2 Graphic-Based Software

Update the existing EMCS system and Johnson Controls server in Building 137 to incorporate and integrate the new DDC system. Update work includes graphics control package. The graphic-based software in the existing EMCS system shall be updated to provide a user-friendly interface to the DDC system. Graphic-based software shall provide graphical representation of the building, the building mechanical systems, and the DDC system. The current value and point name of every I/O point shall be shown on at least one graphic and in its appropriate physical location relative to building and mechanical systems.

- a. Graphic shall closely follow the style of the control drawings in

representing mechanical systems, sensors, controlled devices and point names.

- b. Graphic Title: Graphics shall have an identifying title visible when the graphic is viewed.
- c. Dynamic Update: When the workstation is on-line with the control system, point data shall update dynamically on the graphic images.
- d. Graphic Penetration: Provide graphic penetration when the capability exists. For systems without graphic penetration, provide menu penetration for selection of individual graphics to give same hierarchical affect provided by graphic penetration.
- e. Graphic Types: Graphic-based software shall have graphics of the building exterior, building section, floor plans, and mechanical systems. Provide the following graphics:
  - 1. Building Exterior Graphic: Show exterior architecture, major landmarks, and building number.
  - 2. Building Section Graphic: Show floors in section graphic with appropriate floor name on each floor.
  - 3. Floor Plan Graphics: Provide a single graphic for each floor, unless the graphic will contain more information than can reasonably be shown on a single graphic. Each heating or cooling zone within a floor plan shall have a zone name and its current temperature displayed within the zone outline. show each controlled variable in the zone. Provide visual warning for each point in alarm.
  - 4. Mechanical System Graphics: Provide two-dimensional drawings to symbolize mechanical equipment; do not use line drawings. show controlled or sensed mechanical equipment. Each graphic shall consist of a single mechanical system; examples are a graphic for an air handling unit, a graphic for a VAV box, a graphic for a heating water system and a graphic for a chiller system. Place point name and point value adjacent to sensor or controlled device. Provide visual warning of each point in alarm. Point values shall update dynamically on the graphic.
- f. Graphic Editing: Full capacity as provided by a draw software package shall be included for operator editing of graphics. graphics may be created, deleted, modified, and text added. Provide capability to store graphic symbols in a symbol directory and import these symbols into graphics. A minimum of 256 colors shall be available.
- g. Dynamic Point Editing: Provide full editing capability for deleting, adding, and modifying dynamic points on graphics.
- h. Trending: Trend data shall be displayed graphically, with control variable and process variable plotted as functions of time on the same chart. Graphic display of trend data shall be internal to the workstation software and not resulting from download of trend data into a third-party spreadsheet program such as Excel, unless such transfer is automatic and transparent to the operator, and the third-party software is included with the workstation software package. At the operator's discretion, trend data shall be plotted real time.

### 2.1.1.5 DDC Software

#### 2.1.1.5.1 Programming

Provide programming to execute the sequence of operation indicated. Provide all programming, programming software tools, and programming hardware tools to configure and program all controllers. If the laptop computer provided elsewhere is used as a programming tool, provide all necessary accessories for full functionality. All software shall be licensed to Marine Corps Air Station, Cherry Point Complex for unrestricted use on Cherry Point Complex and reproduction for use on Cherry Point Complex. Software keys and "dongles" are not permitted. Provide sequence of operation routines in simple, easy-to-follow logic with detailed text comments describing what the logic does and how it corresponds to the project's written sequence of operation.

- a. Graphic-based programming shall use a library of function blocks made from pre-programmed code designed for BAS control. Function blocks shall be assembled with interconnecting lines, depicting the control sequence in a flowchart. If providing a computer with device programming tools as part of the project, graphic programs shall be viewable in real time showing present values and logical results from each function block.
- b. Menu-based programming shall be done by entering parameters, definitions, conditions, requirements, and constraints.
- c. For line-by-line and text-based programming, declare variable types (local, global, real, integer, etc.) at the beginning of the program. Use descriptive comments frequently to describe the programming.
- d. If providing a computer with device programming tools as part of the project, provide a means for detecting program errors and testing software strategies with a simulation tool. Simulation may be inherent within the programming software suite, or provided by physical controllers mounted in a NEMA 1 test enclosure. The test enclosure shall contain one dedicated controller of each type provided under this contract, complete with power supply and relevant accessories.

#### 2.1.1.5.2 Parameter Modification

All writeable object properties, and all other programming parameters needed to comply with the project specification shall be adjustable for devices at any network level, including those accessible with web-browser communication, and regardless of programming methods used to create the applications.

#### 2.1.1.5.3 Short Cycling Prevention

Provide setpoint differentials and minimum on/off times to prevent equipment short cycling.

#### 2.1.1.5.4 Equipment Status Delay

Provide an adjustable delay from when equipment is commanded on or off and when the control program looks to the status input for confirmation.

#### 2.1.5.5 Run Time Accumulation

Use the Elapsed Time Property to provide re-settable run time accumulation for each Binary Output Object connected to mechanical loads greater than 1 HP, electrical loads greater than 10 KW, or wherever else specified.

#### 2.1.5.6 Timed Local Override

Provide a non-cumulative adjustable override time for the push of a local override button.

#### 2.1.5.7 Time Synchronization

Provide time synchronization, including adjustments for leap years, daylight saving time, and operator time adjustments.

#### 2.1.5.8 Scheduling

Provide operating schedules as indicated, with equipment assigned to groups. Changing the schedule of a group shall change the operating schedule of all equipment in the group. Groups shall be capable of operator creation, modification, and deletion. Provide capability to view and modify schedules in a seven-day week format. Provide capability to enter holiday and override schedules one full year at a time.

#### 2.1.5.9 Object Property Override

Allow writeable object property values to accept overrides to any valid value. Where specified or required for the sequence of control, the Out Of Service property of Objects shall be modifiable using BACnet's write property service. When documented, exceptions to these requirement are allowed for life, machine, and process safeties.

#### 2.1.5.10 Alarms and Events

Alarms and events shall be capable of having programmed time delays and high-low limits. All alarms/events shall report to the EMCS server. Alarms/events shall be stored within the Site Building Controller (SBC). Provide alarms/events in agreement with the point schedule, sequence of operation, and the BAS Owner. At a minimum, provide programming to initiate alarms/events any time a piece of equipment fails to operate, a control point is outside normal range or condition shown on schedules, communication to a device is lost, a device has failed, or a controller has lost its memory.

#### 2.1.5.11 Trending

Provide BACnet trend services capable of trending all object present values set points, and other parameters indicated for trending on project schedules. Trends may be associated into groups, and a trend report may be set up for each group. Trends are stored within a device on the BACnet network, with operator selectable trend intervals from 10 seconds up to 60 minutes. The minimum number of consecutive trend values stored at one time shall be 100 per variable. When trend memory is full, the most recent data shall overwrite the oldest data.

The SBC shall upload trends automatically upon reaching 3/4 of the device buffer limit (via Notification\_Threshold property), by operator request, or by time schedule for archiving. Archived and real-time trend data shall be



available for viewing numerically and graphically for at the workstation and connected notebook computers.

#### 2.1.5.12 Device Diagnostics

Each controller shall have diagnostic LEDs for power, communication, and device fault condition. The DDC system shall recognize and report a non-responsive controller.

#### 2.1.5.13 Power Loss

Upon restoration of power, the DDC system shall perform an orderly restart and restoration of control.

#### 2.1.5.14 Access Control

Provide at least five levels of password protection for operator interfaces. The lowest level only allowing viewing of graphics. The second level allows viewing graphics and changing space temperature setpoints. The third level allows the previous level's capability, plus changing operating schedules. The fourth level allows access to all functions except passwords. The highest level provides all administrator rights and allows full access to all programming, including setting new passwords and access levels. Provide the BAS Owner with the highest level password access. Provide automatic log out if no keyboard or mouse activity is detected after a user-defined time delay.

#### 2.1.5.15 Configuration Tool

Provide the software with the manufacturer's installation CDs and licenses. Licenses shall allow unrestricted use and reproduction for use at the Cherry Point Complex. Software shall not require the use of software keys or "dongles" Configure the software according to the DDC system manufacturer's specifications and in agreement with BACnet standards found in ASHRAE 135, Annex L.

The software shall permit complete monitoring, modification, and troubleshooting interface with the DDC system. The operator interface with the software shall be menu-driven with appropriate displays and menu commands to manipulate the DDC system's objects, point data, operating schedules, control routines, system configuration, trends, alarms, messages, graphics, and reports. Trends shall be capable of graphic display in real time, with variables plotted as functions of time. Each alarmed point shall be capable of displaying its alarm history, showing when it went into alarm, if and when it was acknowledged, and when it went out of alarm. The modification of DDC system parameters and object properties shall be accomplished with "fill in the blank" and/or "point and drag" methods. Modifications shall download to the appropriate controllers at the operator's request.

#### 2.1.5.16 Graphics Software

Provide web-based system graphics viewable on browsers compatible with MS Internet Explorer 6.X or greater using an industry-standard file format such as HTML, BMP, JPEG, or GIF. Graphics for new projects must be consistent with base standards including layout and device naming. Contractor shall install this graphics package on the EMCS Server, bind all points, and demonstrate operability.

Graphic displays shall have full-screen resolution when viewed on the workstation and notebook computers. Dynamic data on graphics pages shall refresh within 10 seconds using an Internet connection, or 30 seconds using a dial-up modem connection. Graphics viewing shall not require additional "plug-in" software like Java, Shockwave and Flash applications unless the software is readily available for free over the Internet, and certified for use with Government provided personal computers.

The graphics shall show the present value and object name for each of the project's I/O points on at least one graphic page. Arrange point values and names on the graphic displays in their appropriate physical locations with respect to the floor plan or equipment graphic displayed. Graphics shall allow the operator to monitor current status, view zone and equipment summaries, use point-and-click navigation between graphic pages, and edit setpoints and parameters directly from the screens. Items in alarm shall be displayed using a different color or other obvious visual indicator. Provide graphics with the following:

- a. Graphic Types: Provide at least one graphic display for each piece of HVAC equipment, building floor, and controlled zone. Indicate dynamic point values, operating statuses, alarm conditions, and control setpoints on each display. Provide summary pages where appropriate.
  - (1) Building Floor Plans: Provide a floor plan graphic for each of the building's floors with dynamic display of space temperature and other important data. If used, indicate and provide links to sub-plan areas. If possible, use the project's electronic drawing files for the graphic backgrounds. Provide clear names for important areas, such as "Main Conference Room." Include room names and numbers where applicable. Include features such as stairwells, elevators, and main entrances. Where applicable, include the mechanical room, HVAC equipment, and control component locations, with corresponding links to the equipment graphics.
  - (2) Sub-plan Areas: Where a building's floor plan is too large to adequately display on the screen, sub-divide the plan into distinct areas, and provide a separate graphic display for each area. Provide same level of detail requested in building floor plan section above.
  - (3) HVAC Equipment: Provide a graphic display for each piece of HVAC equipment, such as a fan coil unit, VAV terminal, or air handling unit. Equipment shall be represented by a two or three-dimensional drawing. Where multiple pieces of equipment combine to form a system, such as a central chiller plant or central heating plant, provide one graphic to depict the entire plant. Indicate the equipment, piping, ductwork, dampers, and control valves in the installed location. Include labels for equipment, piping, ductwork, dampers, and control valves. Show the direction of air and water flow. Include dynamic display of applicable object data with clear names in appropriate locations.
  - (4) Sequence of Operation: Provide a graphic screen displaying the written out full sequence of operation for each piece of HVAC equipment. Provide a link to the sequence of operation displays on their respective equipment graphics. Include dynamic real-time data within the text for setpoints and variables.
- b. Graphic Title: Provide a prominent, descriptive title on each graphic

page.

- c. Dynamic Update: When the workstation is on-line, all graphic I/O object values shall update with change-of-value services, or by operator selected discrete intervals.
- d. Graphic Linking: Provide forward and backward linking between floor plans, sub-plans, and equipment.
- e. Graphic Editing: Provide installed software to create, modify, and delete the DDC graphics. Include the ability to store graphic symbols in a symbol directory and import these symbols into the graphics.
- f. Dynamic Point Editing: Provide full editing capability for deleting, adding, and modifying dynamic points on the graphics.

## 2.2 SENSORS AND INPUT HARDWARE

Coordinate sensor types with the BAS Owner to keep them consistent with existing installations.

### 2.2.1 Field-Installed Temperature Sensors

Where feasible, provide the same sensor type throughout the project. Avoid using transmitters unless absolutely necessary.

#### 2.2.1.1 Thermistors

Precision thermistors may be used in applications below 200 degrees F. Sensor accuracy over the application range shall be 0.36 degree F or less between 32 to 150 degrees F. Stability error of the thermistor over five years shall not exceed 0.25 degrees F cumulative. A/D conversion resolution error shall be kept to 0.1 degrees F. Total error for a thermistor circuit shall not exceed 0.5 degrees F.

#### 2.2.1.2 Resistance Temperature Detectors (RTDs)

Provide RTD sensors with platinum elements compatible with the digital controllers. Encapsulate sensors in epoxy, series 300 stainless steel, anodized aluminum, or copper. Temperature sensor accuracy shall be 0.1 percent (1 ohm) of expected ohms (1000 ohms) at 32 degrees F. Temperature sensor stability error over five years shall not exceed 0.25 degrees F cumulative. Direct connection of RTDs to digital controllers without transmitters is preferred. When RTDs are connected directly, lead resistance error shall be less than 0.25 degrees F. The total error for a RTD circuit shall not exceed 0.5 degrees F. Allow an additional 0.5 percent accuracy for averaging sensors.

#### 2.2.1.3 Temperature Sensor Details

- a. Room Type: Provide the sensing element components within a decorative protective cover suitable for surrounding decor. Provide room temperature sensors with timed override button, setpoint adjustment lever, digital temperature display. Provide a communication port for a portable operator interface like a notebook computer or PDA.
- b. Duct Probe Type: Ensure the probe is long enough to properly sense the air stream temperature.

- c. Duct Averaging Type: Continuous averaging sensors shall be one foot in length for each 4 square feet of duct cross-sectional area, and a minimum length of 6 feet.
- d. Pipe Immersion Type: Provide minimum three-inch immersion. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel when used in steel piping, and brass when used in copper piping. Provide the sensor well with a heat-sensitive transfer agent between the sensor and the well interior.
- e. Outside Air Type: Provide the sensing element on the building's north side with a protective weather shade that positions the sensor approximately 3 inches off the wall surface, does not inhibit free air flow across the sensing element, and protects the sensor from snow, ice, and rain.

#### 2.2.2 Transmitters

Provide transmitters with 4 to 20 mA or 0 to 10 VDC linear output scaled to the sensed input. Transmitters shall be matched to the respective sensor, factory calibrated, and sealed. Size transmitters for an output near 50 percent of its full-scale range at normal operating conditions. The total transmitter error shall not exceed 0.1 percent at any point across the measured span. Supply voltage shall be 12 to 24 volts AC or DC. Transmitters shall have non-interactive offset and span adjustments. For temperature sensing, transmitter drift shall not exceed 0.03 degrees F a year.

##### 2.2.2.1 Relative Humidity Transmitters

Provide transmitters with an accuracy equal to plus or minus 3 percent from 0 to 90 percent scale, and less than one percent drift per year. Sensing elements shall be the polymer type.

##### 2.2.2.2 Pressure Transmitters

Provide transmitters integral with the pressure transducer.

#### 2.2.3 Current Transducers

Provide current transducers to monitor motor amperage. Current switches may be used to indicate on/off status.

#### 2.2.4 Air Quality Sensors

Provide power supply for each sensor.

##### 2.2.4.1 CO2 Sensors

Provide photo-acoustic type CO2 sensors with integral transducers and linear output. The devices shall read CO2 concentrations between 0 and 2000 ppm with full scale accuracy of at least plus or minus 100 ppm.

##### 2.2.4.2 Air Quality Sensors

Provide full spectrum air quality sensors using a hot wire element based on the Taguchi principle. The sensor shall monitor a wide range of gaseous volatile organic components common in indoor air contaminants like paint

fumes, solvents, cigarette smoke, and vehicle exhaust. The sensor shall automatically compensate for temperature and humidity, have span and calibration potentiometers, operate on 24 VDC power with output of 0-10 VDC, and have a service rating of 32 to 140 degrees F and 5 to 95 percent relative humidity.

## 2.2.5 Input Switches

### 2.2.5.1 Timed Local Overrides

Provide buttons or switches to override the DDC occupancy schedule programming for each major building zone during unoccupied periods, and to return HVAC equipment to the occupied mode. This requirement is waived for zones clearly intended for 24 hour continuous operation.

### 2.2.6 Freeze Protection Thermostats

Provide special purpose thermostats with flexible capillary elements 20 feet in length for coil face areas up to 40 square feet. Provide additional thermostats for larger coils. Provide switch contacts rated for the respective motor starter's control circuit voltage. Include auxiliary contacts for the switch's status condition. A freezing condition at any 18-inch increment along the sensing element's length shall activate the switch. The thermostat shall be equipped with a manual push-button reset switch so that when tripped, the thermostat requires manual resetting before the HVAC equipment can restart.

### 2.2.7 Air Flow Measurement Stations

Air flow measurement stations shall have an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements shall be the RTD or thermistor type, traversing the ducted air in at least two directions. The air flow pressure drop across the station shall not exceed 0.1 inch water gage at a velocity of 2,000 fpm. The station shall be suitable for air flows up to 2500 fpm, and a temperature range of 0 to 140 degrees F. The station's measurement accuracy over the range of 125 to 2,500 fpm shall be plus or minus 3 percent of the measured velocity. Station transmitters shall provide a linear, temperature-compensated 4 to 20 mA or 0 to 10 VDC output. The output shall be capable of being accurately converted to a corresponding air flow rate in cubic feet per minute. Transmitters shall be a 2-wire, loop powered device. The output error of the transmitter shall not exceed 0.5 percent of the measurement.

### 2.2.8 Air Flow Measurement For Terminal Devices

Air flow measurement for terminal devices such as variable air volume boxes, with or without fan power shall have an array of pressure sensing elements that sense total pressure and static pressure. The flow measurement shall be integral to the device controller and shall be by differential pressure sensor. The air flow shall measure flows down to 300 fpm with an accuracy of 5 percent of reading.

### 2.2.9 Energy Metering

Provide energy meters to collect steam and water consumption, and hot water solar collector generation for the facility and report to the EMCS database.

#### 2.2.9.1 Steam Meters

Steam meters shall be the vortex type, with pressure compensation, a minimum turndown ratio of 10 to 1. Output signal shall be 4-20 ma, pulsed, or BACnet (MS/TP), all compatible with installed DDC system.

#### 2.2.9.2 Water meters

Water meters 1" and smaller shall be positive displacement nutating disk. Water meters larger than 1" shall be compound type. Output signal shall be 4-10 ma, pulse, or BACnet (MS/TP).

#### 2.2.9.3 Hot Water Solar Collector Meters

Meters for hot water solar collectors may be an integrated BTU meter with a BACnet output or may be a combination of temperature sensors and water flow meter monitored by a DDC controller with the DDC system calculating the BTU transfer. Water flow can be measured by orifice or venturi meter selected for the anticipated system flow rate. Temperature sensors shall be placed in both the supply to and the return from the solar collector array.

### 2.3 OUTPUT HARDWARE

#### 2.3.1 Control Dampers

Provide factory manufactured aluminum blade/galvanized steel frame dampers where indicated. Control dampers shall comply with SMACNA 1966 except as modified or supplemented by this specification. Published damper leakage rates and respective pressure drops shall have been verified by tests in compliance with AMCA 500-D requirements.

Provide damper assembly frames constructed of 13 gauge minimum thickness galvanized steel channels with mitered and welded corners. Damper axles shall be 0.5 inches minimum diameter plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings.

Dampers shall be rated for not less than 2000 fpm air velocity. The pressure drop through each damper when full-open shall not exceed 0.04 inches water gage at 1000 fpm face velocity. Damper assemblies in ductwork subject to above 3-inch water gauge static air pressure shall be constructed to meet SMACNA Seal Class "A" construction requirements.

Provide the damper operating linkages outside of the air stream, including crank arms, connecting rods, and other hardware that transmits motion from the damper actuators to the dampers, shall be adjustable. Additionally, operating linkages shall be designed and constructed to have a 2 to 1 safety factor when loaded with the maximum required damper operating force. Linkages shall be brass, bronze, galvanized steel, or stainless steel.

Provide access doors or panels in hard ceilings and walls for access to all concealed damper operators and damper locking setscrews.

For field-installed control dampers, a single damper section shall have blades no longer than 48 inches and no higher than 72 inches. The maximum damper blade width shall be 12 inches. Larger sized dampers shall be built using a combination of sections.

Frames shall be at least 2 inches wide. Flat blades shall have edges folded

for rigidity. Blades shall be provided with compressible gasket seals along the full length of the blades to prevent air leakage when closed.

The damper frames shall be provided with jamb seals to minimize air leakage. Seals shall be suitable for an operating temperature range of minus 40 degrees F to 200 degrees F.

The leakage rate of each damper when full-closed shall be no more than 3 cfm per sq. foot of damper face area at 1.0 inches water gage static pressure.

## 2.3.2 Control Valves

### 2.3.2.1 Valve Assembly

Valve bodies shall be designed for 125 psig minimum working pressure or 150 percent of the operating pressure, whichever is greater. Valve stems shall be Type 300 series stainless steel. Valve leakage ratings shall be 0.01 percent of rated Cv value. Class 125 copper alloy valve bodies and Class 150 steel or stainless steel valves shall meet the requirements of ASME B16.5. Cast iron valve components shall meet the requirements of ASTM A126 Class B or C.

### 2.3.2.2 Butterfly Valves

Butterfly valves shall be the threaded lug type suitable for dead-end service and for modulation to the fully-closed position, with stainless steel shafts supported by bearings, non-corrosive discs geometrically interlocked with or bolted to the shaft (no pins), and EPDM seats suitable for temperatures from minus 20 degrees F to plus 250 degrees F. Valves shall have a means of manual operation independent of the actuator.

### 2.3.2.3 Two-Way Valves

Two-way modulating valves shall have an equal percentage characteristic.

### 2.3.2.4 Three-Way Valves

Three-way valves shall have an equal percentage characteristic.

### 2.3.2.5 Valves for Chilled Water, Condenser Water, and Glycol Fluid Service

- a. Bodies for valves 1-1/2 inches and smaller shall be brass or bronze, with threaded or union ends. Bodies for valves from 2 inches to 3 inches inclusive shall be of brass, bronze, or iron. Bodies for 2 inch valves shall have threaded connections. Bodies for valves from 2-1/2 to 3 inches shall have flanged connections.
- b. Internal valve trim shall be brass or bronze, except that valve stems shall be stainless steel.
- c. Unless indicated otherwise, provide modulating valves sized for 2 psi minimum and 4 psi maximum differential across the valve at the design flow rate.
- d. Valves 4 inches and larger shall be butterfly valves, unless indicated otherwise.

#### 2.3.2.6 Valves for Hot Water Service

Valves for hot water service below 250 Degrees F:

- a. Bodies for valves 1-1/2 inches and smaller shall be brass or bronze, with threaded or union ends. Bodies for valves from 2 inches to 3 inches inclusive shall be of brass, bronze, or iron. Bodies for 2 inch valves shall have threaded connections. Bodies for valves from 2-1/2 to 3 inches shall have flanged connections.
- b. Internal trim (including seats, seat rings, modulation plugs, valve stems, and springs) of valves controlling water above 210 degrees F shall be Type 300 series stainless steel.
- c. Internal trim for valves controlling water 210 degrees F or less shall be brass or bronze. Valve stems shall be Type 300 series stainless steel.
- d. Non-metallic parts of hot water control valves shall be suitable for a minimum continuous operating temperature of 250 degrees F or 50 degrees F above the system design temperature, whichever is higher.
- e. Unless indicated otherwise, provide modulating valves sized for 2 psi minimum and 4 psi maximum differential across the valve at the design flow rate.
- f. Valves 4 inches and larger shall be butterfly valves, unless indicated otherwise.

#### 2.3.2.7 Valves for High Temperature Hot Water Service

Valves for hot water service 250 Degrees F above:

- a. Valve bodies shall conform to ASME B16.34 Class 300. Valve and actuator combination shall be normally closed. Bodies shall be carbon steel, globe type with welded ends on valves 1 inch and larger. Valves smaller than 1 inch shall have socket-weld ends. Packing shall be virgin polytetrafluoroethylene (PTFE).
- b. Internal valve trim shall be Type 300 series stainless steel.
- c. Unless indicated otherwise, provide modulating valves sized for 2 psi minimum and 4 psi maximum differential across the valve at the design flow rate.

#### 2.3.2.8 Valves for Steam Service

The entire body for valves 1-1/2 inches and smaller shall be brass or bronze, with threaded or union ends. Bodies for valves from 2 to 3 inches inclusive shall be of brass, bronze, or carbon steel. Bodies for valves 4 inches and larger shall be carbon steel. Bodies for 2 inch valves shall have threaded connections. Bodies for valves 2-1/2 inches and larger shall have flanged connections. Internal valve trim shall be Type 300 series stainless steel.

#### 2.3.3 Actuators

Provide direct-drive electric actuators for all control applications, except where indicated otherwise.



#### 2.3.3.1 Electric Actuators

Each actuator shall deliver the torque required for continuous uniform motion and shall have internal end switches to limit the travel, or be capable of withstanding continuous stalling without damage. Actuators shall function properly within 85 to 110 percent of rated line voltage. Provide actuators with hardened steel running shafts and gears of steel or copper alloy. Fiber or reinforced nylon gears may be used for torques less than 16 inch-pounds. Provide two-position actuators of single direction, spring return, or reversing type. Provide modulating actuators capable of stopping at any point in the cycle, and starting in either direction from any point. Actuators shall be equipped with a switch for reversing direction, and a button to disengage the clutch to allow manual adjustments. Provide the actuator with a hand crank for manual adjustments, as applicable. Actuators without spring-return may only be used on terminal fan coil units, terminal VAV units, convectors, and unit heaters. Spring return actuators shall be provided on all control dampers and all control valves except terminal fan coil units, terminal VAV units, convectors, and unit heaters; unless indicated otherwise. Each actuator shall have distinct markings indicating the full-open and full-closed position, and the points in-between.

#### 2.3.4 Output Signal Conversion

#### 2.3.5 Output Switches

##### 2.3.5.1 Control Relays

Field installed and DDC panel relays shall be double pole, double throw, UL listed, with contacts rated for the intended application, indicator light, and dust proof enclosure. The indicator light shall be lit when the coil is energized and off when coil is not energized. Relays shall be the socket type, plug into a fixed base, and replaceable without tools or removing wiring. Encapsulated "PAM" type relays may be used for terminal control applications.

### 2.4 ELECTRICAL POWER AND DISTRIBUTION

#### 2.4.1 Transformers

Transformers shall conform to UL 506. For control power other than terminal level equipment, provide a fuse or circuit breaker on the secondary side of each transformer.

#### 2.4.2 Surge and Transient Protection

Provide each digital controller with surge and transient power protection. Surge and transient protection shall consist of the following devices, installed externally to the controllers.

##### 2.4.2.1 Power Line Surge Protection

Provide surge suppressors on the incoming power at each controller or grouped terminal controllers. Surge suppressors shall be rated in accordance with UL 1449, have a fault indicating light, and conform to the following:

- a. The device shall be a transient voltage surge suppressor, hard-wire

type individual equipment protector for 120 VAC/1 phase/2 wire plus ground.

- b. The device shall react within 5 nanoseconds and automatically reset.
- c. The voltage protection threshold, line to neutral, shall be no more than 211 volts.
- d. The device shall have an independent secondary stage equal to or greater than the primary stage joule rating.
- e. The primary suppression system components shall be pure silicon avalanche diodes.
- f. The secondary suppression system components shall be silicon avalanche diodes or metal oxide varistors.
- g. The device shall have an indication light to indicate the protection components are functioning.
- h. All system functions of the transient suppression system shall be individually fused and not short circuit the AC power line at any time.
- i. The device shall have an EMI/RFI noise filter with a minimum attenuation of 13 dB at 10 kHz to 300 MHz.
- j. The device shall comply with IEEE C62.41.1 and IEEE C62.41.2, Class "B" requirements and be tested according to IEEE C62.45.
- k. The device shall be capable of operating between minus 20 degrees F and plus 122 degrees F.

#### 2.4.3 Wiring

Provide complete electrical wiring for the DDC System, including wiring to transformer primaries. Unless indicated otherwise, provide all normally visible or otherwise exposed wiring in conduit. Where conduit is required, control circuit wiring shall not run in the same conduit as power wiring over 100 volts. Circuits operating at more than 100 volts shall be in accordance with Section 26 20 00, INTERIOR DISTRIBUTION SYSTEM. Run all circuits over 100 volts in conduit, metallic tubing, covered metal raceways, or armored cable. Use plenum-rated cable for circuits under 100 volts in concealed accessible spaces. Examples of these spaces include HVAC plenums, within walls, above suspended ceilings, in attics, and within ductwork. All wiring in mechanical rooms and mezzanines shall be run in conduit.

##### 2.4.3.1 Power Wiring

The following requirements are for field-installed wiring:

- a. Wiring for 24 V circuits shall be insulated copper 18 AWG minimum and rated for 300 VAC service.
- b. Wiring for 120 V circuits shall be insulated copper 14 AWG minimum and rated for 600 VAC service.

#### 2.4.3.2 Analog Signal Wiring

Field-installed analog signal wiring shall be in accordance with manufacturer's installation instructions. Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.

### 2.5 FIRE PROTECTION DEVICES

#### 2.5.1 Duct Smoke Detectors

Provide duct smoke detectors in HVAC ducts in accordance with NFPA 72 and NFPA 90A, except as indicated otherwise. Provide UL listed or FM approved detectors, designed specifically for duct installation.

### 2.6 VARIABLE FREQUENCY (MOTOR) DRIVES

Provide variable frequency drives (VFDs) as indicated. VFDs shall convert 240 or 460 volt (plus or minus 10 percent), three phase, 60 hertz (plus or minus 2Hz), utility grade power to adjustable voltage/frequency, three phase, AC power for stepless motor control from 5 percent to 105 percent of base speed. VFDs shall be UL listed as delivered to the end user. The VFD shall meet the requirements specified in the most current National Electrical Code. Each VFD shall also meet the following:

- a. The VFD shall use sine coded Pulse Width Modulation (PWM) technology. PWM calculations shall be performed by the VFD microprocessor.
- b. The VFD shall be capable of automatic control by a remote 4-20 mA 0 to 10 VDC signal, BACnet interface, or manually by the VFD control panel.

#### 2.6.1 VFD Quality Assurance

VFDs shall be the manufacturer's current standard production unit with at least 10 identical units successfully operating in the field.

#### 2.6.2 VFD Service Support

- a. Warranty: Provide the VFDs with a minimum 24-month full parts and labor warranty. The warranty shall start when the contract's HVAC system is accepted by the Government. Include warranty documentation, dates, and contact information with the VFD on-site service manuals.
- b. VFD Service Manuals: Provide the VFDs with all necessary installation, operation, maintenance, troubleshooting, service, and repair manuals in English including related factory technical bulletins. Provide the documents factory bound, in sturdy 3-ring binders, or hard bound covers. Provide a title sheet on the outside of each binder indicating the project title, project location, installing contractor, contract number, and the VFD manufacturer, address, and telephone number. Each

binder shall include a table of contents and tabbed dividers, with all material neatly organized. The documentation provided shall be specifically applicable to this project, shall be annotated to reflect the actual project conditions, and shall provide a complete and concise depiction of the installed work. Provide a storage cabinet on or near the VFD large enough to hold all of the documentation. Have the cabinet's proposed installation site approved in advance by the Contracting Officer. Prominently label the cabinet "VFD OPERATION AND MAINTENANCE MANUALS." Clearly label each manual with the wording "MECHANICAL ROOM COPY - DO NOT REMOVE".

- c. Technical Support: Provide the VFDs with manufacturer's technical telephone support in English, readily available during normal working hours, and free of charge for the life of the equipment.
- d. Initial Start-Up: Provide the VFDs with factory-trained personnel for the on-site start-up of the HVAC equipment and associated VFD. The personnel shall be competent in the complete start-up, operation, and repair of the particular model VFD installed. The factory start-up representative shall perform the factory's complete recommended start-up procedures and check-out tests on the VFD. Include a copy of the start-up test documentation with the VFD on-site service manuals.
- e. Provide the VFDs with on-site/hands-on training for the user and maintenance personnel. Provide a capable and qualified instructor with minimum two years field experience with the operation and maintenance of similar VFDs. The training shall occur during normal working hours and last not less than 2 hours. Coordinate the training time with the Contracting Officer and the end user. The VFD service manuals shall be used during the training. The contractor shall ensure the manuals are on-site before the start of training. The training shall cover all operational aspects of the VFD.

#### 2.6.3 VFD Features

VFDs shall have the following features:

- a. A local operator control keypad capable of:
  - (1) Remote/Local operator selection with password access.
  - (2) Run/Stop and manual speed commands.
  - (3) All programming functions.
  - (4) Scrolling through all display functions.
- b. Digital display capable of indicating:
  - (1) VFD status.
  - (2) Frequency.
  - (3) Motor RPM.
  - (4) Phase current.
  - (5) Fault diagnostics in descriptive text.

(6) All programmed parameters.

- c. Standard PI loop controller with input terminal for controlled variable and parameter settings.
- d. User interface terminals for remote control of VFD speed, speed feedback, and an isolated form C SPDT relay, which energizes on a drive fault condition.
- e. An isolated form C SPDT auxiliary relay which energizes on a run command.
- f. A metal NEMA 1 enclosure for indoors, NEMA 4 with heater for outdoors.
- g. An adjustable carrier frequency with 16 KHz minimum upper limit.
- h. A built in or external line reactor with 3 percent minimum impedance to protect the VFDs DC buss capacitors and rectifier section diodes.

#### 2.6.4 Programmable Parameters

VFDs shall include the following operator programmable parameters:

- a. Upper and lower limit frequency.
- b. Acceleration and Deceleration rate.
- c. Variable torque volts per Hertz curve.
- d. Starting voltage level.
- e. Starting frequency level.
- f. Display speed scaling.
- g. Enable/disable auto-restart feature.
- h. Enable/disable soft stall feature.
- i. Motor overload level.
- j. Motor stall level.
- k. Jump frequency and hysteresis band.
- l. PWM carrier frequency.

#### 2.6.5 Protective Features

VFDs shall have the following protective features:

- a. An electronic adjustable inverse time current limit with consideration for additional heating of the motor at frequencies below 45Hz, for the protection of the motor.
- b. An electronic adjustable soft stall feature, allowing the VFD to lower the frequency to a point where the motor will not exceed the full-load amperage when an overload condition exists at the requested frequency. The VFD will automatically return to the requested frequency when load

conditions permit.

- c. A separate electronic stall at 110 percent VFD rated current, and a separate hardware trip at 190 percent current.
- d. Ground fault protection that protects the output cables and motor from grounds during both starting and continuous running conditions.
- e. The ability to restart after the following faults:
  - (1) Overcurrent (drive or motor).
  - (2) Power outage.
  - (3) Phase loss.
  - (4) Over voltage/Under voltage.
- f. The ability shut down if inadvertently started into a rotating load without damaging the VFD or the motor.
- g. The ability to keep a log of a minimum of four previous fault conditions, indicating the fault type and time of occurrence in descriptive text.
- h. The ability to sustain 110 percent rated current for 60 seconds
- i. The ability to shutdown safely or protect against and record the following fault conditions:
  - (1) Over current (and an indication if the over current was during acceleration, deceleration, or running).
  - (2) Over current internal to the drive.
  - (3) Motor overload at start-up.
  - (4) Over voltage from utility power.
  - (5) Motor running overload.
  - (6) Over voltage during deceleration.
  - (7) VFD over heat.
  - (8) Load end ground fault.
  - (9) Abnormal parameters or data in VFD EEPROM.

#### 2.6.6 Minimum Operating Conditions

VFDs shall be designed and constructed to operate within the following service conditions:

- a. Ambient Temperature Range, 0 to 120 degrees F.
- b. Non-condensing relative humidity to 90 percent.

### 2.6.7 Additional Features

Provide VFDs with the following additional features:

- a. BACnet MS/TP communication interface port
- b. RFI/EMI filters
- c. One spare VFD of each model provided, fully programmed and ready for back-up operation when connected.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Perform the installation under the supervision of competent technicians regularly employed in the installation of DDC systems.

#### 3.1.1 BACnet Naming and Addressing

Coordinate with the EMCS Owner and provide naming and addressing consistent with existing buildings already loaded on the EMCS server. All DDC controllers shall have a Cherry point unique instance number and all Site Building Controllers shall have a Cherry Point unique name. See "EMCS Equipment and Points Nomenclature for Cherry Point", "EMCS Point Naming Convention for Cherry Point" and "EMCS Graphic Conventions for Cherry Point" attached at the end of this specification section.

##### a. MAC Address

Every BACnet device shall have an assigned and documented MAC Address unique to its network. For Ethernet networks, document the MAC Address assigned at its creation. For ARCNET or MS/TP, assign from 4 to 128.

##### b. Network Numbering

Assign unique numbers to each new network installed on the BACnet internetwork. Provide ability for changing the network number; either by device switches, network computer, or field operator interface. The BACnet internetwork (all possible connected networks) can contain up to 65,534 possible unique networks.

##### c. Device Object Identifier Property Number

Assign unique Device "Object\_Identifier" property numbers or device instances for each device on the BACnet internetwork. Provide for future modification of the device instance number; either by device switches, network computer, or field interface. BACnet allows up to 4,194,302 possible unique devices per internetwork.

##### d. Device Object Name Property Text

The Device Object Name property field shall support 32 minimum printable characters. Assign unique Device "Object\_Name" property names with plain-English descriptive names for each device. For example, the Device Object Name for the device controlling the first floor air handler unit at Building 3408 would be:

Device Object\_Name = CW System B3408

A Device Object Name for a VAV box controller might be:

Device Object\_Name = VAV BOX25

- e. Object Name Property Text (Other than Device Objects)

The Object Name property field shall support 32 minimum printable characters. Assign Object Name properties with plain-English names descriptive of the application. Examples include "Zone 1 Temperature" and "Fan Start/Stop".

- f. Object Identifier Property Number (Other than Device Objects)

Assign Object Identifier property numbers according to design drawings or tables if provided. If not provided, Object Identifier property numbers may be assigned at the Contractor's discretion but must be approved by the Government. In this case they must be documented and unique for like object types within the device.

### 3.1.2 Minimum BACnet Object Requirements

- a. Use of Standard BACnet Objects in accordance with existing Cherry Point standards

For the following points and parameters, use standard BACnet objects, where all relevant object properties can be read using BACnet's Read Property Service, and all relevant object properties can be modified using BACnet's Write Property Service:  
all device physical inputs and outputs, all set points, all PID tuning parameters, all calculated pressures, flow rates, and consumption values, all alarms, all trends, all schedules, and all equipment and lighting circuit operating status.

- b. BACnet Object Description Property

The Object Description property shall support 32 minimum printable characters. For each object, complete the description property field using a brief, narrative, plain English description specific to the object and project application. For example: "HW Pump 1 Proof." Document compliance, length restrictions, and whether the description is writeable in the device PICS.

- c. Analog Input, Output, and Value Objects

Support and provide Description and/or Device\_Type text strings matching signal type and engineering units shown on the points list.

- d. Binary Input, Output, and Value Objects

Support and provide Inactive\_Text and Active\_Text property descriptions matching conditions shown on the points list.

- e. Calendar Object

For devices with scheduling capability, provide at least one Calendar Object with ten-entry capacity. All operators may view Calendar Objects; authorized operators may make modifications from a workstation. Enable the writeable Date List property and support all



calendar entry data types.

f. Schedule Object

Use Schedule Objects for all building system scheduling. All operators may view schedule entries; authorized operators may modify schedules from a workstation.

g. Loop Object or Equal

Use Loop Objects or equivalent BACnet objects in each applicable field device for PID control. Regardless of program method or object used, allow authorized operators to adjust the Update Interval, Setpoint, Proportional Constant, Integral Constant, and Derivative Constant using BACnet read/write services.

### 3.1.1.3 Minimum BACnet Service Requirements

a. Command Priorities

Use commandable BACnet objects to control machinery and systems, providing the priority levels listed below. If the sequence of operation requires a different priority, obtain approval from the Contracting Officer.

| <u>Priority Level</u> | <u>Application</u>         |
|-----------------------|----------------------------|
| 1                     | Manual-Life Safety         |
| 2                     | Automatic-Life Safety      |
| 3                     | (User Defined)             |
| 4                     | (User Defined)             |
| 5                     | Critical Equipment Control |
| 6                     | Minimum On/Off             |
| 7                     | (User Defined)             |
| 8                     | Manual Operator            |
| 9                     | (User Defined)             |
| 10                    | (User Defined)             |
| 11                    | Load Shedding              |
| 12                    | (User Defined)             |
| 13                    | (User Defined)             |
| 14                    | (User Defined)             |
| 15                    | (User Defined)             |
| 16                    | (User Defined)             |

b. Alarming

- (1) Alarm Priorities - Coordinate alarm and event notification with the BAS Owner.
- (2) Notification Class - Enable writeable Priority, Ack Required, and Recipient List properties of Notification Class objects.
- (3) Event Notification Message Texts - Use condition specific narrative text and numerical references for alarm and event notification.

c. Updating Displayed Property Values

Allow workstations to display property values at discrete polled

intervals, or based on receipt of confirmed and unconfirmed Change of Value notifications. The COV increment shall be adjustable by an operator using BACnet services, and polled intervals shall be adjustable at the operator workstation.

#### 3.1.4 Local Area Networks

Obtain Government approval before connecting new networks with existing networks. Network numbers and device instance numbers shall remain unique when joining networks. Do not change existing network addressing without Government approval. See also "BACnet Naming and Addressing".

#### 3.1.5 BACnet Routers, Bridges, and Switches

Provide the quantity of BACnet routers, bridges, and switches necessary for communications shown on the BACnet Communication Architecture schematic. Provide BACnet routers with BACnet Broadcast Message Device (BBMD) capability on each BACnet internetwork communicating across an MS/TP network. Configure each BACnet device and bridge, router, or switch to communicate on its network segment. All switches provided by the contractor shall be approved by base telephone.

#### 3.1.6 Wiring Criteria

- a. Run circuits operating at more than 100 volts in rigid or flexible conduit, metallic tubing, covered metal raceways, or armored cable.
- b. Do not run binary control circuit wiring in the same conduit as power wiring over 100 volts. Where analog signal wiring requires conduit, do not run in the same conduit with AC power circuits or control circuits operating at more than 100 volts.
- c. Provide circuit and wiring protection required by NFPA 70.
- d. Run all wiring located inside mechanical rooms in conduit.
- e. Do not bury aluminum-sheathed cable or aluminum conduit in concrete.
- f. Input/output identification: Permanently label each field-installed wire, cable, and pneumatic tube at each end with descriptive text using a commercial wire marking system that fully encircles the wire, cable, or tube. Locate the markers within 2 inches of each termination. Match the names and I/O number to the project's point list. Similarly label all power wiring serving control devices, including the word "power" in the label. Number each pneumatic tube every six feet. Label all terminal blocks with alpha/numeric labels. All wiring and the wiring methods shall be in accordance with UL 508A.
- g. For controller power, provide new 120 VAC circuits, with ground, if not defined on the electrical drawings. Provide each circuit with a dedicated breaker, and run wiring in its own conduit, separate from any control wiring. Connect the controller's ground wire to the electrical panel ground; conduit grounds are not acceptable.
- h. Surge Protection: Install surge protection according to manufacturer's instructions. Multiple controllers fed from a common power supply may be protected by a common surge protector, properly sized for the total connected devices.

- i. Grounding: Ground controllers and cabinets to a good earth ground as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Conduit grounding is not acceptable; all grounding shall have a direct path to the building earth ground. Ground sensor drain wire shields at the controller end.
- j. The Contractor shall be responsible for correcting all associated ground loop problems.
- k. Run wiring in panel enclosures in covered wire track.

#### 3.1.7 Accessibility

Install all equipment so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install digital controllers, data ports, and concealed actuators, valves, dampers, and like equipment in locations freely accessible through access doors.

#### 3.1.8 Digital Controllers

- a. Install as stand alone control devices (see definitions).
- b. Locate control cabinets at the locations shown on the drawings. If not shown on the drawings, install in the most accessible space, close to the controlled equipment.

#### 3.1.9 Hand-Off-Auto Switches

Wire safety controls such as smoke detectors and freeze protection thermostats to protect the equipment during both hand and auto operation.

#### 3.1.10 Temperature Sensors

Install temperature sensors in locations that are accessible and provide a good representation of sensed media. Installations in dead spaces are not acceptable. Calibrate sensors according to manufacturer's instructions. Do not use sensors designed for one application in a different application.

##### 3.1.10.1 Room Temperature Sensors

Mount the sensors on interior walls to sense the average room temperature at the locations indicated. Avoid locations near heat sources such as copy machines or locations by supply air outlet drafts. Mount the center of the sensor 5 feet above the finished floor.

##### 3.1.10.2 Duct Temperature Sensors

- a. Probe Type: Provide a gasket between the sensor housing and the duct wall. Seal the duct penetration air tight. Seal the duct insulation penetration vapor tight.
- b. Averaging Type (and coil freeze protection thermostats): Weave the capillary tube sensing element in a serpentine fashion perpendicular to the flow, across the duct or air handler cross-section, using durable non-metal supports. Prevent contact between the capillary and the duct or air handler internals. Provide a duct access door at the sensor location. The access door shall be hinged on the side, factory insulated, have cam type locks, and be as large as the duct will permit, maximum 18 by 18 inches. For sensors inside air handlers, the

sensors shall be fully accessible through the air handler's access doors without removing any of the air handler's internals.

#### 3.1.10.3 Immersion Temperature Sensors

Provide thermowells for sensors measuring piping, tank, or pressure vessel temperatures. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in piping at elbows to sense flow across entire area of well. Wells shall not restrict flow area to less than 70 percent of pipe area. Increase piping size as required to avoid restriction. Provide thermal conductivity material within the well to fully coat the inserted sensor.

#### 3.1.10.4 Outside Air Temperature Sensors

Provide outside air temperature sensors in weatherproof enclosures on the north side of the building, away from exhaust hoods and other areas that may affect the reading. Provide a shield to shade the sensor from direct sunlight.

#### 3.1.11 Energy Meters

Locate energy meters as indicated. Connect each meter output to the DDC system, to measure both instantaneous and accumulated energy usage.

#### 3.1.12 Damper Actuators

Where possible, mount actuators outside the air stream in accessible areas.

#### 3.1.13 Thermometers and Gages

Mount devices to allow reading while standing on the floor or ground, as applicable.

#### 3.1.14 Pressure Sensors

Locate pressure sensors as indicated.

#### 3.1.15 Component Identification Labeling

Using an electronic hand-held label maker with white tape and bold black block lettering, provide an identification label on the exterior of each new control panel, control device, actuator, and sensor. Also provide labels on the exterior of each new control actuator indicating the (full) open and (full) closed positions. For labels located outdoors, use exterior grade label tape, and provide labels on both the inside and outside of the panel door or device cover. Acceptable alternatives are white plastic labels with engraved bold black block lettering permanently attached to the control panel, control device, actuator, and sensor. Have the labels and wording approved by the BAS Owner prior to installation.

#### 3.1.16 Network and Telephone Communication Lines

When telephone lines or network connections by the Government are required, provide the Contracting Officer at least 60 days advance notice of need. Provide 1 inch conduit and Cat 5 cable from the Supervisory Building controller (SBC) to the network connection (most likely in the telephone equipment room).

### 3.2 INTERFACE WITH EXISTING EMCS

Interface the new DDC system with Cherry Point's existing EMCS. Obtain Government approval before connecting new DDC system to the EMCS. Any device connected directly to the EMCS must be approved by the Designated Approving Authority by following procedures listed in the DIACAP instruction. Complete installation and programming includes graphic creation, scheduling, alarming, lard management scheduling and trending. The server is located in Building 87: workstations are located at Buildings 87 and 159. Only Johnson Controls factory trained technicians, approved by the EMCS Engineer will be allowed to program the EMCS.

### 3.3 TEST AND BALANCE SUPPORT

The controls contractor shall coordinate with and provide on-site support to the test and balance (TAB) personnel specified under Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC. This support shall include:

- a. On-site operation and manipulation of control systems during the testing and balancing.
- b. Control setpoint adjustments for balancing all relevant mechanical systems, including VAV boxes.
- c. Tuning control loops with setpoints and adjustments determined by TAB personnel.

### 3.4 CONTROLS SYSTEM OPERATORS MANUALS

Provide five electronic and three printed copies of a Controls System Operators Manual. The manual shall be specific to the project, written to actual project conditions, and provide a complete and concise depiction of the installed work. Provide information in detail to clearly explain all operation requirements for the control system.

Provide with each manual: CDs of the project's control system drawings, control programs, data bases, graphics, and all items listed below. Include gateway back-up data and configuration tools where applicable. Provide CDs in jewel case with printed and dated project-specific labels on both the CD and the case. For text and drawings, use Adobe Acrobat or MS Office file types. When approved by the Government, AutoCAD and Visio files are allowed. Give files descriptive English names and organize in folders.

Provide printed manuals in sturdy 3-ring binders with a title sheet on the outside of each binder indicating the project title, project location, contract number, and the controls contractor name, address, and telephone number. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. Manuals shall include the following:

- a. A copy of the as-built control system (shop) drawings set, with all items specified under the paragraph "Submittals." Indicate all field changes and modifications.
- b. A copy of the project's mechanical design drawings, including any official modifications and revisions.
- c. A copy of the project's approved Product Data submittals provided under

the paragraph "Submittals."

- d. A copy of the project's approved Performance Verification Testing Plan and Report. Test report will be a 48 hour trend report verifying all temperature setpoints listed in the sequence of operation. The trend report should be printed from the EMCS server. All systems (AHU's, ERV's, CHWS, HWS) should be part of this section.
- e. A copy of the project's approved final TAB Report. (Added by the Mechanical Contractor (Division 23)).
- f. Printouts of all control system programs, including controller setup pages if used. Include plain-English narratives of application programs, flowcharts, and source code.
- g. Printouts of all physical input and output object properties, including tuning values, alarm limits, calibration factors, and set points.
- h. A table entitled "AC Power Table" listing the electrical power source for each controller. Include the building electrical panel number, panel location, and circuit breaker number.
- i. The DDC manufacturer's hardware and software manuals in both print and CD format with printed project-specific labels. Include installation and technical manuals for all controller hardware, operator manuals for all controllers, programming manuals for all controllers, operator manuals for all workstation software, installation and technical manuals for the workstation and notebook, and programming manuals for the workstation and notebook software.
- j. A list of qualified control system service organizations for the work provided under this contract. Include their addresses and telephone numbers.
- k. A written statement entitled "Technical Support" stating the control system manufacturer or authorized representative will provide toll-free telephone technical support at no additional cost to the Government for a minimum of two years from project acceptance, will be furnished by experienced service technicians, and will be available during normal weekday working hours. Include the toll-free technical support telephone number.
- l. A written statement entitled "Software Upgrades" stating software and firmware patches and updates will be provided upon request at no additional cost to the Government for a minimum of two years from contract acceptance. Include a table of all DDC system software and firmware provided under this contract, listing the original release dates, version numbers, part numbers, and serial numbers.

#### 3.4.1 Storage Cabinets

In one project mechanical room, provide a wall-mounted metal storage cabinet with hinged doors. Provide cabinets large enough to hold the entire set of Controls System Operators Manuals, and the HVAC operation and maintenance manuals provided under Division 23 HVAC. Locate cabinets adjacent to DDC control panels where applicable. Have each cabinet's proposed installation site approved in advance by the Contracting Officer and the BAS Owner. Prominently label each cabinet with the wording "OPERATION AND MAINTENANCE MANUALS." Place one of the three hard copies of

the Operators Manual in this cabinet. Prominently label each binder with the wording "MECHANICAL ROOM COPY - DO NOT REMOVE."

### 3.5 PERFORMANCE VERIFICATION TESTING (PVT)

#### 3.5.1 General

The PVT shall demonstrate compliance of the control system work with the contract requirements. The PVT shall be performed by the Contractor and witnessed and approved by the Government. If the project is phased, provide separate testing for each phase. A Pre-PVT meeting to review the Pre-PVT Checklist is required to coordinate all aspects of the PVT and shall include the Contractor's QA representative, the Contractor's PVT administrator, the Contracting Officer's representative, and the EMCS Owner.

#### 3.5.2 Performance Verification Testing Plan

Submit a detailed PVT Plan of the proposed testing for Government approval. Develop the PVT Plan specifically for the control system in this contract. The PVT Plan shall be a clear list of test items arranged in a logical sequence. Include the intended test procedure, the expected response, and the pass/fail criteria for every component tested.

The plan shall clearly describe how each item is tested, indicate where assisting personnel are required (like the mechanical contractor), and include what procedures are used to simulate conditions. Include a separate column for each checked item and extra space for comments. Where sequences of operations are checked, insert each corresponding routine from the project's sequence of operation. For each test area, include signature and date lines for the Contractor's PVT administrator, the Contractor's QA representative, the Contracting Officer's representative, and the EMCS Owner to acknowledge successful completion.

#### 3.5.3 PVT Sample Size

Test all central plant equipment, primary air handling unit controllers, and fan coil unit controllers unless otherwise directed. Use the DDC system to verify all VAV boxes are controlling as specified. The Government may require testing of like controllers beyond a statistical sample if sample controllers require retesting or do not have consistent results.

The Government may witness all testing, or random samples of PVT items. When only random samples are witnessed, the Government may choose which ones.

#### 3.5.4 Pre-Performance Verification Testing Checklist

Submit the following as a list with items checked off once verified. Provide a detailed explanation for any items that are not completed or verified.

- a. Verify all required mechanical installation work is successfully completed, and all HVAC equipment is working correctly (or will be by the time the PVT is conducted).
- b. Verify HVAC motors operate below full-load amperage ratings.
- c. Verify all required control system components, wiring, and accessories

are installed.

- d. Verify the installed control system architecture matches approved drawings.
- e. Verify all control circuits operate at the proper voltage and are free from grounds or faults.
- f. Verify all required surge protection is installed.
- g. Verify the A/C Power Table specified in "CONTROLS SYSTEM OPERATORS MANUALS" is accurate.
- h. Verify all DDC network communications with the EMCS function properly, including commanding set points, and load shedding.
- i. Verify air handling unit and VAV box coil performance by commanding all valves 100 percent open in both heating and cooling. Record the entering and leaving air temperatures. Record the entering water temperature. This data shall be printed, stored, and saved for future reference.
- j. Verify each digital controller's programming is backed up.
- k. Verify all wiring, components, and panels are properly labeled.
- l. Verify all required points are programmed into devices.
- m. Verify all TAB work affecting controls is complete.
- n. Verify all valve and actuator zero and span adjustments are set properly.
- o. Verify all sensor readings are accurate and calibrated.
- p. Verify each control valve and actuator goes to normal position upon loss of power.
- q. Provide 48 hours of trend data to verify all systems are functioning as specified. Trend reports will verify control set point adjustment per the temperature re-set schedules (as required by sequence of operation).

Provide the following Trends:

- (1) Chilled water System: supply temperature (actual), return temperature (actual)
- (2) Hot Water System: supply temperature (actual), return temperature (actual), supply temperature set point.
- (3) Air Handling Unit: discharge air temperature set point, return air temperature set point, discharge air temperature (actual), return air temperature (actual), valve command position.
- (4) VAV Box (10 percent of VAV's): room temperature set point, room temperature (actual), associated AHU discharge air temperature (actual).
- (5) Energy Recovery Unit: Wheel status, wheel discharge air



temperature (actual), wheel discharge air humidity (actual), unit discharge air temperature set point, unit discharge air temperature (actual).

(6) Fan Coil Unit: valve command position, room temperature set point, room temperature (actual).

- r. Verify each controller works properly in stand-alone mode.
- s. Verify all safety controls and devices function properly, including freeze protection and interfaces with building fire alarm systems.
- t. Verify all electrical interlocks work properly.
- u. Verify all workstations, notebooks and maintenance personnel interface tools are delivered, all system and database software is installed, and graphic pages are created for each device controlled by the DDC system.
- v. Verify the as-built (shop) control drawings are completed.
- w. Verify all required alarms are identified at the EMCS server and proper notification is setup for each alarm condition.

#### 3.5.5 Conducting Performance Verification Testing

- a. Provide trend report for each HVAC system that is part of the buildings DDC system. The trend report shall include a value for each set point listed in the sequence of operation.
- b. Identify any values that do not meet the sequence of operation requirements, make repairs (re-program) and run a new trend for the system. Document each deficiency and corrective action taken.
- c. If re-testing is required, follow the procedures for the initial PVT. The Government may require re-testing of any control system components affected by the original failed test.

#### 3.5.6 Controller Capability and Labeling

Test the following for each controller:

- a. Memory: Demonstrate that programmed data, parameters, and trend/ alarm history collected during normal operation is not lost during power failure.
- b. Direct Connect Interface: Demonstrate the ability to connect directly to each type of digital controller with a portable electronic device like a notebook computer or PDA. Show that maintenance personnel interface tools perform as specified in the manufacturer's technical literature.
- c. Stand Alone Ability: Demonstrate controllers provide stable and reliable stand-alone operation using default values or other method for values normally read over the network. Building DDC system shall function to the project's specifications if connection to the EMCS server is lost.
- d. Wiring and AC Power: Demonstrate the ability to disconnect any controller safely from its power source using the AC Power Table.

Demonstrate the ability to match wiring labels easily with the control drawings. Demonstrate the ability to locate a controller's location using the BACnet Communication Architecture Schematic and floor plans.

- e. Nameplates and Tags: Show the nameplates and tags are accurate and permanently attached to control panel doors, devices, sensors, and actuators.

#### 3.5.7 EMCS Server Operation

- a. Show points lists agree with naming conventions.
- b. Show that graphics are complete.
- c. Show the UPS operates as specified.

#### 3.5.8 BACnet Communications and Interoperability at the EMCS Server

Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. If available or required in this specification, use a BACnet protocol analyzer to assist with identifying devices, viewing network traffic, and verifying interoperability. These requirements must be met even if there is only one manufacturer of equipment installed. Testing includes the following:

- a. Data Presentation: On each BACnet Operator Workstation, demonstrate graphic display capabilities.
- b. Reading of Any Property: Demonstrate the ability to read and display any used readable object property of any device on the network.
- c. Setpoint and Parameter Modifications: Show the ability to modify all setpoints and tuning parameters in the sequence of control or listed on project schedules. Modifications are made with BACnet messages and write services initiated by an operator using workstation graphics, or by completing a field in a menu with instructional text.
- d. Peer-to-Peer Data Exchange: Show all BACnet devices are installed and configured to perform BACnet read/write services directly (without the need for operator or workstation intervention), to implement the project sequence of operation, and to share global data.
- e. Alarm and Event Management: Show that alarms/events are installed and prioritized according to the BAS Owner. Demonstrate time delays and other logic is set up to avoid nuisance tripping, e.g., no status alarms during unoccupied times or high supply air during cold morning start-up. Show that operators with sufficient privilege can read and write alarm/event parameters for all standard BACnet event types. Show that operators with sufficient privilege can change routing (BACnet notification classes) for each alarm/event including the destination, priority, day of week, time of day, and the type of transition involved (TO-OFF NORMAL, TO-NORMAL, etc.).
- f. Schedule Lists: Show that schedules are configured for start/stop, mode change, occupant overrides, and night setback as defined in the sequence of operations.
- g. Schedule Display and Modification: Show the ability to display any schedule with start and stop times for the calendar year. Show that

all calendar entries and schedules are modifiable from any connected workstation by an operator with sufficient privilege.

- h. Archival Storage of Data: Show that data archiving is handled by the operator workstation/server, and local trend archiving and display is accomplished with BACnet Trend Log objects.
- i. Modification of Trend Log Object Parameters: Show that an operator with sufficient privilege can change the logged data points, sampling rate, and trend duration.
- j. Device and Network Management: Show the following capabilities:
  - (1) Display of Device Status Information
  - (2) Display of BACnet Object Information
  - (3) Silencing Devices that are Transmitting Erroneous Data
  - (4) Time Synchronization
  - (5) Remote Device Reinitialization
  - (6) Backup and Restore Device Programming and Master Database(s)
  - (7) Configuration Management of Half-Routers, Routers and BBMDs
  - (8) Demonstrate load shed operations if commanded by the EMCS.

#### 3.5.9 Execution of Sequence of Operation

Demonstrate that the HVAC system operates properly through the complete sequence of operation. Use read/write property services to globally read and modify parameters over the internetwork.

#### 3.5.10 Control Loop Stability and Accuracy

For all control loops tested, give the Government trend graphs of the control variable over time, demonstrating that the control loop responds to a 20 percent sudden change of the control variable set point without excessive overshoot and undershoot. If the process does not allow a 20 percent set point change, use the largest change possible. Show that once the new set point is reached, it is stable and maintained. Control loop trend data shall be in real-time with the time between data points 30 seconds or less.

#### 3.5.11 Performance Verification Testing Report

Upon successful completion of the PVT, submit a PVT Report to the Government and prior to the Government taking use and possession of the facility. Do not submit the report until all problems are corrected and successfully re-tested. The report shall include the annotated PVT Plan used during the PVT. Where problems were identified, explain each problem and the corrective action taken. Include a written certification that the installation and testing of the control system is complete and meets all of the contract's requirements.

### 3.6 TRAINING REQUIREMENTS

Provide a qualified instructor (or instructors) with two years minimum field experience with the installation and programming of similar BACnet DDC systems. Orient training to the specific systems installed. Coordinate training times with the Contracting Officer and BAS Owner after receiving approval of the training course documentation. Training shall take place at the job site and/or a nearby Government-furnished location. A training day shall occur during normal working hours, last no longer than 8 hours and include a one-hour break for lunch and two additional 15-minute breaks. The project's approved Controls System Operators Manual shall be used as the training text. The Contractor shall ensure the manuals are submitted, approved, and available to hand out to the trainees before the start of training.

#### 3.6.1 Training Documentation

Submit training documentation for review 30 days minimum before training. Documentation shall include an agenda for each training day, objectives, a synopsis of each lesson, and the instructor's background and qualifications. The training documentation can be submitted at the same time as the project's Controls System Operators Manual.

#### 3.6.2 Phase I Training - Fundamentals

The Phase I training session shall last one day and be conducted in a classroom environment with complete audio-visual aids provided by the contractor. Provide each trainee a printed 8.5 by 11 inch hard-copy of all visual aids used. Upon completion of the Phase I Training, each trainee should fully understand the project's DDC system fundamentals. The training session shall include the following:

##### a. Review of O&M Manual

1. Network Drawing
2. Equipment
3. Flow Diagram
4. Sequence of Operation
5. Wiring
6. Valve Schedule
7. Damper Schedule
8. Bill of Material

##### b. Network

1. Communication Equipment
2. Configuration Setup of Program
3. Backup Procedures

##### c. Mechanical Equipment

1. Flow Diagram
2. Wiring & Terminations
3. Hardware Interlocks
4. Sequence of Operation
5. Program Decisions and Illustrations of How Program Meets the Sequence of Operation
6. Global Programming Affecting Each Piece of Equipment

d. Building Data Base

1. Alarm Management
2. Trend Management
3. Building Global Interlocks
4. System Load Shedding & Demand Limiting
5. Utility Data (Water, Steam, Solar)

e. System Tools

1. Network Equipment
2. Supervisory Controllers
3. Equipment Controllers
4. Archives

3.6.3 Phase II Training - Operation

Provide Phase II Training shortly after completing Phase I Training. The Phase II training session shall last one day and be conducted at the DDC system workstation, at a notebook computer connected to the DDC system in the field, and at other site locations as necessary. Upon completion of the Phase II Training, each trainee should fully understand the project's DDC system operation. The training session shall include the following:

- a. A walk-through tour of the mechanical system and the installed DDC components (controllers, valves, dampers, surge protection, switches, thermostats, sensors, etc.)
- b. Adding and removing network devices

-- End of Section --

## SECTION 23 21 13.00 20

## LOW TEMPERATURE WATER (LTW) HEATING SYSTEM

04/06

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

- |           |   |
|-----------|---|
| ASSE 1003 | (2009) Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI approved 2010) |
| ASSE 1017 | (2009) Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems - (ANSI approved 2010)  |

## AMERICAN WELDING SOCIETY (AWS)

- |           |   |
|-----------|---|
| AWS Z49.1 | (2005) Safety in Welding and Cutting and Allied Processes |
|-----------|---|

## ASME INTERNATIONAL (ASME)

- |              |  |
|--------------|--|
| ASME B1.1    | (2003; R 2008) Unified Inch Screw Threads (UN and UNR Thread Form)                                     |
| ASME B1.20.1 | (1983; R 2006) Pipe Threads, General Purpose (Inch)  |
| ASME B16.1   | (2010) Gray Iron Threaded Fittings; Classes 25, 125 and 250  |
| ASME B16.11  | (2009) Forged Fittings, Socket-Welding and Threaded  |
| ASME B16.18  | (2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings  |
| ASME B16.21  | (2011) Nonmetallic Flat Gaskets for Pipe Flanges   |
| ASME B16.22  | (2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings             |
| ASME B16.24  | (2006) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500 |

|                       |  |
|-----------------------|--|
| ASME B16.3            | (2010) Malleable Iron Threaded Fittings, Classes 150 and 300   |
| ASME B16.34           | (2013) Valves - Flanged, Threaded and Welding End  |
| ASME B16.36           | (2009) Orifice Flanges   |
| ASME B16.39           | (2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300                                 |
| ASME B16.5            | (2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard                              |
| ASME B16.9            | (2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings  |
| ASME B18.2.2          | (2010) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series) |
| ASME B31.9            | (2011) Building Services Piping  |
| ASME B40.100          | (2005) Pressure Gauges and Gauge Attachments   |
| ASME BPVC SEC VIII D1 | (2007; Addenda 2008; Addenda 2009) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1         |

## ASTM INTERNATIONAL (ASTM)

|                 |   |
|-----------------|---|
| ASTM A123/A123M | (2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products                                 |
| ASTM A194/A194M | (2010a) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both |
| ASTM A307       | (2014) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength                                     |
| ASTM A53/A53M   | (2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless                           |
| ASTM B32        | (2008) Standard Specification for Solder Metal  |
| ASTM B88        | (2009) Standard Specification for Seamless Copper Water Tube  |
| ASTM D 1785     | (2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120                           |

ASTM F 1007 (1986; R 2007) Pipeline Expansion Joints of the Packed Slip Type for Marine Application

ASTM F 1120 (1987; R 2010) Standard Specification for Circular Metallic Bellows Type Expansion Joints for Piping Applications

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015 (1994; R 1995) Copper Tube Handbook

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-110 (2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

MSS SP-58 (2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

MSS SP-67 (2002a) Butterfly Valves

MSS SP-69 (2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

MSS SP-70 (2006) Gray Iron Gate Valves, Flanged and Threaded Ends

MSS SP-72 (2010) Ball Valves with Flanged or Butt-Welding Ends for General Service

MSS SP-80 (2008) Bronze Gate, Globe, Angle and Check Valves

MSS SP-85 (2002) Gray Iron Globe & Angle Valves Flanged and Threaded Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2 (2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V

NEMA ICS 6 (1993; R 2011) Enclosures

NEMA MG 1 (2009) Motors and Generators

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-V-12003 (Rev F; Am 1; CANC Notice 1) Valves, Plug, Cast-Iron or Steel, Manually Operated



## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

|               |  |
|---------------|--|
| CID A-A-1689  | (Rev B) Tape, Pressure-Sensitive Adhesive,<br>(Plastic Film)                                       |
| CID A-A-50560 | (Basic) Pumps, Centrifugal, Water<br>Circulating, Electric-Motor-Driven                            |
| CID A-A-59617 | (Basic) Unions, Brass or Bronze, Threaded<br>Pipe Connections and Solder-Joint Tube<br>Connections |
| FS WW-H-191   | (Rev E; Notice 2) Heater, Fluid,<br>Industrial (Instantaneous, Steam, Water<br>Converter Type)     |
| FS WW-S-2739  | (Basic; Notice 1) Strainers, Sediment:<br>Pipeline, Water, Air, Gas, Oil, or Steam                 |

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

|                 |   |
|-----------------|---|
| 29 CFR 1910.144 | Safety Color Code for Marking Physical<br>Hazards |
| 29 CFR 1910.219 | Mechanical Power Transmission Apparatus           |

## 1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS applies to this section with additions and modifications specified herein.

## 1.3 SYSTEM DESCRIPTION

Except as specified otherwise, equipment and piping components shall be suitable for use in low temperature water heating system. Except as modified herein, the pressure temperature limitations shall be as specified in the referenced standards and specifications. Pressures in this specification are pressures in pounds per square inch above atmospheric pressure, and temperatures are in degrees Fahrenheit (F).

## 1.3.1 Hot Water Heating System

Submit plan, elevations, dimensions, capacities, and ratings. Include the following:

- a. Unit heaters
- b. Pumps
- c. Valves
- d. Expansion tanks
- e. Flow measuring equipment
- f. Air separating tank
- g. Converters

#### 1.4 SUBMITTALS

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

##### SD-03 Product Data

###### Pumps

Include pump speed and characteristic curve for performance of impeller selected for each pump. Curves shall indicate capacity vs head, efficiency, and brake power for full range, from shut-off to free delivery.

###### Expansion tanks

###### Flow measuring equipment

###### External air separation tanks

###### Hot water heating pipe

##### SD-06 Test Reports

###### Hydrostatic test of piping system

##### SD-07 Certificates

###### Backflow preventer certification

###### Welder's qualifications

##### SD-10 Operation and Maintenance Data

###### Converters

#### 1.5 QUALITY ASSURANCE

##### 1.5.1 Standard Commercial Product for Terminal Units

Terminal units provided shall comply with features called out in this specification and shall be the manufacturer's standard commercial product. Additional or better features which are not prohibited by this specification but which are a part of the manufacturer's standard commercial product, shall be included in the terminal units being furnished. A standard commercial product is a product which has been sold or is currently being offered for sale, on the commercial market through advertisements or manufacturer's catalogs, or brochures. Provide Institute of Boiler and Radiator Manufacturer (IBR) or Steel Boiler Institute (SBI) rating for required capacity.

##### 1.5.2 Welding

##### 1.5.2.1 Welding Procedures

Before performing welding, submit three copies of welding procedure

specification for all metals to be used in the work, together with proof of welder's qualification as outlines in ASME B31.9.

#### 1.5.2.2 Welder's Qualifications

Before welder or operator performs welding, submit three copies of Welder's Performance Qualification Record in conformance with ASME B31.9 showing that the welder was tested under the approved procedure specification submitted by the Contractor. In addition, submit each welder's assigned number, letter, or symbol used to identify the work of the welder.

#### 1.5.2.3 Identification of Welder's Work

Ensure that each welder's assigned number, letter or symbol is affixed immediately upon completion of the weld. To welders making defective welds after passing a qualification test, give a requalification test. Upon failing to pass the test, do not permit welder to work in this contract.

#### 1.5.2.4 Previous Qualifications

Welding procedures, welders, and welding operators previously qualified by test may be accepted for this contract without requalification subject to the approval and provided that all the conditions specified in ASME B31.9 are met before a procedure can be used.

#### 1.5.3 Brazing and Soldering

##### 1.5.3.1 Brazing Procedure

ASME B31.9. Brazing procedure for joints shall be as outlined in CDA A4015.

##### 1.5.3.2 Soldering, Soldering Preparation, and Procedures for Joints

ASME B31.9 and as outlined in CDA A4015.

#### 1.5.4 Backflow Preventer Certification

Submit a Certificate of Full Approval or a current Certificate of Approval for backflow preventers.

#### 1.6 SAFETY STANDARDS

##### 1.6.1 Welding

Safety in welding and cutting of pipe shall conform to AWS Z49.1.

##### 1.6.2 Guards

Couplings, motor shafts, gears and other moving parts shall be guarded, in accordance with OSHA 29 CFR 1910.219. Guards shall be cast iron or expanded metal. Guard parts shall be rigid and removable without disassembling the guarded unit.

## PART 2 PRODUCTS

## 2.1 PIPE AND FITTINGS

## 2.1.1 Hot Water Heating Pipe (Supply and Return)

ASTM A53/A53M electric resistance welded or seamless Schedule 40 steel pipe or ASTM B88 Type L hard drawn Copper tubing.

## 2.1.2 Fittings

Provide fittings compatible with the pipe being provided and shall conform to the following requirements.

## 2.1.2.1 Steel or Malleable Iron Pipe

Sizes 1/8 to 2 inches. ASME B16.11 steel socket welding or screwed type or ASME B16.3 for screwed type malleable iron fittings.

## 2.1.2.2 Steel, Cast Iron, or Bronze

Sizes 2 1/2 inches and above. Steel fitting butt welding type ASME B16.9 or ASME B16.5 flanged type. Cast iron fittings flanged type ASME B16.1. Bronze fittings up to 8 inch size flanged type ASME B16.24.

## 2.1.2.3 Fittings for Copper Tubing

ASME B16.18 cast bronze solder joint type or ASME B16.22 wrought copper solder joint type. Fittings may be flared or compression joint type.

## 2.1.3 Unions

## 2.1.3.1 Steel Pipe

Provide ASME B16.39, malleable iron unions, threaded connections.

## 2.1.3.2 Copper Tubing

Provide CID A-A-59617, bronze unions, solder joint end.

## 2.1.3.3 Dielectric Union

Provide insulated union with galvanized steel female pipe-threaded end and a copper solder joint end conforming with ASME B16.39, Class 1, dimensional, strength and pressure requirements. Union shall have a water-impervious insulation barrier capable of limiting galvanic current to one percent of the short-circuit current in a corresponding bimetallic joint. When dry, insulation barrier shall be able to withstand a 600-volt breakdown test.

## 2.1.4 Flanges

Remove raised faces when used with flanges having a flat face.

## 2.1.4.1 Steel Flanges

ASME B16.5 forged steel, welding type.

#### 2.1.4.2 Cast Iron Screwed Flanges

ASME B16.1.

#### 2.1.4.3 Bronze Screwed Flanges

ASME B16.24.

#### 2.1.5 Drains and Overflows

##### 2.1.5.1 Copper Tubing

ASTM B88, Type M, hard drawn, cast brass or wrought copper fittings, Grade Sb5 solder joints.

##### 2.1.5.2 PVC Pipe

ASTM D 1785, Schedule 40, and solvent weld joints.

#### 2.1.6 Valves

Valves shall have rising stems and shall open when turned counterclockwise.

##### 2.1.6.1 Gate Valves

- a. Bronze Gate Valves: MSS SP-80, 2 inches and smaller, wedge disc, inside screw type not less than Class 150. Use solder joint ends with copper tubing.
- b. Steel Gate Valves: ASME B16.34, provide with open stem and yoke type with solid wedge or flexible wedge disc and heat and corrosion-resistant steel trim.
- c. Cast Iron Gate Valves: MSS SP-70, 2 1/2 inches and larger, open stem and yoke type with bronze trim.

##### 2.1.6.2 Globe and Angle Valves

- a. Bronze Globe and Angle Valves: MSS SP-80, 2 inches and smaller, Class 200, except use Class 150 with solder ends for copper tubing. Valves shall have renewable seat and discs except solder end valves which shall have integral seats.
- b. Steel Globe and Angle Valves: ASME B16.34, provide with heat and corrosion-resistant trim.
- c. Cast Iron Globe and Angle Valves: MSS SP-85, 2 1/2 inches and larger, with bronze trim, tapped drains and brass plug.

##### 2.1.6.3 Check Valves

- a. Bronze Check Valves: MSS SP-80, 2 inches and smaller, regrinding swing check type, Class 200.
- b. Steel Swing Check Valves: ASME B16.34, regrinding swing check type, Class 200.

(1) Swing check valves shall have bolted caps.

- (2) Steel Lift check valves 2 inches and smaller shall have bolted caps. Lift check valves 2 1/2 inches and larger shall have pressure seal caps.

c. Cast Iron Check Valves: ASME B16.34, 2 1/2 inches and larger, bronze trim, non-slam, eccentric disc type for centrifugal pump discharge service.

#### 2.1.6.4 Temperature Regulating Valves

Provide ASSE 1017 copper alloy body with adjustable range thermostat.

#### 2.1.6.5 Water Pressure-Reducing Valves

ASSE 1003.

#### 2.1.6.6 Plug Valves

MIL-V-12003, except that a replaceable valve seat will not be required. Type I - lubricated, tapered plug valves.

#### 2.1.6.7 Ball Valves

Flanged or butt-welding ends ball valve shall conform to MSS SP-72, steel. Threaded, socket-welding, solder joint, grooved and flared ends shall conform to MSS SP-110.

#### 2.1.6.8 Flow Control Balancing Valves

Copper alloy or cast iron body, copper alloy or stainless internal working parts, and integral pointer that indicates the degree of valve opening. Valves shall be suitable for 125 psig at 190 degrees F hot water. Valve shall function as a service valve when in fully closed position. Valve body shall have factory-installed tapings for differential pressure meter connections for verification of pressure differential across valve orifice. Meter connections shall have positive check valves or shutoff valves. Each valve shall have metal tag showing the gallons per minute flow for each differential pressure reading.

#### 2.1.6.9 Butterfly Valves

Conform with MSS SP-67, Type I - Tight shut off valve, and flanged valve ends. Valve body material shall be cast iron and shall be bubble tight for shutoff at 150 psig. Flanged and flangeless type valves shall have Type 300 series corrosion resistant steel stems and corrosion resistant or bronze discs with molded elastomer disc seals. Flow conditions shall be for the regulation from maximum flow to complete shutoff by way of throttling effect. Valves shall be provided in closed system. Valves smaller than 8 inches shall have throttling handles. Valves 8 inches and larger shall have totally enclosed manual gear operators with adjustable balance return stops and indicators. Valves shall have a minimum of 7 locking positions and shall be suitable for water temperatures up to 200 degrees F.

#### 2.1.6.10 Relief Valves

Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

#### 2.1.6.11 Balancing Valves

Balancing valves shall be calibrated bronze body balancing valves with integral ball valve and venturi or valve orifice and valve body pressure taps for flow measurement based on differential pressure readings. Valve pressure taps and meter connections shall have seals and built-in check valves with threaded connections for a portable meter. Meter shall be provided by the same manufacturer and be capable of reading system pressures and shall meet the requirements of the paragraph entitled "Flow Measuring Equipment." Valves shall have internal seals to prevent leakage around rotating element and be suitable for full shut-off rated pressure. Valves shall have an operator with integral pointer and memory stop. Balancing valves shall be selected for the required flows as indicated on the plans.

#### 2.1.7 End Connections

##### 2.1.7.1 Flexible Connectors

Provide flexible pipe connectors on piping connected to equipment. Flexible section shall consist of rubber, tetrafluoroethylene resin, corrosion-resistant steel, bronze, monel, or galvanized steel. Material provided and configuration shall be suitable for pressure, temperature, and circulating medium. Flexible section shall have threaded, welding, soldering, flanged or socket-weld ends and shall be suitable for service intended. Flexible section may be reinforced with metal retaining rings, with built-in braided wire reinforcement and restriction bolts or with wire braid cover suitable for service intended.

##### 2.1.7.2 Steel Piping

Screwed or socket welded for 2 inches and smaller and flanged or butt welded for 2 1/2 inches and larger.

- a. Screwed Joints With Taper Threads: ASME B1.20.1.
- b. Flanged Joints: Bolting and gaskets shall be as follows:
  - (1) Bolting: Bolt and stud material ASTM A307, Grade B, and nut material ASTM A194/A194M, Grade 2. Bolt, stud, and nut dimensions ASME B18.2.2 threads ASME B1.1 coarse type with Class 2A fit for bolts and studs, and Class 2B fit for nuts. Bolts or bolt studs shall extend completely through the nuts and may have reduced shanks of a diameter not less than the diameter at root of threads. Carbon steel bolts shall have American Standard regular square or heavy hexagon heads and shall have American Standard heavy semifinished hexagonal nuts conforming to ASME B18.2.2.
  - (2) Gaskets: ASME B16.21, Nonasbestos compressed material 1/16 inch thickness full face or self-centering flat ring type and suitable for pressure and temperature of the piping system.
- c. Butt Weld Joints: ASME B31.9. Backing rings shall conform to ASME B31.9. Ferrous rings shall not exceed 0.05 percent sulfur; for alloy pipe, backing rings shall be of material compatible with the chemical composition of the parts to be welded and preferably of the same composition. Provide continuous machined or split band backing rings.

d. Socket Weld Joints: ASME B31.9.

2.1.7.3 Joints for Copper Tubing

- a. Solder conforming to ASTM B32 alloy grade Sb5 or Sn96. Solder and flux shall be lead free (less than 0.2 percent of lead).
- b. Copper Tube Extracted Joint: An extracted mechanical tee joint 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.

2.1.8 Expansion Joints

2.1.8.1 Packless Type

Provide ASTM F 1120, Type III with fabricated corrosion-resistant steel bellows.

2.1.8.2 Guided Slip-Tube Type

Provide ASTM F 1007, Type IV internally-externally guided, injected semiplastic type packing.

2.1.9 Instrumentation

2.1.9.1 Pressure and Vacuum Gauges

Provide ASME B40.100 with restrictor.

2.1.9.2 Indicating Thermometers

Thermometers shall be dial type with an adjustable angle suitable for the service. Provide thermowell sized for each thermometer in accordance with the thermowell specification. Fluid-filled thermometers (mercury is not acceptable) shall have a nominal scale diameter of 5 inches. Construction shall be stainless-steel case with molded glass cover, stainless-steel stem and bulb. Stem shall be straight, length as required to fit well. Bimetal thermometers shall have a scale diameter of 3 1/2 inches. Case shall be hermetic. Case and stem shall be constructed of stainless steel. Bimetal stem shall be straight and of a length as required to fit the well.

2.1.9.3 Pressure/Temperature Test Ports

Pressure/Temperature Test Ports shall have brass body and EPDM and/or Neoprene valve seals. Ports shall be rated for service between 35 and 275 degrees F and up to 500 psig. Ports shall be provided in lengths appropriate for the insulation thickness specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS and installed to allow a minimum of 12 inches of access for probe insertion. Provide with screw-on cap attached with a strap or chain to prevent loss when removed. Ports shall be 1/4 inch NPT and accept 1/8 inch diameter probes.



## 2.1.10 Miscellaneous Pipeline Components

### 2.1.10.1 Air Vent

Provide float type air vent in hydronic systems. Vent shall be constructed of brass or semi-steel body, copper float, and stainless steel valve and valve seat. Design air vent to suit system operating temperature and pressure. Provide isolating valve to permit service without draining the system. Pipe discharge of vent to a drain.

### 2.1.10.2 Strainers

Strainers for classes 125 and 250 piping in IPS 1/2 to 8 inches, inclusive, FS WW-S-2739 and locate as indicated.

### 2.1.10.3 Hangers and Supports

Design and fabrication of pipe hangers, supports, and welding attachments shall conform to MSS SP-58 and ASME B31.9. Hanger types and supports for bare and covered pipe shall conform to MSS SP-69 for the temperature range.

### 2.1.10.4 Pipe Sleeves

Sleeves in masonry and concrete walls, floors, and roof slabs shall be ASTM A53/A53M, Schedule 40 or Standard Weight, hot-dip galvanized steel pipe. Sleeves in partitions shall be zinc-coated sheet steel having a nominal weight of not less than 0.906 pound per square foot.

### 2.1.10.5 Escutcheon Plates

Provide one piece or split hinge metal plates for piping passing through floors, walls, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces and paint finish on metal plates in unfinished spaces.

## 2.2 CENTRAL MECHANICAL EQUIPMENT

### 2.2.1 Converters

Steam to hot water converters shall conform to FS WW-H-191 and shall have capacity as indicated for the design conditions. The converters shall be designed for support by separate pipe hangers, and temperature regulator shall be provided.

## 2.3 PIPING SYSTEM EQUIPMENT

### 2.3.1 Pumps

Provide hot water circulating pumps, CID A-A-50560, Service A. Pump casing and flange shall be made of close-grained cast iron. Shaft shall be carbon or alloy steel with lubricated bearings and impeller shall be bronze. Select pumps so that the operating point on selected impeller-curve will lie at or to the left of shutoff side of, and not more than 5 percent below, point of maximum efficiency for impeller. Provide motors of open splash proof type conforming to NEMA MG 1 and suitable for electrical characteristic as indicated. Motor starters shall conform to NEMA ICS 2 wye-delta type with NEMA ICS 6 general purpose enclosure.

### 2.3.2 Expansion Tanks

Provide welded steel, constructed and tested hydrostatically in accordance with ASME BPVC SEC VIII D1. Tank shall be equipped with all necessary fittings. The tank and fittings shall be pressure rated at least equal to the test pressure of the total system. Zinc coat the tank inside and out after fabrication by the hot dip process ASTM A123/A123M.

### 2.3.3 External Air Separation Tanks

Provide tank constructed of steel, designed for not less than 75 psig, and constructed and tested in accordance with the requirements of ASME BPVC SEC VIII D1. Provide tangential inlet and outlet connections, flanged for sizes 2 1/2 inches and larger. Each unit shall have an internal design suitable for creating the required vortex and subsequent air separation. Provide with automatic air release device and galvanized steel strainer. Provide a blow down connection with a gate valve and piped to nearest floor drain.

### 2.3.4 Flow Measuring Equipment

Orifice or venturi type. Flow metering equipment including pitot tubes, venturis, orifice plates, flanges, and indicating meters shall be the product of one and the same manufacturer. Provide flowmeters of permanent type. Flowmeters shall be suitable for service in which they are to be installed. Primary elements of flowmeters shall conform to ASME recommendations for flowmeters. Provide bronze, monel, or stainless steel materials for wetted parts of flow meters.

- a. Orifices: Square-edge type, made of corrosion and erosion resistant metal and mounted between pipe flanges having factory-made pressure taps provided with shutoff valves. Orifice flanges shall conform to ASME B16.36.
- b. Tubular Flowmeters: Flow measuring elements consisting of venturi tubes or pitot tubes where indicated. Locations and arrangement of piping, both upstream and downstream of flow measuring elements shall conform to the manufacturer's published literature. Provide each flow measuring element with an integral tab, or a metal tag on a corrosion-resistant steel wire, extending outside pipe covering, and stamped or printed in a visible position with manufacturer's name and address; serial number of meter to which it is to be connected; name, number, or location of equipment served; specified rate of flow; and multiplier to be applied to meter reading. Provide taps with shutoff valves and quick connecting hose fittings for portable meters or double ferrule compression fittings for connection to tubing for permanently located meters or recorders. Tubes shall be calibrated in accordance with ASME recommendations.
  - (1) Venturi Tubes: Certified by the manufacturer for the actual piping configuration and any necessary piping changes required for certification without additional cost to the Government. Throat diameter for each venturi tube shall be designed so that at specified rate of flow the scale reading will fall between 50 percent and 80 percent of full scale value. Select venturi tube sizes from the manufacturer's latest published tables of flow versus differential pressure. Unrecovered head loss at maximum flow shall not exceed 10 percent. Provide bronze or cast iron tubes with bronze-lined throats, with flanged, threaded, or welded

ends to suit piping system. Provide bodies of fabricated steel and fittings of the same class as piping in which installed. Two integral meter taps shall be provided in each venturi tube. Connections for attachment to portable flow meter hoses shall be readily accessible and not over 6 feet above a floor or permanent platform.

- (2) Pitot Tube Assemblies: Provide corrosion-resistant materials. Tubes shall be capable of measuring liquid flow through tube elements providing an averaged, interpolated flow measurement from a single, fixed position. Provide self cleaning elements and impact tube designed to rotate when turned by the operator to protect pressure-sensing elements of tube when not in use. Location and total amount of pitot tubes required for system flow measurement shall be as recommended by the manufacturer and as indicated.

- c. Meters: Designed for a full scale pressure differential of 50 inches water gage for tubular type or 100 inches water gage for orifice type. Dials shall have square root or linear scales with developed length of not less than 12 inches. Provide flush mounted panel meters that read directly in gallons per minute. Dials of portable meters shall have square root scales reading from 0 to 100 gpm for use with multiplier stamped on orifice or tubular type. Provide meters designed for not less than 200 psi and protected against pressure surges. Meter bodies shall have taps for venting and draining.

- (1) Permanently Mounted Meters: Each meter shall be connected completely as indicated and provided with the following: three valve manifold equalizer lines, two block valves, two vent and drain valves, and an integral pulsation damper. Overall accuracy of meters shall be plus or minus 2 percent of full scale flow over a range from 20 to 100 percent of full scale flow.

## 2.4 TERMINAL UNITS

## 2.5 ELECTRICAL EQUIPMENT

Provide complete with motors, motor starters, thermal overload protection, and controls. Equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

## 2.6 INSULATION

Provide shop and field applied insulation as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

## 2.7 ASBESTOS PROHIBITION

Asbestos and asbestos containing products are prohibited.

# PART 3 EXECUTION

## 3.1 PREPARATION

Provide storage for equipment and material at the project site. All parts shall be readily accessible for inspection, repair, and renewal. Protect

material and equipment from the weather.

### 3.2 INSTALLATION

Piping fabrication, assembly, welding, soldering, and brazing shall conform to ASME B31.9. Piping shall follow the general arrangement shown. Route piping and equipment within buildings out of the way of lighting fixtures and doors, windows, and other openings. Run overhead piping in buildings in inconspicuous positions. Provide adequate clearances from walls, ceilings, and floors to permit welding of joints and application of insulation. Make provision for expansion and contraction of pipe lines. Make changes in size of water lines with reducing fittings. Do not bury, conceal, or insulate until piping has been inspected, tested, and approved. Do not run piping concealed in walls, partitions, underground, or under the floor except as otherwise indicated. Where pipe passes through building structure, locate pipe joints and expansion joints where they may be inspected. Provide flanged joints where necessary for normal maintenance and where required to match valves and equipment. Furnish gaskets, packing, and thread compounds suitable for the service. Provide long radius ells where possible to reduce pressure drops. Pipe bends in lieu of welding fittings may be used where space permits. Pipe bends shall have a uniform radius of at least five times the pipe diameter and shall be free from appreciable flattening, wrinkling, or thinning of the pipe. Do not use mitering of pipe to form elbows, notching straight runs to form full sized tees, or any similar construction. Make branch connections over 2 inches with welding tees except factory made forged welding branch outlets or nozzles having integral reinforcements conforming to ASME B31.9 may be used, provided the nominal diameter of the branch is at least one pipe size less than the nominal diameter of the run. Branch connections 2 inches and under can be threaded or welded. Run vertical piping plumb and straight and parallel to walls. Provide sleeves for lines passing through building structure. Provide a fire seal where pipes pass through fire wall, fire partitions, fire rated pipe chase walls, or floors above grade. Install piping connected to equipment with flexibility for thermal stresses and for vibration, and support and anchor so that strain from weight and thermal movement of piping is not imposed on the equipment.

#### 3.2.1 Hangers and Supports

Unless otherwise indicated, horizontal and vertical piping attachments shall conform to MSS SP-58. Band and secure insulation protection shields without damaging pipe insulation. Continuous inserts and expansion bolts may be used.

#### 3.2.2 Grading of Pipe Lines

Unless otherwise indicated, install horizontal lines of hot water piping to grade down in the direction of flow with a pitch of not less than one inch in 30 feet, except in loop mains and main headers where the flow may be in either direction.

#### 3.2.3 Pipe Sleeves

Provide sleeves where pipes and tubing pass through masonry or concrete walls, floors, roof, and partitions. Annular space between pipe, tubing, or insulation and the sleeve shall not be less than 1/4 inch. Hold sleeves securely in proper position and location before and during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls, partitions, or slabs. Sleeves in floor slabs shall extend 2 inches

above finished floor. Firmly pack space between pipe or tubing and sleeve with oakum and caulk on both ends of the sleeve with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. Seal both ends of penetrations through fire walls and fire floors to maintain fire resistive integrity with UL listed fill, void, or cavity material.

#### 3.2.4 Flashing for Buildings

Provide flashing where pipes pass through building roofs, and make outside walls tight and waterproof.

#### 3.2.5 Unions and Flanges

Provide unions and flanges to permit easy disconnection of piping and apparatus. Each connection having a screwed-end valve shall have a union. Place unions and flanges no farther apart than 100 feet. Install unions downstream of valves and at equipment or apparatus connections. Provide unions on piping under 2 inches in diameter, and provide flanges on piping 2 inches and over in diameter. Provide dielectric unions or flanges between ferrous and non-ferrous piping, equipment, and fittings; except that bronze valves and fittings may be used without dielectric couplings for ferrous-to-ferrous or non-ferrous-to-non-ferrous connections.

#### 3.2.6 Connections for Future Equipment

Locate capped or plugged outlets for connections to future equipment as indicated.

#### 3.2.7 Changes in Pipe Size

Provide reducing fittings for changes in pipe size; reducing bushings are not permitted. In horizontal lines, provide eccentric reducing fittings to maintain the top of the lines in the same plane.

#### 3.2.8 Cleaning of Pipe

Thoroughly clean each section of pipe, fittings, and valves free of foreign matter before erection. Prior to erection, hold each piece of pipe in an inclined position and tap along its full length to loosen sand, mill scale and other foreign matter. For pipe 2 inches and larger, draw wire brush, of a diameter larger than that of the inside of the pipe, several times through the entire length of pipe. Before making final connections to apparatus, wash out interior of piping thoroughly with water. Plug or cap open ends of mains during shutdown periods. Do not leave lines open where foreign matter might enter the pipe.

#### 3.2.9 Valves

Install valves in conformance with ASME B31.9. Provide gate valves unless otherwise directed. Install valves with stems horizontal or above. Locate or equip stop valves to permit operation from floor level, or provide with safe access in the form of walkways or ladders. Install valves in positions accessible for operation and repair.

##### 3.2.9.1 Globe Valves

Install globe valves so that the pressure is below the disk and the stem horizontal.

### 3.2.9.2 Relief Valves

Provide valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks. Select system relief valve so that capacity is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment. Pipe relief valve outlet to the nearest floor drain.

### 3.2.10 Pressure Gage

Provide a shut-off valve or pet cock between pressure gages and the line.

### 3.2.11 Thermometers

Provide thermometers and thermal sensing elements of control valves with a separable socket. Install separable sockets in pipe lines in such a manner to sense the temperature of flowing the fluid and minimize obstruction to flow.

### 3.2.12 Strainers

Provide strainers, with meshes suitable for the services, where indicated, or where dirt might interfere with the proper operation of valve parts, orifices, or moving parts of equipment.

### 3.2.13 Pumps

Select pumps for specified fluid temperatures, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve. Support piping adjacent to pump such that no weight is carried on pump casings. Install close coupled and base mounted pumps on concrete base, with anchor bolts, set and level, and grout in place and provide supports under elbows on pump suction and discharge line sizes 4 inches and over. Lubricate pump before start-up.

### 3.2.14 Equipment Foundations

Locate equipment foundations as shown on the drawings. Size, weight, and design shall preclude shifting of equipment under operating conditions. Foundations shall meet the requirements of the equipment manufacturer.

### 3.2.15 Equipment Installation

Install equipment in accordance with installation instructions of the manufacturers. Grout equipment mounted on concrete foundations before installing piping. Install piping in such a manner as not to place a strain on the equipment. Do not bolt flanged joints tight unless they match. Grade, anchor, guide, and support piping without low pockets.

### 3.2.16 Cleaning of Systems

As installation of the various system components is completed, fill, start, and vent prior to cleaning. Place terminal control valves in open position. Add cleaner to closed system at concentration as recommended by manufacturer. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water. Circulate for 6 hours at design temperatures, then

drain. Refill with clean water and repeat until system cleaner is removed. Use neutralizer agents on recommendation of system cleaner supplier and approval of Contracting Officer. Remove, clean, and replace strainer screens. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required. Preliminary or final tests are not permitted until cleaning is approved.

### 3.2.17 Painting of Piping and Equipment

Provide in accordance with Section 09 90 00 PAINTS AND COATINGS.

### 3.2.18 Identification of Piping

Identify piping in accordance with OSHA 29 CFR 1910.144, except that labels or tapes may be used in lieu of painting or stenciling. Spacing of identification marking on runs shall not exceed 50 feet. Materials for labels and tapes shall conform to CID A-A-1689, and shall be general purpose type and color class. Painting and stenciling shall conform to Section 09 90 00 PAINTS AND COATINGS.

## 3.3 FIELD QUALITY CONTROL

Perform inspections and tests as specified herein to demonstrate that piping and equipment, as installed, is in compliance with contract requirements. Start up and operate the system. During this time, periodically clean the various strainers until no further accumulation of foreign material occurs. Exercise care so that minimum loss of water occurs when strainers are cleaned. Adjust safety and automatic control instruments to place them in proper operation and sequence.

### 3.3.1 Hydrostatic Test of Piping System

Test piping system hydrostatically using water not exceeding 100 degrees F. Conduct tests in accordance with the requirements of ASME B31.9 and as follows. Test piping system after all lines have been cleaned and before applying insulation covering. Remove or valve off from the system, gages, and other apparatus which may be damaged by the test before the tests are made. Install calibrated test pressure gage in the system to observe any loss in pressure. Maintain test pressure for a sufficient length of time to enable an inspection of each joint and connection. Perform tests after installation and prior to acceptance. Notify the Contracting Officer in writing 14 days prior to the time scheduled for the tests.

### 3.3.2 Auxiliary Equipment and Accessory Tests

Observe and check pumps, accessories, and equipment during operational and capacity tests for leakage, malfunctions, defects, noncompliance with referenced standards, or overloading.

## 3.4 TESTING, ADJUSTING, AND BALANCING

Test, adjust, and balance the hydronic system in accordance with Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.

### 3.4.1 Markings of Settings

Following final acceptance of the balancing report, the settings of all valves, splitters, dampers, and other adjustment devices shall be

permanently marked so that adjustment can be restored if disturbed at anytime.

-- End of Section --



## SECTION 23 22 13.35 40

## STEAM TRAPS

02/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM A216/A216M (2008) Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

ASTM A278/A278M (2001; R 2006) Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650 degrees F (350 degrees C)

## 1.2 GENERAL REQUIREMENTS

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS applies to work specified in this section.

Submit manufacturer's catalog data for steam traps in accordance with referenced standards contained in this section.

## 1.3 SUBMITTALS

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

SD-03 Product Data

Manufacturer's Catalog Data

SD-07 Certificates

Steam Traps

Trap Bodies and Components

## PART 2 PRODUCTS

## 2.1 MATERIALS

Ensure that traps exposed to weather are freezeproof.

Submit certificates for steam traps and trap bodies and components showing conformance with the referenced standards contained in this section.

## 2.2 TRAP APPLICATION

| <u>SERVICE</u>   | <u>TRAP TYPE</u>  |
|--|---|
| Steam mains, risers, branches  | Type IB, inverted bucket with thermostatic air vent where necessary |
| Steam mains, risers, and branches, weather-exposed and subject to freezing | Refer to drawings   |
| Steam coils associated with fans   | Type F&T, float and thermostatic                                    |
| Steam coils not associated with fans and not subject to freezing           | Type T, thermostatic  |
| Hot-water converter  | Type F&T, float and thermostatic                                    |
| Flash tank   | Type IB, inverted bucket  |

## 2.3 TRAP-SIZING CRITERIA

Size traps in steam mains, risers, and branches to provide an actual capacity, under normal operating conditions, of not less than three times the normal condensing rate.

Size traps draining underground steam mains to provide an actual capacity, under normal operating conditions, of not less than four times the normal condensing rate.

Size traps in steam mains, risers, and branches, weather-exposed and subject to freezing, to provide an actual capacity, under normal operating conditions, of two times normal condensing rate and duplex. Provide two identical traps, sized appropriately at each drainage point.

Size traps draining steam coils under modulating control to provide an actual capacity, under conditions normal to the system and including 1/2-pound per square inch (psi) coil pressure, of two times normal condensing rate and capable of opening at maximum coil steam pressure.

Size traps in all other services to provide an actual capacity, under normal operating conditions, of three times normal condensing rate.

Trap safety factors are minimal. Increase safety factor where necessary to ensure proper system drainage for a given application. Do not decrease without written approval.

## 2.4 TRAP TYPE, CONSTRUCTION, AND MATERIALS

Provide trap bodies and components with a primary working steam pressure (wsp)-rating equal to or in excess of the maximum wsp of the steam system to which they are applied.

Provide cast iron trap bodies for pressures 125-psi wsp and under in accordance with ASTM A278/A278M, Class 30.

Provide welded end connection trap bodies of cast steel in accordance with ASTM A216/A216M, Grade WCB

Ensure traps have permanent external identification of service indicating rating and orifice size.

#### 2.4.1 Type F&T

Provide float and thermostatic traps with AISI 300 series corrosion-resistant steel, heliarc-welded floats and operating mechanisms, and hardened 13 percent chrome corrosion-resistant steel seats and valves.

Balance thermostatic elements, pressure type, with corrosion-resistant alloy bellows charged with a fluid that provides the most rapid response to changes in temperature.

Make bellows suitable for service with condensate having a pH of 6.0.

Design traps to permit removal and replacement of all operating and wearing parts without disturbing piping connections to trap body.

Design bellows to permit removal while hot without overexpansion and shield from direct blast of steam and condensate.

Fit bodies with drain plug.

### PART 3 EXECUTION

#### 3.1 TRAP INSTALLATION

Install traps in accordance with the manufacturer's instructions.

#### 3.2 COMPONENT INSTALLATION

Install trap components in accordance with the manufacturer's instructions.

-- End of Section --

## SECTION 23 22 23.00 40

## STEAM CONDENSATE PUMPS

02/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASME INTERNATIONAL (ASME)

ASME BPVC SEC VIII D1 (2007; Addenda 2008; Addenda 2009) BPVC  
Section VIII-Rules for Construction of  
Pressure Vessels Division 1

## HYDRAULIC INSTITUTE (HI)

HI M100 (2009) HI Pump Standards Set

## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 1940-1 (2003; Cor 2005) Mechanical Vibration -  
Balance Quality Requirements for Rotors in  
a Constant (Rigid) State - Part 1:  
Specification and Verification of Balance

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2009) Motors and Generators

## 1.2 SUBMITTALS

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

## SD-03 Product Data

Submit Manufacturer's catalog data for condensate pumps showing  
equipment foundation data and equipment and performance data  
including performance curves and indicating brake power, head (gpm),  
and NPSH.

## SD-06 Test Reports

Ensure test reports for condensate pumps consist of pump flow  
capacity tests in accordance with the paragraph entitled,  
"Testing," of this section.

## Pump Flow Capacity Tests

## SD-07 Certificates

Submit certificates for the following items showing conformance with the referenced standards contained in this section.

Condensate Return Pump Units

Condensate Receiver

### 1.3 GENERAL REQUIREMENTS

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS applies to work specified in this section.

Section 23 05 48.00 40 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT applies to work specified in this section.

Connection diagrams for condensate pumps shall show details of cable and motor connections.

Submit Control diagrams for condensate pumps showing motor starters, relays, or any other component necessary for safe operation.

Ensure Installation drawings for condensate pumps are in accordance with the manufacturer's recommended instructions.

Submit Manufacturer's catalog data for condensate pumps showing equipment foundation data and equipment and performance data including performance curves and indicating brake power, head (gpm), and NPSH.

#### 1.3.1 Factory Tests

The manufacturer shall test the pump and submit prior to shipment of the finished pump the following test data:

Pump flow capacity tests - Pump flow shall conform to requirements listed in accordance with paragraph entitled, "CONDENSATE-RETURN PUMP UNITS," of this section.

Efficiency tests - Pump efficiency shall conform to the approved design documents.

Vibration tests - Vibration tests shall conform to requirements listed in accordance with paragraph entitled, "TESTING," of this section.

## PART 2 PRODUCTS

### 2.1 CONDENSATE RETURN PUMP UNITS

Factory assemble condensate-return pump units and include condensate receivers, motor-driven pump(s), manual and automatic liquid-level controls, and other accessories as specified herein or which may be necessary for complete and satisfactorily operating units(s).

Pump(s) and all accessories mounted on the receiver and unit(s) shall be

complete with all intercomponent piping and wiring. Receiver and unit(s) shall be complete with all intercomponent piping and wiring. Receiver shall have integral cast lugs for securing to mounting surface. Pump suction piping shall contain a shutoff valve for pump servicing.

Condensate-return pump units shall be simplex type.

Condensate-return pump unit shall be factory tested for capacity and pressure.

#### 2.1.1 Pumps

Pumps shall be close coupled or flexible coupled with guard centrifugal volute vertically or horizontally mounted on or next to receiver. Pumps shall conform to applicable requirements of HI M100 standards and shall be bronze mounted. Casing shall be close-grained cast iron with renewable wearing ring. Provide tapped openings for automatic venting, draining, and pressure-gage connection. Pump shaft shall be AISI Type 300 series corrosion-resistant steel. Pump seal shall be manufacturer's standard for continuous service at 250 degrees F, minimum, at seal rotating and stationary members interface and 209-degree F pumped fluid. Compensate impeller for hydraulic thrust, balance rotating assembly, and ensure strength of shafting such that when pump is operating at its worst hydraulic condition, vibration readings conform to ISO 1940-1, G6.3. Pumps shall be capable of handling 209-degree F condensate without cavitation or vapor binding while delivering specified capacity.

#### 2.1.2 Motor Requirements

Motors shall be vertical or horizontal and conform to NEMA MG 1, requirements specified under the electrical sections of the specifications and to the following additional requirements.

Motor insulation shall be Class H or manufacturer's standard and be suitable for satisfactory operation under the following conditions:

Still air at 65 percent relative humidity, with service-location temperatures to 122 degrees F

Thermal conduction along motor shaft immersed in 209-degree F water

Proximity of motor to receiver surfaces at 209 degrees F

Lubricants shall be specifically suitable for high-temperature service.

#### 2.1.3 Receiver

Condensate receiver shall be a single tank constructed of close-grained cast iron with a minimum receiver wall thickness of 5/16 inch or steel with a rust-resistant interior coating.

Fit each receiver with:

Redline borosilicate gage glass and nonferrous shutoff valve assembly for use in case of glass breakage.

External inlet strainer with removable basket for pump protection.

Thermometer with separable well conforming to requirements specified

elsewhere in this section.

Receiver top-vent connection and drain at lowest point. Assemble drain closures with tetrafluoroethylene tape.

#### 2.1.4 Controls

Simplex-unit control shall consist of a float-operated switch UL rated for the load imposed and wired to the motor. Float and float arm shall be AISI Type 304 or 316 corrosion-resistant steel. Copper float mechanisms are not acceptable.

Duplex-unit control shall consist of a float-operated automatic mechanical alternator controlling at two levels with double-pole alternating switches and operated by a single float. Control shall automatically alternate operation of two pumps to deliver total capacity of two pumps under peak-load conditions, and automatically operate second pump should on-line pump fail. Switch shall be UL rated for the load imposed and be wired to motors. Float and float arm shall be AISI Type 304 or 316 corrosion-resistant steel. Copper float mechanisms are not acceptable.

Duplex unit control shall consist of an automatic electric sequence controller used in conjunction with two motor controllers, two selector switches, and two float switches, complete with intercomponent wiring, installed in a NEMA Type 1 enclosure mounted on the receiver. Provide selector switches with automatic OFF positions. Provide a momentary-contact test pushbutton. One float switch shall control the alternator to provide automatic alternation of the two pumps. Second float switch shall provide simultaneous operation of two pumps to deliver total capacity of two pumps under peak-load conditions and automatically operate second pump should on-line pump fail. Switches shall be UL rated for the load imposed. Floats and float arms shall be AISI Type 304 or 316 corrosion-resistant steel. Copper float mechanisms are not acceptable.

#### 2.2 CONDENSATE RECEIVER

Design and construct receiver in accordance with ASME BPVC SEC VIII D1 for operation under atmospheric conditions but certified as hydrostatically tested at 100 pounds per square inch, gage.

Receiver shall be manufacturer's standard vessel.

##### 2.2.1 Materials and Construction

Construct receiver of either cast iron or galvanized steel with dished heads, indicated openings including those for vent, inlets, discharge, drain, gage-glass connections, and level-control devices. Minimum tank opening shall be 1-inch iron pipe size. Couplings shall be forged carbon steel. Nozzle-piping weight shall be Schedule 80. Piping, flanges, and fittings shall conform to specifications for connecting condensate piping system.

Mount receiver as indicated.

Provide one 11- by 15-inch gasketed manhole at a point in the head or shell for access when receiver is in place.

Sandblast receiver internal surfaces, including nozzles, to white metal, to a profile required by the coating manufacturer. Coat internal surfaces

with a multiple-coat baked or air-dry phenolic system to produce, in not less than three coats, a dry-film thickness of not less than 7 mils. Ensure coating is certified as suitable for continuous service when immersed in condensate at a temperature not less than 300 degrees F.

### 2.2.2 Accessories

Provide receiver with a shutoff-valve-equipped gage-glass assembly to indicate liquid level over not less than 80 percent of receiver diameter from the bottom. Gage glass shall be red-lined borosilicate glass and fitted with wire or sheet-metal guards.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install equipment in accordance with manufacturer's recommendations.

Based on the motor nominal operating speed, align the Pump and driver to the following specifications:

| Speed(RPM) | angle(mils) | offset(mils/inch) |
|------------|-------------|-------------------|
| 600        | 6.0         | 2.0               |
| 900        | 5.0         | 1.5               |
| 1200       | 4.0         | 1.0               |
| 1800       | 3.0         | 0.5               |
| 3600       | 1.5         | 0.4               |
| 7200       | 1.0         | .03               |

### 3.2 TESTING

#### 3.2.1 Vibration Analyzer

Use an FFT analyzer to measure vibration levels. It shall have the following characteristics: A dynamic range greater than 70 dB; a minimum of 400 line resolution; a frequency response range of 5 Hz-10 KHz(300-600000 cpm); the capacity to perform ensemble averaging, the capability to use a Hanning window; auto-ranging frequency amplitude; a minimum amplitude accuracy over the selected frequency range of plus or minus 20 percent or plus or minus 1.5 dB.

An accelerometer, either stud-mounted or mounted using a rare earth, low mass magnet and sound disk(or finished surface) shall be used with the FFT analyzer to collect data. The mass of the accelerometer and its mounting shall have minimal influence on the frequency response of the system over the selected measurement range.

#### 3.2.2 Acceptance Testing

Prior to pump final acceptance, use vibration analysis to demonstrate that pump and motor are aligned as specified, and ensure misalignment does not impart more than .04 inches per second vibration level at 2 times run speed.

Vibration analysis shall also verify pump conformance to specifications. Vibration levels shall not be more than .075 in/sec at 1 times run speed and at pump frequency, and .04 in/sec at other multiples of run speed.

Demonstration that the pump is non-overloading at any operating point and



that the flow capacity is as specified.

Provide final test reports to the Contracting Officer. Reports shall have a cover letter/sheet clearly marked with the System name, Date, and the words "Final Test Reports - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

-- End of Section --

## SECTION 23 22 25.00 40

## STEAM VALVES

02/11

## PART 1 GENERAL

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS 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.

## ASME INTERNATIONAL (ASME)

- |             |  |
|-------------|--|
| ASME B16.1  | (2010) Gray Iron Threaded Fittings;<br>Classes 25, 125 and 250 |
| ASME B16.34 | (2013) Valves - Flanged, Threaded and<br>Welding End           |

## ASTM INTERNATIONAL (ASTM)

- |                 |   |
|-----------------|---|
| ASTM A106/A106M | (2010) Standard Specification for Seamless<br>Carbon Steel Pipe for High-Temperature<br>Service           |
| ASTM A126       | (2004; R 2014) Standard Specification for<br>Gray Iron Castings for Valves, Flanges,<br>and Pipe Fittings |

## ISA - INTERNATIONAL SOCIETY OF AUTOMATION (ISA)

- |            |   |
|------------|---|
| ISA RP60.9 | (1981) Piping Guide for Control Centers |
|------------|---|

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)

- |           |  |
|-----------|--|
| MSS SP-70 | (2006) Gray Iron Gate Valves, Flanged and<br>Threaded Ends |
| MSS SP-80 | (2008) Bronze Gate, Globe, Angle and Check<br>Valves       |

## 1.2 SUBMITTALS

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

SD-03 Product Data

Dial Cocks

Diaphragm Control And Instrument Valves

Gate Valves

Globe And Angle Valves

Check Valves;

### 1.3 ADMINISTRATIVE REQUIREMENTS

#### 1.3.1 Pre-Installation Meetings

Prior to commencement of work, submit the following to the Contracting Officer for review and approval:

- b. Submit certificates of conformance for the following items showing conformance to the referenced standards contained in this section:

- (1) Gate Valves
- (2) Globe and Angle Valves
- (3) Check Valves
- (6) Dial Cocks
- (7) Diaphragm Control and Instrument Valves

## PART 2 PRODUCTS

### 2.1 COMPONENTS

#### 2.1.1 Dial Cocks

Provide dial cocks in sizes 2-1/2-inch ips and smaller with pointer and etched position dial rated 150-psi working steam pressure (wsp) and made of manufacturer's standard all-brass construction.

#### 2.1.2 Diaphragm Control And Instrument Valves (DCIV)

Provide diaphragm control and instrument valves in sizes 1/4 and 3/8 inch with a forged-brass body with reinforced tetrafluoroethylene diaphragm, and an AISI 300 series corrosion-resistant steel spring with round phenolic handle. Fit handle with disks color-coded in accordance with ISA RP60.9.

## 2.2 FABRICATION

### 2.2.1 Gate Valves

#### 2.2.1.1 Gate Valves 125 psi

Provide valves rated 125-psi (wsp) and ensure conformance to MSS SP-80, with wedge disc, rising stem, inside screw, 125-pound for sizes 2 inches and under and to MSS SP-70 for sizes over 2 inches.

Ensure body end connections are flanged for all valves larger than 2 inches and screwed in sizes 2 inches and under to suit specified piping system end connection and maintenance requirements.

For valves in sizes 2 inches and under, provide union-bonnet type, made of cast iron conforming to ASTM A126, Class B.

Ensure stem is rising and backseating type.

Ensure packing is fiber braid impregnated with 30 percent tetrafluoroethylene.

Provide cast iron valve wheels.

For condensate service, provide screwed-end gate valves, 150-psi, wsp-rated, forged steel, conforming to ASME B16.34, with manufacturer's standard corrosion-resistant steel trim.

Provide integral bypass globe valves around valves larger than 6 inches. Factory install main valve body taps. Provide globe type, factory installed bypass valves, with a socket welded end conforming to ASME B16.34. Ensure valve seat and plug disk are hard-surfaced and seats are be removable replaceable type. Provide pressure tubing piping connections conforming to Schedule 80 ASTM A106/A106M, Grade B, without change of direction fittings; i.e., bent, and include a socket welded end 3,000-psi-rated, forged steel union with corrosion-resistant steel insert. Ensure connection is to valve bosses located to perform specified function. Ship valves with integral bypass bolted to crates in a manner that will preclude damage to bypass assembly.

Provide integral drain valves. Factory finish main valve boss penetration, and field install. Provide gate type drain valve. Provide pressure tubing type piping conforming to ASTM A106/A106M, Grade B. Cap drain discharge, and thread closure assembly with tetrafluoroethylene tape.

### 2.2.2 Globe And Angle Valves

#### 2.2.2.1 Globe And Angle Valves 125 psi

Provide valves rated 125-psi (wsp) conforming to MSS SP-80, globe, 125-pound.

Provide flanged body end connections for all valves larger than 2 inches and screwed for sizes 2 inches and under.

For valves 2 inches and under in size, provide union bonnet type.

Ensure cast iron conforms to ASTM A126, Class B.

Provide rising and backseating type stem.

Composition seating surface disc construction may be substituted for metal plug disc connection.

Provide integral drain valves. Ensure main valve boss penetration is factory finished and drain assembly is factory installed. Ensure drain valve is gate type. Provide pressure tubing type piping conforming to ASTM A106/A106M, Grade B. Ensure drain discharge is capped, and threaded closure assembly is made with tetrafluoroethylene tape. Provide all necessary handling and shipping care.

### 2.2.3 Check Valves

#### 2.2.3.1 Check Valves 125 psi

Provide valves rated 125-psi wsp, standard horizontal swing type, conforming to MSS SP-80, swing check, 125-pound.

Provide flanged body end connections for all valves larger than 2 inches; screwed in sizes 2 inches and under.

Provide gasketed-bolted type body to cover connection; cast iron, conforming to ASTM A126, Class B in sizes larger than 2 inches. Ensure flanges to ASME B16.1.

Provide corrosion-resistant steel swing check pin. Ensure swing check angle of closure is manufacturer's standard, unless a specific angle is indicated.

Provide re-grindable metal type valve disk.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install valves in accordance with the manufacturer's recommendations, approved installation drawings, and in accordance with the applicable requirements of Section 23 05 15 COMMON PIPING FOR HVAC.

-- End of Section --

## SECTION 23 22 26.00 20

## STEAM SYSTEM AND TERMINAL UNITS

02/10

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN WELDING SOCIETY (AWS)

AWS Z49.1 (2005) Safety in Welding and Cutting and Allied Processes

## ASME INTERNATIONAL (ASME)

ASME A13.1 (2007) Scheme for the Identification of Piping Systems

ASME B1.1 (2003; R 2008) Unified Inch Screw Threads (UN and UNR Thread Form)

ASME B1.20.1 (1983; R 2006) Pipe Threads, General Purpose (Inch)

ASME B16.11 (2009) Forged Fittings, Socket-Welding and Threaded

ASME B16.18 (2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings

ASME B16.20 (2007) Metallic Gaskets for Pipe Flanges - Ring-Joint, Spiral Wound, and Jacketed

ASME B16.21 (2011) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.22 (2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B16.24 (2006) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500

ASME B16.3 (2010) Malleable Iron Threaded Fittings, Classes 150 and 300

ASME B16.34 (2013) Valves - Flanged, Threaded and Welding End

ASME B16.39 (2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300

|                       |  |
|-----------------------|--|
| ASME B16.5            | (2013) Pipe Flanges and Flanged Fittings:<br>NPS 1/2 Through NPS 24 Metric/Inch Standard                                 |
| ASME B16.9            | (2007) Standard for Factory-Made Wrought<br>Steel Buttwelding Fittings   |
| ASME B18.2.1          | (2012; Errata 2013) Square and Hex Bolts<br>and Screws (Inch Series)   |
| ASME B18.2.2          | (2010) Nuts for General Applications:<br>Machine Screw Nuts, Hex, Square, Hex<br>Flange, and Coupling Nuts (Inch Series) |
| ASME B31.1            | (2014; INT 1-47) Power Piping  |
| ASME B40.100          | (2005) Pressure Gauges and Gauge<br>Attachments  |
| ASME BPVC             | (2010) Boiler and Pressure Vessels Code  |
| ASME BPVC SEC IX      | (2010) BPVC Section IX-Welding and Brazing<br>Qualifications   |
| ASME BPVC SEC VIII D1 | (2007; Addenda 2008; Addenda 2009) BPVC<br>Section VIII-Rules for Construction of<br>Pressure Vessels Division 1         |

## ASTM INTERNATIONAL (ASTM)

|                 |  |
|-----------------|--|
| ASTM A106/A106M | (2010) Standard Specification for Seamless<br>Carbon Steel Pipe for High-Temperature<br>Service  |
| ASTM A194/A194M | (2010a) Standard Specification for Carbon<br>and Alloy Steel Nuts for Bolts for<br>High-Pressure or High-Temperature Service,<br>or Both |
| ASTM A307       | (2014) Standard Specification for Carbon<br>Steel Bolts and Studs, 60 000 PSI Tensile<br>Strength  |
| ASTM A53/A53M   | (2010) Standard Specification for Pipe,<br>Steel, Black and Hot-Dipped, Zinc-Coated,<br>Welded and Seamless                              |
| ASTM B32        | (2008) Standard Specification for Solder<br>Metal  |
| ASTM B88        | (2009) Standard Specification for Seamless<br>Copper Water Tube  |

## COPPER DEVELOPMENT ASSOCIATION (CDA)

|           |                                     |
|-----------|-------------------------------------|
| CDA A4015 | (1994; R 1995) Copper Tube Handbook |
|-----------|-------------------------------------|

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)

|           |  |
|-----------|--|
| MSS SP-45 | (2003; R 2008) Bypass and Drain Connections  |
| MSS SP-58 | (2009) Pipe Hangers and Supports -<br>Materials, Design and Manufacture,<br>Selection, Application, and Installation |
| MSS SP-69 | (2003) Pipe Hangers and Supports -<br>Selection and Application (ANSI Approved<br>American National Standard)        |
| MSS SP-80 | (2008) Bronze Gate, Globe, Angle and Check<br>Valves   |

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

|            |   |
|------------|---|
| NEMA ICS 2 | (2000; R 2005; Errata 2008) Standard for<br>Controllers, Contactors, and Overload<br>Relays Rated 600 V |
| NEMA ICS 6 | (1993; R 2011) Enclosures   |
| NEMA MG 1  | (2009) Motors and Generators  |

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

|             |   |
|-------------|---|
| MIL-E-17814 | (Rev F; CANC Notice 1) Expansion Joints,<br>Pipe, Slip-Type, Packed |
| MIL-V-18436 | (1987; Rev F) Valves, Check, Bronze, Cast<br>Iron, and Steel Body   |

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

|               |  |
|---------------|--|
| CID A-A-1689  | (Rev B) Tape, Pressure-Sensitive Adhesive,<br>(Plastic Film)                                       |
| CID A-A-50494 | (Basic; Notice 1) Exhaust Head, Steam  |
| CID A-A-50558 | (Basic; Notice 1) Valves, Pressure<br>Regulating, Steam  |
| CID A-A-50559 | (Basic; Notice 1) Valves,<br>Temperature-Regulating (Thermostatically<br>Controlled)               |
| CID A-A-50568 | (Basic; Notice 1) Gages, Liquid Level<br>Measuring, Tank   |
| CID A-A-59617 | (Basic) Unions, Brass or Bronze, Threaded<br>Pipe Connections and Solder-Joint Tube<br>Connections |
| CID A-A-60001 | (Basic) Traps, Steam   |
| FS F-P-2908   | (Basic; Notice 1) pumping Units,<br>Condensate, Return; and Boiler Feed Package                    |



|              |  |
|--------------|--|
| FS F-V-2906  | (Basic) Valves, Air Venting, Steam   |
| FS QQ-B-654  | (Rev A; Notice 1) Brazing Alloys, Silver   |
| FS WW-H-191  | (Rev E; Notice 2) Heater, Fluid,<br>Industrial (Instantaneous, Steam, Water<br>Converter Type) |
| FS WW-S-2739 | (Basic; Notice 1) Strainers, Sediment:<br>Pipeline, Water, Air, Gas, Oil, or Steam             |

## 1.2 GENERAL REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section, with the additions and modifications specified herein. This section includes steam and condensate piping, convertors, condensate return units, used for heating within the building. Steam boilers, feedwater treatment equipment, process steam terminal units, boiler feed piping, and blow-off piping are not covered in this section.

### 1.2.1 Classes and Maximum Working Pressures

Equipment, piping, and piping components shall be suitable for use under the maximum working pressure indicated. Except as modified herein, the pressure temperature limitations shall be as specified in the referenced standards and specifications.

### 1.2.2 Standard Commercial Product

The terminal units provided shall, as a minimum, comply with the features specified herein and shall be the manufacturer's standard commercial product. Additional or better features which are not specifically prohibited herein but which are a part of the manufacturer's standard commercial product, shall be included in the terminal units being furnished. A standard commercial product is a product which has been sold or is currently being offered for sale, on the commercial market through advertisements or manufacturer's catalogs or brochures. Provide Institute of Boiler and Radiator Manufacturer (IBR) or Steel Boiler Institute (SBI) rating for required capacity.

### 1.2.3 Welding Safety

AWS Z49.1.

### 1.2.4 Definitions

#### 1.2.4.1 High Pressure Piping System

A system whose pressure is greater than 15 psig and shall conform to ASME B31.1.

#### 1.2.4.2 Low Pressure Piping System

A system whose pressure is 15 psig or less.

#### 1.2.4.3 Terminal Unit

An enclosed unit that provides heated air from a steam coil and includes

natural convection units, radiation, and forced air units.

#### 1.2.4.4 Piping and Piping System

Includes pipe, tubing, flanges, bolting, gaskets, valves, safety valves, fittings, and pressure containing parts of other piping components, hangers, supports, guides, expansion joints, anchors, and other equipment items necessary to prevent overstressing the pressure containing parts.

### 1.3 SUBMITTALS

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

#### SD-03 Product Data

Convertors

Condensate return pumping units

TrapsFlash Tanks

#### SD-06 Test Reports

Steam piping tests

#### SD-07 Certificates

Welding procedure

Welder's Performance Qualification Record

#### SD-08 Manufacturer's Instructions

Convertors

Condensate return pumping units

Include manufacturer's recommendations for equipment foundations.

### 1.4 QUALITY ASSURANCE

#### 1.4.1 Welding Procedure

Submit welding procedure specification for metals included in the work, together with proof of the procedure's qualifications as outlined in ASME B31.1.

#### 1.4.2 Welder's Performance Qualification Record

Submit to the Contracting Officer the Welder's Performance Qualification Record in conformance with ASME B31.1 for each welder, showing that the welder was tested under the approved procedure specification submitted by the Contractor. In addition, the Contractor shall submit list of welders and welder's symbols, assigned number, or letter which shall be used to identify the work of the welder which shall be affixed immediately upon completion of the weld. Welders making defective welds after passing a qualification test shall be required to take a requalification test. Welders failing the requalification tests will not be permitted to work under this contract.

#### 1.4.3 Previous Qualifications

Welding procedures, welders, and welding operators previously qualified by test may be accepted for this contract without requalification subject to approval if the conditions specified in ASME B31.1 are met before a procedure can be used.

### PART 2 PRODUCTS

#### 2.1 PIPE AND PIPE SYSTEM

##### 2.1.1 High Pressure Steam Piping System (Over 15 psig)

ASME B31.1 for a steam working pressure of 30 psig and a temperature of 300 degrees F, a condensate pressure of 15 psig, and a temperature of 200 degrees F.

##### 2.1.1.1 High Pressure Steam Piping

ASTM A106/A106M or ASTM A53/A53M, Grade B, Schedule 40, black steel, electric-resistance welded or seamless. Use ASTM A53/A53M pipe for bending.

##### 2.1.2 Low Pressure Steam Piping System

ASME B31.1 for a steam working pressure of 15 psig or less, a condensate pressure of 5 psig, and a temperature of 180 degrees F.

##### 2.1.2.1 Low Pressure Steam Piping

- a. Steel Piping: ASTM A53/A53M, Schedule 40, black, electric-resistance welded or seamless. Use ASTM A53/A53M pipe for bending.
- b. Copper Tubing: ASTM B88, Type K.

##### 2.1.3 Condensate Return Piping (100 psig or Less)

##### 2.1.3.1 Steel Piping

ASTM A106/A106M or ASTM A53/A53M, Grade B, Schedule 80, black, electric-resistance welded or seamless.

##### 2.1.3.2 Copper Tubing (15 psig or Less)

ASTM B88, Type K.

#### 2.1.4 Fittings

Provide fittings compatible in all respects (material, size, pressure, and temperature limitations) with the pipe being used and within any further limitations of ASME B31.1.

##### 2.1.4.1 Fittings for Steel Pipe

###### a. Sizes 1/8 to 2 inches:

(1) Steel Fittings: ASME B16.11, socket welding or threaded. Where pressure exceeds 15 psig, provide socket-welding type only.

(2) Malleable Iron Fittings: ASME B16.3, threaded.

###### b. Sizes 2 1/2 inches and larger:

(1) Steel Fittings: ASME B16.9, butt welding or ASME B16.5, flanged.

(2) Bronze Fittings: ASME B16.24, flanged. Sizes larger than 8 inches are not permitted.

##### 2.1.4.2 Fittings for Copper Tubing

ASME B16.18, cast copper alloy or ASME B16.22, wrought copper, solder joint type. Flared or compression joint type fittings for tube sizes not exceeding 2 inches outside diameter (O.D.) may be provided as permitted in ASME B31.1.

#### 2.1.5 Unions

##### 2.1.5.1 Unions for Steel Pipe

ASME B16.39, threaded.

##### 2.1.5.2 Unions for Copper Tubing

CID A-A-59617, solder joint end type.

#### 2.1.6 Flanges

Remove the raised faces on flanges when used with flanges having a flat face.

##### 2.1.6.1 Steel Flanges

ASME B16.5, forged steel, welding type.

##### 2.1.6.2 Bronze Flanges

ASME B16.24, threaded.

#### 2.1.7 Valves

Shall conform to the following paragraphs. End connections shall conform to paragraph entitled "End Connections."

## 2.1.7.1 Gate Valves

- a. Bronze Gate Valves: MSS SP-80, Type 1 (solid wedge, non-rising stem), 3 inches and smaller, threaded or solder joint ends, and not less than Class 150.
- b. Steel Gate Valves: ASME B16.34. Provide outside screw and yoke type with solid wedge or flexible wedge disc, and with trim suitable for the service temperature and pressure.

## 2.1.7.2 Globe and Angle Valves

- a. Bronze Globe and Angle Valves: MSS SP-80, Type 1 (metal disc, integral seat) or Type 3 (metal disc, renewable seat), 3 inches and smaller, threaded or solder joint ends, Class 200 except that Class 150 with solder joint ends may be used for copper tubing. Valves shall have renewable seats and discs, except solder joint end valves which shall have integral seats.
- b. Steel Globe and Angle Valves: ASME B16.34, with trim suitable for the service temperature and pressure.

## 2.1.7.3 Check Valves

- a. Bronze Check Valves: MSS SP-80, Type 3 (swing check, metal disc to metal seat), 3 inches and smaller, threaded or solder joint ends, Class 200, regrinding type.
- b. Steel Check Valves: MIL-V-18436, with trim suitable for the service temperature and pressure.
  - (1) Swing Check Valves: Shall have bolted caps.
  - (2) Lift Check Valves: Shall have threaded or bolted caps.

## 2.1.7.4 Steam Pressure Reducing Valves

CID A-A-50558.

## 2.1.7.5 Temperature Regulating Valves

CID A-A-50559.

## 2.1.7.6 Air Vent Valves

FS F-V-2906, with vacuum holding device, pressure rated for the intended service, and with a capacity based on manufacturer's standard for the connection size, cast iron prohibited.

## 2.1.7.7 Safety Valves

MIL-V-18436, and sized in accordance with ASME BPVC. Set point shall be as indicated, cast iron prohibited.

## 2.1.8 End Connections

## 2.1.8.1 Steel Piping

Sizes 2 inches and smaller threaded or socket welded; sizes 2 1/2 inches and larger flanged or butt welded.

a. Threaded Joints: ASME B1.20.1.

b. Flanged Joints: Flanges shall conform to paragraph entitled "Flanges." Bolting and gaskets shall be as follows:

(1) Bolting: Material used for bolts and studs shall conform to ASTM A307, Grade B; and material for nuts shall conform to ASTM A194/A194M, Grade 2. Dimensions of bolts, studs, and nuts shall conform to ASME B18.2.1 and ASME B18.2.2 with threads conforming to ASME B1.1coarse type, with Class 2A fit for bolts and studs, and Class 2B fit for nuts. Bolts or bolt-studs shall extend completely through the nuts and may have reduced shanks of a diameter not less than the diameter at root of threads. Carbon steel bolts shall have American Standard regular square or heavy hexagon heads and shall have American Standard heavy semifinished hexagonal nuts, conforming to ASME B18.2.1 and ASME B18.2.2.

(2) Gaskets: Gaskets shall be as follows:

Gaskets shall be as thin as the finish of surfaces will permit. Metal or metal-jacketed non-asbestos gaskets shall be used with small male and female or small tongue-and-groove flanges or flanged fittings; they may be used with steel flanges with lapped, large male and female, large tongue-and-groove, or raised faces. Full faced gaskets shall be used with flat-faced bronze flanges. Lapped steel flanges, or raised-face steel flanges shall have ring gaskets with an outside diameter extending to the inside of the bolt holes. Widths of gaskets for small male and female and for tongue-and-groove joints shall be equal to the widths of the male face or tongue. Gaskets shall have an inside diameter equal to or larger than the port openings. Rings for ring joints shall be in accordance with dimensions in ASME B16.20, suitable for the service conditions encountered, and shall be softer than the flanges. Dimensions for non-metallic gaskets shall be in accordance with ASME B16.21.

c. Butt Weld Joints: ASME B31.1. The use of backing rings shall conform to ASME B31.1. Ferrous rings shall be of good weldable quality and shall not exceed 0.05 percent sulfur; for alloy pipe, backing rings shall be of material compatible with the chemical composition of the parts to be welded and preferably of the same composition. Backing rings shall be continuous machined or split band type.

d. Socket Weld Joints: ASME B31.1.

## 2.1.8.2 Joints for Copper Tubing

a. Solder Joints: ASTM B32, alloy grade Sb5 solder for steam pressure 15 psig or less.

b. Brazed Joints: FS QQ-B-654 for steam pressure 120 psig or less.

## 2.1.9 Expansion Joints

### 2.1.9.1 Guided Slip-Tube Type

MIL-E-17814.

## 2.1.10 Instrumentation

### 2.1.10.1 Pressure and Vacuum Gages

ASME B40.100 with restrictor, locate as indicated. Provide scale range for intended service. Scale range not to exceed two times (2X) the indicated pressure of piping.

### 2.1.10.2 Tank Gages

CID A-A-50568, locate as indicated.

### 2.1.10.3 Indicating Thermometers

Thermometers shall be dial type with an adjustable angle suitable for the service. Provide thermowell sized for each thermometer in accordance with the thermowell specification. Fluid-filled thermometers (mercury is not acceptable) shall have a nominal scale diameter of 5 inches. Construction shall be stainless-steel case with molded glass cover, stainless-steel stem, and bulb. Stem shall be straight, length as required to fit well. Bimetal thermometers shall have a scale diameter of 3 1/2 inches. Case shall be hermetic. Case and stem shall be constructed of stainless steel. Bimetal stem shall be straight and of a length as required to fit the well.

## 2.1.11 Miscellaneous Pipeline Components

### 2.1.11.1 Air Traps

CID A-A-60001 for float-operated steam traps (non-thermostatic), except that the valve mechanism shall be inverted so as to be closed, not opened, by rising water. Arrange float-controlled valves to close promptly when water enters the traps. Locate traps as indicated.

### 2.1.11.2 Steam Traps

CID A-A-60001, thermostatic and non-thermostatic steam traps. Provide traps with separate strainers and locate as indicated.

### 2.1.11.3 Strainers

FS WW-S-2739, Style Y (Y pattern) for Class 125 and 250 piping in sizes 1/2 to 8 inches, inclusive, locate as indicated, cast iron prohibited.

### 2.1.11.4 Exhaust Heads

CID A-A-50494, for atmospheric discharge of exhaust steam.

### 2.1.11.5 Hangers, Supports, Spacing Requirements, and Attachments

MSS SP-58 and ASME B31.1 for materials, design, and manufacture. MSS SP-69 for selection and application.

#### 2.1.11.6 Flash Tanks

Construct of steel for a minimum working pressure of 125 psig. Provide the tank with a vent and valved drain.

### 2.2 CONVERTORS

FS WW-H-191, steam to hot water convertors, with capacity as indicated for the design conditions. Design convertor for floor support and provide temperature regulator.

### 2.3 CONDENSATE RETURN UNITS

#### 2.3.1 Condensate Return Pumping Units

FS F-P-2908, with hexahedral, floor-mounted receiver, duplex pump unit, with capacity as indicated.

#### 2.3.2 Pump Motors

NEMA MG 1, suitable for the electrical characteristics as indicated. Motors shall be open, splash proof type.

#### 2.3.3 Motor Starters

NEMA ICS 2, wye-delta type with NEMA ICS 6 general purpose enclosure.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Work material and equipment into a complete, convenient, and economical system or systems; and provide apparatus, parts, materials, and accessories which are necessary to accomplish this result.

#### 3.1.1 Piping

Fabricate, assemble, weld, solder, braze, and install piping and pipe system in accordance with ASME B31.1 and as further qualified herein. Piping shall follow the general arrangement shown. Cut piping accurately to measurements established, for the work shown, by the Contractor, and work into place without springing or forcing, except where cold-springing is indicated. Locate piping and equipment within buildings entirely out of the way of lighting fixtures, conduit, and doors, windows, and other openings. Run overhead piping in buildings in the most inconspicuous positions. Provide adequate clearances from walls, ceilings, and floors to permit the welding of joints; at least 6 inches for pipe sizes 4 inches and smaller, 10 inches for pipe sizes larger than 4 inches, and in corners provide sufficient clearance to permit the welder to work between the pipe and one wall. Make provision for expansion and contraction of pipe lines. Do not bury, conceal, or insulate piping until it has been inspected, tested, and approved. Do not conceal piping in walls, partitions, underground, or under the floor except as indicated. Where pipe passes through building structure, do not conceal pipe joints, but locate where they may be readily inspected and not weaken building structure. Run insulated pipe as shown and as required with sufficient clearance to permit application of insulation. Use flanged joints only where necessary for normal maintenance and where required to match valves and equipment. Gaskets, packing, and thread compounds shall be suitable for the service.



Apply joint compound or tape on male thread only. Use long radius ells wherever possible to reduce pressure drops. Pipe bends may be used in lieu of welding fittings where space permits. Pipe bends shall have a uniform radius of at least five times the pipe diameter and shall be free from any appreciable flattening, wrinkling, or thinning of the pipe. Mitering of pipe to form elbows, notching straight runs to form full sized tees, or any similar construction shall not be used. Make branch connections with welding tees except factory made forged welding branch outlets or nozzles having integral reinforcements conforming to ASME B31.1 may be used, provided the nominal diameter of the branch is at least one pipe size less than the nominal diameter of the run. Run piping as indicated, and avoid interference with other piping, conduit, or equipment. Run vertical piping plumb and straight and parallel to walls, except where specifically shown otherwise. Do not trap lines, except where indicated. Use reducing fittings for changes in pipe sizes. The use of bushings is prohibited. In horizontal lines 2 1/2 inches and larger, use reducing fittings of the eccentric type to maintain the bottom of the lines in the same plane for steam lines and to maintain the top of the lines in the same plane for condensate lines except where a trap or pocket would result. Provide suitable size sleeves for lines passing through building structure. Install piping connected to equipment to provide flexibility for thermal stresses and for vibration. Support and anchor pipe so that strain from weight and thermal movement of piping is not imposed on the equipment. Thoroughly clean each section of pipe, fittings, and valves of foreign matter before erection. Before placing in position, clean the inside of black steel pipe by rapping along its full length to loosen sand, mill scale, and other foreign matter; pipe 2 inches and larger shall have a wire brush of a diameter larger than that of the inside of the pipe drawn through its entire length several times. Before final connections are made to the apparatus, thoroughly wash out the piping interior with water. Blow out steam piping with high-pressure steam, if available, or compressed air, removing rust, oil, chips, sand, and other material. Plug or cap open ends of mains during shutdown periods. Do not leave lines open at any place where any foreign matter might accidentally enter pipe.

#### 3.1.1.1 Welding

- a. Welding of Piping: Welding of joints in piping, butt welds, fillet welds, bends, loops, offsets, and preparation and cleaning of pipe shall be in accordance with ASME B31.1. Welds shall be visually examined and meet acceptance standards indicated in Chapter VI of ASME B31.1.
- b. Quality of Welds: Quality of welds, correction of defects, stress relieving, and preheating shall be in accordance with ASME B31.1.
- c. Arc Welding and Gas Welding: In accordance with ASME BPVC SEC IX.

#### 3.1.1.2 Brazing and Soldering

- a. Brazing and soldering procedure qualification shall conform to ASME B31.1. Brazing procedure for joints shall be as outlined in the CDA A4015.
- b. Soldering, soldering preparation, and procedures for joints shall be in accordance with ASME B31.1 and as outlined in the CDA A4015.
- c. Copper Tube Extracted Joint: An extracted mechanical tee joint 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 ensure a free flow joint. Braze extracted joints using a copper phosphorous classification brazing filler metal. Soldered joints shall not be permitted.

#### 3.1.1.3 Hangers and Supports

Unless otherwise indicated, horizontal and vertical piping attachments shall conform to MSS SP-58. Continuous inserts and expansion bolts may be used.

#### 3.1.1.4 Grading and Venting of Pipe Lines

Unless otherwise indicated, install horizontal lines of steam and return piping to grade down in the direction of flow with a pitch of not less than one inch in 30 feet, except in loop mains and main headers where the flow may be in either direction. When counterflow of condensate within the steam pipe occurs in a portion of a pipeline, pitch up in the direction of steam flow a minimum of 6 inches per 100 feet and increase pipe diameters by one standard pipe size. Steam mains pitched away from the boiler shall contain drip connection and air vent valves at the extreme end. Air vents shall be provided at the highest point of any vertical riser. Drip connections shall not be interconnected above the water line of the boiler.

#### 3.1.1.5 Pipe Sleeves

Provide pipe sleeves where pipes and tubing pass through masonry or concrete walls, floors, roofs, and partitions. Use Schedule 40 galvanized steel pipe sleeves in outside walls below and above grade, in floor, and in roof slabs. Sleeves in partitions shall be zinc-coated sheet steel having a weight of not less than 0.907 psf. Space between pipe, tubing, or insulation and the sleeve shall be not less than 1 inch. Hold sleeves securely in proper position and location before and during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls, partitions, or slabs. Sleeves in floor slabs shall extend 2 inches above the finished floor. Pack space between the pipe or tubing and the sleeve firmly with oakum and caulk both ends of the sleeve with elastic cement.

#### 3.1.1.6 Floor, Wall, and Ceiling Plates

Secure plates to the pipe with enough clearance for thermal expansion of pipe. Use chromium-plated steel or nickel-plated cast iron plates on pipes passing through floors and partitions of toilet rooms and where indicated; use painted cast iron, malleable iron, or steel for all other plates.

#### 3.1.1.7 Flashing for Buildings

Provide tight waterproof flashing where pipes pass through building roofs and outside walls.

#### 3.1.1.8 Unions and Flanges

Provide unions and flanges where necessary to permit easy disconnection of piping and apparatus, and as indicated. Provide a union for each threaded end valve. Use unions on piping smaller than 2 inches in diameter, and

use flanges on piping 2 inches and larger in diameter. Provide dielectric unions or flanges between ferrous and non-ferrous piping, equipment, and fittings; except that bronze valves and fittings may be used without dielectric couplings for ferrous-to-ferrous or non-ferrous to non-ferrous connections. Dielectric fittings shall utilize a non-metallic filler which will prevent current flow. The spacer shall be suitable for the pressure and temperature of the service. The fittings shall otherwise conform to the requirements of paragraph entitled "Fittings."

#### 3.1.1.9 Traps and Connections

Traps shall be of the type and capacity for the service and shall be properly supported and connected. Except for thermostatic traps in pipe coils, radiators, and convectors, install traps with a dirt pocket and strainer between it and the piping or apparatus it drains. When necessary to maintain in continuous service apparatus or piping which is to be drained, provide a three-valve bypass so that the trap may be removed and repaired and condensate may drain through the throttled bypass valve. Provide a check valve on the discharge side of the trap whenever the trap is installed for lift or operating against a back pressure, or discharges into a common return line. When a thermodynamic trap is used, a check valve is not required or recommended. Provide test connections on the discharge side of the high and medium pressure traps when they are specifically required. The test connection shall include a 1/2 inch globe valve with uncapped nipple.

#### 3.1.1.10 Connections for Future Equipment

Locate capped or plugged outlets for connections to future equipment as indicated.

### 3.1.2 Valves

#### 3.1.2.1 General

Install valves in conformance with ASME B31.1, ASME BPVC SEC VIII D1, and as required herein, at the locations indicated and elsewhere as required for the proper functioning of the system. Use gate valves unless otherwise directed. Install stop valves in the supply lines equipped or located so as to permit operation from floor level, or provided with safe access in the form of walkways or ladders. Install valves in positions accessible for operation and repair. Provide gate valves 8 inches and larger with globe-valved bypass in accordance with MSS SP-45.

#### 3.1.2.2 Globe Valves

Install globe valves so that the pressure shall be below the disk. Install globe valves with the stems horizontal on steam and exhaust lines.

#### 3.1.2.3 Steam Pressure-Reducing Valves

Provide the steam line entering each pressure-reducing valve with a strainer. Provide each pressure-reducing valve unit with two cutout valves and with a globe or angle bypass valve and bypass piping. Provide each pressure-reducing valve unit with an indicating steam gage to show the reduced pressure, and a safety valve on the low pressure side with sufficient capacity to relieve the high pressure steam.

#### 3.1.2.4 Valves for Radiators

Install a radiator valve on each radiator.

#### 3.1.2.5 Safety Valves

Provide with drip pan elbows.

#### 3.1.3 Pressure Gages

Install a shutoff valve or petcock between each pressure gage and the line, and gages on steam lines shall have a syphon installed ahead of the gage.

#### 3.1.4 Thermometers

Provide thermometers and thermal sensing elements of control valves with a separable socket. Install separable sockets in pipe lines in such a manner to sense the temperature of the flowing fluid and minimize obstruction to flow.

#### 3.1.5 Strainers

Provide strainers with meshes suitable for the services where indicated, and where dirt might interfere with the proper operation of valve parts, orifices, and moving parts of equipment.

#### 3.1.6 Equipment Foundations

Design equipment foundations of sufficient size and weight to provide isolation and to preclude shifting of equipment under operating conditions. Foundations shall meet the requirements of the equipment manufacturer. When required by the Contracting Officer, the equipment manufacturer's approval of the foundation design and construction for the equipment involved shall be obtained.

#### 3.1.7 Equipment Installation

Install equipment as specified and in accordance with the manufacturer's installation instructions. Grout equipment mounted on concrete foundations before piping is installed. Install piping in such a manner as not to place a strain on any of the equipment. Do not bolt flanged joints tight unless they match. Adequately extend expansion bends before installation. Grade, anchor, guide, and support piping without low pockets.

#### 3.1.8 Cleaning of System

As installations of the various system components are completed, clean before final closing. Remove foreign matter from equipment and surrounding areas. Preliminary or final tests shall not be performed until the cleaning is approved.

#### 3.1.9 Identification of Piping

Labels for pipes 3/4 inch diameter and larger shall bear printed legends to identify contents of pipes and arrows to shown direction of flow. Labels shall have color coded background to signify levels of hazard in accordance with ASME A13.1. Legends and type and size of characters shall also conform as ASME A13.1. Make labels of plastic sheet CID A-A-1689 with pressure sensitivity suitable for the intended applications, or they may be

premolded of plastic to fit over pipe. For pipe smaller than 3/4 inch diameter, provide brass identification tags 1 1/2 inches in diameter with legends in depressed black filled characters.

### 3.2 FIELD TESTS AND INSPECTIONS

Field inspections, field tests, and trial operations specified in this section shall be performed by the Contractor. The Contractor shall provide gas, oil, labor, equipment, and incidentals required for testing, except that in accordance with Division 1 the Government will provide water or electric power required for tests. The Contractor shall give the Contracting Officer 19 days' advance written notice of the dates and times scheduled for tests and trial operations.

#### 3.2.1 Field Inspections

Inspect piping system prior to initial operation, for conformance to drawings, specifications, and ASME B31.1. Equipment, material, or work rejected because of defects or non-conformance with drawings, specifications, and ASME B31.1 shall be replaced or corrected by the Contractor, as directed by the Contracting Officer.

#### 3.2.2 Field Tests

Conduct the following tests after completion of the piping installation and prior to initial operation.

##### 3.2.2.1 Piping System

Test piping system hydrostatically using water not exceeding 100 degrees F. Conduct tests in accordance with the requirements of ASME B31.1 and as follows. Test the piping system after the lines have been cleaned as herein specified and before any insulation covering has been applied. Test piping system at 1 1/2 times the system pressure or 50 psig whichever is greater. Before performing tests, remove or valve off from the system, gages, traps, and other apparatus which may be damaged by the test pressure. Install a calibrated test pressure gage in the system to observe any loss in pressure. Maintain the required test pressure for a sufficient length of time to enable an inspection to be made of joints and connections. Perform tests after installation and prior to acceptance.

##### 3.2.2.2 Start-Up and Operational Test

Start-up the system and initially operate with components operating. During the test, periodically clean the various strainers until no further accumulation of foreign material occurs. Exercise care so that minimum loss of steam occur when strainers are cleaned. Adjust safety and automatic control instruments as necessary to place them in proper operation and sequence.

##### 3.2.2.3 Extent of Field Tests

After installation and before acceptance, subject the work of this section to necessary field tests, including those herein specified, and in Section 23 05 93 TESTING, ADJUSTING AND BALANCING.

-- End of Section --

## SECTION 23 25 00

CHEMICAL TREATMENT OF WATER FOR MECHANICAL SYSTEMS  
11/08

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASME INTERNATIONAL (ASME)

ASME B40.100 (2005) Pressure Gauges and Gauge Attachments

## ASTM INTERNATIONAL (ASTM)

ASTM D 2688 (2011) Corrosivity of Water in the Absence of Heat Transfer (Weight Loss Methods)

## 1.2 SYSTEM DESCRIPTION

This section covers the provisions and installation procedures necessary for a complete and totally functional water system(s) chemical treatment. Provide and install the system with all necessary System Components, Accessories, Piping Components, and Supplemental Components/Services.

## 1.3 SUBMITTALS

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

SD-03 Product Data

Field Instructions  
Tests  
Training Course

## 1.4 QUALITY ASSURANCE

## 1.4.1 Safety

Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Install safety devices so that proper operation of equipment is not impaired.

## 1.4.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate

all offsets, fittings, and accessories that may be required. Carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Protect all equipment delivered and placed in storage from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

### PART 2 PRODUCTS

#### 2.1 STANDARD PRODUCTS

a. Provide materials and equipment which are standard products of a manufacturer regularly engaged in the manufacturing of such products, that are of a similar material, design and workmanship and that have been in satisfactory commercial or industrial use for two years prior to bid opening.

b. The two-year use shall include applications of equipment and materials under similar circumstances and of similar size. The two years experience shall have been satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures. Products having less than a 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 tests, can be shown.

c. All products shall be supported by a service organization. Submit a certified list of qualified permanent service organizations for support of the equipment, including their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and shall be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

d. The selected service organization shall provide the chemicals required, the concentrations required, and the water treatment equipment sizes and flow rates required. The company shall provide all chemicals required for the chilled water system and fill the systems with chemicals to the levels specified. The chemical shall meet the requirements of this specification as well as the recommendations from the manufacturers of the condenser and cooling tower. Acid treatment chemicals shall not be used.

#### 2.2 GAUGES

Gauges shall conform to ASME B40.100, Class 1, 2, or 3, Style X, Type I or III as required, 4-1/2 inches in diameter with phenolic or metal case.

#### 2.3 CHILLED WATER SYSTEM

A 5 gallon shot feeder shall be provided on the chilled water piping as indicated. The feeder shall be furnished with an air vent, gauge glass, funnel, valves, fittings, and piping.

### 2.3.1 Chilled Water Treatment

Treat chilled water with either a borax/nitrite type treatment or a molybdate type treatment. Both types of treatment can be used with glycol. Borax/nitrite treatment shall be maintained at the limits of 600 to 1000 ppm nitrite, 40 - 50 ppm copper corrosion inhibitor (TT or MBT), and pH of 8.5 to 9.5. Molybdate treatment shall be maintained at the limits of 100 to 125 ppm molybdate, 40 - 50 ppm copper corrosion inhibitor (TT or MBT), and pH of 8.0 to 9.0.

### 2.3.2 Chilled Water Test Kits

One test kit of each type required to determine the water quality as outlined within the operation and maintenance manuals shall be provided (e.g. pH and nitrite or molybdate).

## 2.4 LOW AND MEDIUM TEMPERATURE HOT WATER SYSTEM

Low and medium temperature hot water systems are defined as those operating below 350 degrees F, ( 250 degrees F for Low Temperature).

### 2.4.1 Chemical Feeder

A 5 gallon shot feeder shall be provided on the hot water piping as indicated. Size and capacity of feeder shall be based on local requirements and water analysis. The feeder shall be furnished with an air vent, gauge glass, funnel, valves, fittings, and piping.

### 2.4.2 Low and Medium Temperature Hot Water Treatment

Hot water shall be treated with either a borax/nitrite type treatment or a molybdate type treatment. Both types of treatment can be used with glycol. Borax/nitrite treatment shall be maintained at the limits of 600 to 1000 ppm nitrite, 40 - 50 ppm copper corrosion inhibitor (TT or MBT) and pH of 8.5 to 9.5. Molybdate treatment shall be maintained at the limits of 100 to 125 ppm molybdate, 40 - 50 ppm copper corrosion inhibitor (TT or MBT) and pH of 8.0 to 9.0.

### 2.4.3 Test Kit Requirements

One test kit of each type required to determine the water quality as outlined within the operation and maintenance manuals shall be provided (e.g. pH and nitrite or molybdate).

## 2.5 Test Kit

One test kit of each type required to determine the water quality as outlined within the operation and maintenance manuals shall be provided (e.g. pH, hardness and sulfite).

## 2.6 SUPPLEMENTAL COMPONENTS/SERVICES

Drain and makeup water piping shall comply with the requirements of Section 22 00 00 PLUMBING, GENERAL PURPOSE. Drains which connect to sanitary sewer systems shall be connected by means of an indirect waste.



## PART 3 EXECUTION

## 3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy, before performing any work.

## 3.2 INSTALLATION

Provide all chemicals, equipment and labor necessary to bring all system waters in conformance with the specified requirements. Perform all work in accordance with the manufacturer's published diagrams, recommendations, and equipment warranty requirements.

## 3.3 PIPING

Connections between dissimilar metals shall be made with a dielectric union.

## 3.4 TRAINING COURSE

Submit a schedule, at least 2 weeks prior to the date of the proposed training course, that identifies the date, time, and location for the training. Conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total 8 hours of normal working time and start after the system is functionally completed but prior to final acceptance tests. Submit field instructions, at least 2 weeks prior to construction completion, including equipment layout, wiring and control diagrams, piping, valves and control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The posted instructions shall be framed under glass or laminated plastic and posted where indicated by the Contracting Officer. The field instructions shall cover all of the items contained in the Operation and Maintenance Manuals as well as demonstrations of routine maintenance operations.

## 3.5 TESTS

If the waters of the mechanical systems are not in conformance with the specified requirements or in accordance with manufacturer's recommendations, the water treatment company shall take corrective action to enable compliance. Daily operational tests shall be performed in the directed frequencies to maintain required control to prevent corrosion, scaling and damage to equipment during operation. Submit test schedules, at least 2 weeks prior to the start of related testing, for the condenser/chilled/boiler/condensate/feedwater water quality tests. The schedules shall identify the date, time, frequency and collection location for each test.

## 3.5.1 Chilled Water Testing (monthly)

Once a month, the following tests will be performed on chilled water.

|                      |       |             |
|----------------------|-------|-------------|
| PH                   | _____ |             |
| Nitrite or Molybdate | _____ | ppm (mg/L)  |
| Conductivity         | _____ | micromho/cm |

## 3.5.2 Hot Water Quality Testing

## 3.5.2.1 Low and Medium Temperature Systems (monthly)

Monthly testing shall be completed and recorded for the following parameters.

|                      |                  |
|----------------------|------------------|
| PH                   | _____            |
| Nitrite or Molybdate | _____ ppm (mg/L) |

## 3.5.3 Quality Assurance Testing

Conduct QA testing periodically by an independent water treatment lab/consultant to verify to managers that the mechanical and water treatment systems are being maintained properly. Provide the QA evaluation reports to the government COR.

## 3.5.3.1 Chilled Water Quality Assurance Testing (quarterly)

Quarterly, the following tests shall be performed on chilled water.

|                            |                   |
|----------------------------|-------------------|
| PH                         | _____             |
| Nitrite or Molybdate       | _____ ppm (mg/L)  |
| Conductivity               | _____ micromho/cm |
| Iron (total, as Fe(2)O(3)) | _____ ppm (mg/L)  |
| Written evaluation summary |                   |

## 3.5.3.2 Hot Water Quality Assurance Testing

a. Quarterly testing of Low and Medium Temperature Systems shall be completed and recorded for the following parameters.

|                            |                  |
|----------------------------|------------------|
| PH                         | _____            |
| Nitrite or Molybdate       | _____ ppm (mg/L) |
| Iron (total, as Fe(2)O(3)) | _____ ppm (mg/L) |
| Written evaluation summary |                  |

## 3.5.4 Corrosion Testers

Install corrosion coupon and rack systems to verify corrosion control in the systems. Testers or coupons are installed in flowing system water through a sidestream or rack system. Both mild steel and copper metal samples are to be tested in the corrosion testers in accordance with ASTM D 2688. Samples are to be replaced and analyzed every 3 months. Rates of corrosion less than 3 mpy for steel and 0.2 mpy for copper are acceptable. Corrosion testers shall be installed on the piping systems of the following systems.

Hot water loop

-- End of Section --

## SECTION 23 64 10

## WATER CHILLERS, VAPOR COMPRESSION TYPE

08/08

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 550/590 (2003) Performance Rating of  
Water-Chilling Packages Using the Vapor  
Compression Cycle

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

ANSI/ASHRAE 15 & 34 (2010; Addenda a, b, c, d, e, f, g, h, and  
i) ANSI/ASHRAE Standard 15-Safety Standard  
for Refrigeration Systems and ANSI/ASHRAE  
Standard 34-Designation and Safety  
Classification of Refrigerants

## AMERICAN WELDING SOCIETY (AWS)

AWS Z49.1 (2005) Safety in Welding and Cutting and  
Allied Processes

## ASME INTERNATIONAL (ASME)

ASME BPVC SEC VIII D1 (2007; Addenda 2008; Addenda 2009) BPVC  
Section VIII-Rules for Construction of  
Pressure Vessels Division 1

## ASTM INTERNATIONAL (ASTM)

ASTM A307 (2014) Standard Specification for Carbon  
Steel Bolts and Studs, 60 000 PSI Tensile  
Strength

ASTM B117 (2011) Standard Practice for Operating  
Salt Spray (Fog) Apparatus

ASTM D 520 (2000; R 2011) Zinc Dust Pigment

ASTM F 104 (2011) Standard Classification System for  
Nonmetallic Gasket Materials

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 11 (1977; R 2007) Energy Management Guide for  
Selection and Use of Single Phase Motors

## 1.2 SUBMITTALS

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

## SD-03 Product Data

## Water Chiller

Manufacturer's standard catalog data, at least highlighted to show material, size, options, performance charts and curves, etc. in adequate detail to demonstrate compliance with contract requirements. Data shall include manufacturer's recommended installation instructions and procedures. Data shall be adequate to demonstrate compliance with contract requirements as specified within the paragraphs:

- a. Water Chiller
- b. Chiller Components
- c. Accessories

If vibration isolation is specified for a unit, vibration isolator literature shall be included containing catalog cuts and certification that the isolation characteristics of the isolators provided meet the manufacturer's recommendations.

## Manufacturer's Multi-Year Compressor Warranty

Manufacturer's multi-year warranty for compressor(s) in air-cooled water chillers as specified.

## Factory Tests

Schedules which identify the date, time, and location for each test. Schedules shall be submitted for both the Chiller Performance Test and the Chiller Sound Test.

## SD-07 Certificates

## Refrigeration System;

Where the system, components, or equipment are specified to comply with requirements of AGA, NFPA, ARI, ASHRAE, ASME, or UL, 1 copy of proof of such compliance shall be provided. The label or listing of the specified agency shall be acceptable evidence. In lieu of the label or listing, a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency may be submitted. When performance requirements of this project's drawings and specifications vary from standard ARI rating conditions, computer printouts, catalog, or other application data certified by ARI or a nationally recognized laboratory as described above shall be included. If ARI does not

have a current certification program that encompasses such application data, the manufacturer may self certify that his application data complies with project performance requirements in accordance with the specified test standards.

#### SD-08 Manufacturer's Instructions

Water Chiller - Installation Instruction

#### SD-10 Operation and Maintenance Data

##### Operation and Maintenance Manuals

Six complete copies of an operation manual in bound 8 1/2 by 11 inch booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown at least 4 weeks prior to the first training course. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features. Six complete copies of maintenance manual in bound 8 1/2 by 11 inch booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include piping and equipment layouts and simplified wiring and control diagrams of the system as installed.

### 1.3 SAFETY REQUIREMENTS

Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Safety devices shall be installed so that proper operation of equipment is not impaired. Welding and cutting safety requirements shall be in accordance with AWS Z49.1.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Stored items shall be protected from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material both before and during installation shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

### 1.5 PROJECT REQUIREMENTS

#### 1.6 Warranty

In addition to the warranty requirements specification in Division 00, Contract Requirements, the following major components of the chiller shall be covered by a warranty of a duration period of five years: compressor, and parts.

#### 1.7 MANUFACTURER'S MULTI-YEAR COMPRESSOR WARRANTY

The Contractor shall provide a 10 year parts and labor (includes refrigerant) manufacturer's warranty on the chiller compressor(s). This warranty shall be directly from the chiller manufacturer to the Government

and shall be in addition to the standard one-year warranty of construction. The manufacturer's warranty shall provide for the repair or replacement of the chiller compressor(s) that become inoperative as a result of defects in material or workmanship within 10 years after the date of final acceptance. When the manufacturer determines that a compressor requires replacement, the manufacturer shall furnish new compressor(s) at no additional cost to the Government. Upon notification that a chiller compressor has failed under the terms of the warranty, the manufacturer shall respond in no more than 24 hours. Response shall mean having a manufacturer-qualified technician onsite to evaluate the extent of the needed repairs. The warranty period shall begin on the same date as final acceptance and shall continue for the full product warranty period.

#### 1.7.1 Indexed Notebook

The Contractor shall furnish to the Contracting Officer a bound and indexed notebook containing a complete listing of all water chillers covered by a manufacturer's multi-year warranty. The chiller list shall state the duration of the warranty thereof, start date of the warranty, ending date of the warranty, location of the warranted equipment, and the point of contact for fulfillment of the warranty. This information shall be provided for each chiller and the recorded chiller serial numbers shall identify each chiller. Point of contact shall include the name of the service representative along with the day, night, weekend, and holiday phone numbers for a service call. The completed bound and indexed notebook shall be delivered to the Contracting Office prior to final acceptance of the facility. The Contractor shall furnish with each manufacturer's multi-year warranty the name, address, and telephone number (day, night, weekend, and holiday) of the service representative nearest to the location where the equipment is installed. Upon a request for service under the multi-year warranty, the service representative shall honor the warranty during the warranty period, and shall provide the services prescribed by the terms of the warranty.

#### 1.7.2 Equipment Warranty Tags

At the time of installation, each item of manufacturer's multi-year warranted equipment shall be tagged with a durable, oil- and water-resistant tag, suitable for interior and exterior locations, resistant to solvents, abrasion, and fading due to sunlight. The tag shall be attached with copper wire or a permanent, pressure-sensitive, adhesive backing. The tag shall be installed in an easily noticed location attached to the warranted equipment. The tag for this equipment shall be similar to the following in format, and shall contain all of the listed information:

##### MANUFACTURER'S MULTI-YEAR WARRANTY EQUIPMENT TAG

Equipment/Product Covered: \_\_\_\_\_  
 Manufacturer: \_\_\_\_\_ Model No.: \_\_\_\_\_ Serial No.: \_\_\_\_\_  
 Warranty Period: From \_\_\_\_\_ to \_\_\_\_\_  
 Contract No.: \_\_\_\_\_  
 Warranty Contact: \_\_\_\_\_  
 Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Telephone: \_\_\_\_\_

STATION PERSONNEL SHALL PERFORM PREVENTIVE  
 MAINTENANCE AND OPERATIONAL MAINTENANCE

## PART 2 PRODUCTS

### 2.1 STANDARD COMMERCIAL PRODUCTS

Materials and equipment shall be standard Commercial cataloged products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship.

These products shall have a two year record of satisfactory field service prior to bid opening. the two year record of service shall include applications of equipment and materials under similar circumstances and of similar size.

Products having less than a two year record of satisfactory field service shall be acceptable if a certified record of satisfactory field service for not less than 6000 hours can be shown. The 6000 hour service record shall not include any manufacturer's prototype or factory testing.

Satisfactory field service shall have been completed by a product that has been, and presently is being sold or offered for sale on the commercial market through the following copyrighted means: advertisements, manufacturer's catalogs, or brochures.

### 2.2 MANUFACTURER'S STANDARD NAMEPLATES

Major equipment including chillers, compressors, compressor drivers, condensers, water coolers, receivers, refrigerant leak detectors, heat exchanges, fans, and motors shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment. Plates shall be durable and legible throughout equipment life. Plates shall be fixed in prominent locations with nonferrous screws or bolts.

### 2.3 ELECTRICAL WORK

- a. Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Manual or automatic control and protective or signal devices required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers including the required monitors and timed restart.
- b. For single-phase motors, provide high-efficiency type, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11.
- c. For polyphase motors, provide squirrel-cage medium induction motors, including motors that are part of a system, and that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 11.
- d. Provide motors in accordance with NEMA MG 11 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor. Motors shall be rated for continuous

duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters complete with thermal overload protection and other necessary appurtenances.

e. Provide inverter duty premium efficiency motors for use with variable frequency drives.

## 2.4 SELF-CONTAINED WATER CHILLERS, VAPOR COMPRESSION TYPE

Unless necessary for delivery purposes, units shall be assembled, leak-tested, charged (refrigerant and oil), and adjusted at the factory. In lieu of delivery constraints, a chiller may be assembled, leak-tested, charged (refrigerant and oil), and adjusted at the job site by a factory representative. Unit components delivered separately shall be sealed and charged with a nitrogen holding charge. Parts weighing 50 pounds or more which must be removed for inspection, cleaning, or repair, such as motors, gear boxes, cylinder heads, casing tops, condenser, and cooler heads, shall have lifting eyes or lugs. Chiller shall be provided with a single point wiring connection for incoming power supply. Chiller's condenser and water cooler shall be provided with standard water boxes with grooved mechanical connections.

### 2.4.1 Scroll, Reciprocating, or Rotary Screw Type

Chiller shall be rated in accordance with AHRI 550/590. Chiller shall conform to ANSI/ASHRAE 15 & 34. As a minimum, chiller shall include the following components as defined in paragraph CHILLER COMPONENTS.

- a. Refrigerant and oil
- b. Structural base
- c. Chiller refrigerant circuit
- d. Controls package
- e. Scroll, reciprocating, or rotary screw compressor
- f. Compressor driver, electric motor
- g. Compressor driver connection
- h. Water cooler (evaporator)
- i. Air-cooled condenser coil

## 2.5 CHILLER COMPONENTS

### 2.5.1 Refrigerant and Oil

Refrigerants shall be one of the fluorocarbon gases. Refrigerants shall have number designations and safety classifications in accordance with



ANSI/ASHRAE 15 & 34.

#### 2.5.2 Structural Base

Chiller and individual chiller components shall be provided with a factory-mounted structural steel base (welded or bolted) or support legs.

#### 2.5.3 Chiller Refrigerant Circuit

Chiller refrigerant circuit shall be completely piped and factory leak tested. For multicompressor units, not less than 2 independent refrigerant circuits shall be provided. Circuit shall include as a minimum a combination filter and drier, combination sight glass and moisture indicator, liquid-line solenoid valve for reciprocating, an electronic or thermostatic expansion valve with external equalizer, charging ports, compressor service valves for field-serviceable compressors, and superheat adjustment.

#### 2.5.4 Controls Package

Chiller shall be provided with a complete factory-mounted, prewired electric or microprocessor based operating and safety control system. Controls package shall contain as a minimum a digital display or acceptable gauges, an on-auto-off switch, motor starters, disconnect switches, power wiring, and control wiring. Controls package shall provide operating controls, monitoring capabilities, programmable setpoints, safety controls, and EMCS interfaces as defined below.

##### 2.5.4.1 Operating Controls

Chiller shall be provided with the following adjustable operating controls as a minimum.

- a. Leaving chilled water temperature control
- b. Adjustable timer or automated controls to prevent a compressor from short cycling
- c. Automatic lead/lag controls (adjustable) for multi-compressor units
- d. Load limiting
- e. System capacity control to adjust the unit capacity in accordance with the system load and the programmable setpoints. Controls shall automatically re-cycle the chiller on power interruption.
- f. Startup and head pressure controls to allow system operation at all ambient temperatures down to 40 degrees F
- g. Fan sequencing for air-cooled condenser

##### 2.5.4.2 Monitoring Capabilities

During normal operations, the control system shall be capable of monitoring and displaying the following operating parameters. Access and operation of display shall not require opening or removing any panels or doors.

- a. Entering and leaving chilled water temperatures

- b. Self diagnostic
- c. Operation status
- d. Operating hours
- e. Number of starts
- f. Compressor status (on or off)
- g. Refrigerant discharge and suction pressures
- h. Oil pressure

#### 2.5.4.3 Programmable Setpoints

The control system shall be capable of being reprogrammed directly at the unit. The programmable setpoints shall include the following as a minimum.

- a. Leaving Chilled Water Temperature
- c. Time Clock/Calendar Date

#### 2.5.4.4 Safety Controls with Manual Reset

Chiller shall be provided with the following safety controls which automatically shutdown the chiller and which require manual reset.

- a. Low chilled water temperature protection
- b. High condenser refrigerant discharge pressure protection
- c. Low evaporator pressure protection
- d. Chilled water flow detection
- e. High motor winding temperature protection
- f. Low oil flow protection if applicable
- g. Motor current overload and phase loss protection

#### 2.5.4.5 Safety Controls with Automatic Reset

Chiller shall be provided with the following safety controls which automatically shutdown the chiller and which provide automatic reset.

- a. Over/under voltage protection
- b. Chilled water flow interlock

#### 2.5.4.6 Remote Alarm

During the initiation of a safety shutdown, a chiller's control system

shall be capable of activating a remote alarm bell. In coordination with the chiller, the Contractor shall provide an alarm circuit (including transformer if applicable) and a minimum 4 inch diameter alarm bell. Alarm circuit shall activate bell in the event of machine shutdown due to the chiller's monitoring of safety controls. The alarm bell shall not sound for a chiller that uses low-pressure cutout as an operating control.

#### 2.5.4.7 Energy Management Control System (EMCS) Interface

The control system shall be capable of communicating all data to a remote integrated DDC processor through a single shielded cable. The data shall include as a minimum all system operating conditions, capacity controls, and safety shutdown conditions. The control system shall also be capable of receiving at a minimum the following operating commands.

- a. Remote Unit Start/Stop
- b. Remote Chilled Water Reset

#### 2.5.5 Compressor(s)

##### 2.5.5.1 Scroll Compressor(s)

Compressors shall be of the hermetically sealed design. Compressors shall be mounted on vibration isolators to minimize vibration and noise. Rotating parts shall be statically and dynamically balanced at the factory to minimize vibration. Lubrication system shall be centrifugal pump type equipped with a means for determining oil level and an oil charging valve. Crankcase oil heater shall be provided if standard or if available as an option. If provided, the crankcase oil heater shall be controlled as recommended by the manufacturer.

#### 2.5.6 Compressor Driver, Electric Motor

Motors, starters, , wiring, etc. shall be in accordance with paragraph ELECTRICAL WORK. Motor starter shall be unit mounted as indicated with starter type, wiring, and accessories coordinated with the chiller manufacturer.

#### 2.5.7 Water Cooler (Evaporator)

Cooler shall be of the shell-and-coil or shell-and-tube type design. Condenser's refrigerant side shall be designed and factory pressure tested to comply with ANSI/ASHRAE 15 & 34. Condenser's water side shall be designed and factory pressure tested for not less than 250 psi. Cooler shell shall be constructed of seamless or welded steel. Coil bundles shall be totally removable and arranged to drain completely. Tubes shall be seamless copper, plain, integrally finned with smooth bore or integrally finned with enhanced bore. Each tube shall be individually replaceable. Tubes shall be installed into carbon mild steel tube sheets by rolling. Tube baffles shall be properly spaced to provide adequate tube support and cross flow. Performance shall be based on a water velocity not less than 3 fps. Performance shall be based on a water velocity not less than 3 fps nor more than 12 fps and a fouling factor of 0.0001 h(ft<sup>2</sup>)(degrees F)/Btu.

#### 2.5.8 Air-Cooled Condenser Coil

Condenser coil shall be of the extended-surface fin-and-tube type and shall

be constructed of seamless copper tubes with compatible copper or aluminum fins. Fins shall be soldered or mechanically bonded to the tubes and installed in a metal casing. Coils shall be circuited and sized for a minimum of 5 degrees F subcooling and full pumpdown capacity. Coil shall be factory leak and pressure tested after assembly in accordance with ANSI/ASHRAE 15 & 34.

## 2.6 ACCESSORIES

### 2.6.1 Refrigerant Relief Valve/Rupture Disc Assembly

The assembly shall be a combination pressure relief valve and rupture disc designed for refrigerant usage. The assembly shall be in accordance with ASME BPVC SEC VIII D1 and ANSI/ASHRAE 15 & 34. The assembly shall be provided with a pressure gauge assembly which will provide local indication if a rupture disc is broken. Rupture disc shall be the non-fragmenting type.

### 2.6.2 Refrigerant Signs

Refrigerant signs shall be a medium-weight aluminum type with a baked enamel finish. Signs shall be suitable for indoor or outdoor service. Signs shall have a white background with red letters not less than 0.5 inches in height.

### 2.6.3 Gaskets

Gaskets shall conform to ASTM F 104 - classification for compressed sheet with nitrile binder and acrylic fibers for maximum 700 degrees F service.

### 2.6.4 Bolts and Nuts

Bolts and nuts, except as required for piping applications, shall be in accordance with ASTM A307. The bolt head shall be marked to identify the manufacturer and the standard with which the bolt complies in accordance with ASTM A307.

## 2.7 FABRICATION

### 2.7.1 Factory Coating

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish, except that items located outside of buildings shall have weather resistant finishes that will withstand 500 hours exposure to the salt spray test specified in ASTM B117 using a 5 percent sodium chloride solution. Immediately after completion of the test, the specimen shall show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 1/8 inch on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used shall be coated with a zinc-rich coating conforming to ASTM D 520, Type I.

## 2.8 SUPPLEMENTAL COMPONENTS/SERVICES

### 2.8.1 Chilled and Condenser Water Piping and Accessories

Chilled and condenser water piping and accessories shall be provided and installed in accordance with Section 23 64 26 CHILLED, CHILLED-HOT, AND

## CONDENSER WATER PIPING SYSTEMS.

## 2.8.2 Temperature Controls

Chiller control packages shall be fully coordinated with and integrated into the temperature control system specified in Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC

## PART 3 EXECUTION

## 3.1 INSTALLATION

Installation of water chiller systems including materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with the manufacturer's written installation instructions, including the following:

1. Water chiller - installation instructions

## 3.1.1 Field Painting

Painting required for surfaces not otherwise specified, and finish painting of items only primed at the factory are specified in Section 09 90 00 PAINTS AND COATINGS.

## 3.2 MANUFACTURER'S FIELD SERVICE

The services of a factory-trained representative shall be provided for 2 days. The representative shall advise on the following:

## a. Hermetic machines:

- (1) Testing hermetic water-chilling unit under pressure for refrigerant leaks; evacuation and dehydration of machine to an absolute pressure of not over 300 microns.
- (2) Charging the machine with refrigerant.
- (3) Starting the machine.

## 3.3 CLEANING AND ADJUSTING

Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided for all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions. At least one week before the official equipment warranty start date, all condenser coils on air-cooled water chillers and split-system water chillers shall be cleaned in accordance with the chiller manufacturer's instructions. This work covers two coil cleanings. The condenser coils shall be cleaned with an approved coil cleaner by a service technician, factory trained by the chiller manufacturer. The condenser coil cleaner shall not have any

detrimental affect on the materials or protective coatings on the condenser coils. Testing, adjusting, and balancing shall be as specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

### 3.4 SYSTEM PERFORMANCE TESTS

#### 3.4.1 General Requirements

Before each refrigeration system is accepted, tests to demonstrate the general operating characteristics of all equipment shall be conducted by a registered professional engineer or an approved manufacturer's start-up representative experienced in system start-up and testing, at such times as directed. Tests shall cover a period of not less than 48 hours for each system and shall demonstrate that the entire system is functioning in accordance with the drawings and specifications. Corrections and adjustments shall be made as necessary and tests shall be re-conducted to demonstrate that the entire system is functioning as specified. Prior to acceptance, service valve seal caps and blanks over gauge points shall be installed and tightened. Any refrigerant lost during the system startup shall be replaced. If tests do not demonstrate satisfactory system performance, deficiencies shall be corrected and the system shall be retested. Tests shall be conducted in the presence of the Contracting Officer. Water and electricity required for the tests will be furnished by the Government. Any material, equipment, instruments, and personnel required for the test shall be provided by the Contractor. Field tests shall be coordinated with Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

-- End of Section --

## SECTION 23 64 26

## CHILLED, CHILLED-HOT, AND CONDENSER WATER PIPING SYSTEMS

08/09

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.22/CSA 4.4 (1999; Addenda A 2000, Addenda B 2001; R 2004) Relief Valves for Hot Water Supply Systems

## AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003 (2009) Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI approved 2010)

ASSE 1017 (2009) Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems - (ANSI approved 2010)

## AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C606 (2006) Grooved and Shouldered Joints

## AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M (2004) Specification for Filler Metals for Brazing and Braze Welding

AWS BRH (2007; 5th Ed) Brazing Handbook

AWS D1.1/D1.1M (2010) Structural Welding Code - Steel

AWS Z49.1 (2005) Safety in Welding and Cutting and Allied Processes

## ASME INTERNATIONAL (ASME)

ASME B1.20.1 (1983; R 2006) Pipe Threads, General Purpose (Inch)

ASME B16.1 (2010) Gray Iron Threaded Fittings; Classes 25, 125 and 250

ASME B16.11 (2009) Forged Fittings, Socket-Welding and Threaded

|              |  |
|--------------|--|
| ASME B16.18  | (2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings                            |
| ASME B16.21  | (2011) Nonmetallic Flat Gaskets for Pipe Flanges   |
| ASME B16.22  | (2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings |
| ASME B16.26  | (2013) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes                     |
| ASME B16.3   | (2010) Malleable Iron Threaded Fittings, Classes 150 and 300                               |
| ASME B16.39  | (2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300         |
| ASME B16.9   | (2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings                        |
| ASME B31.9   | (2011) Building Services Piping  |
| ASME B40.100 | (2005) Pressure Gauges and Gauge Attachments   |

## ASTM INTERNATIONAL (ASTM)

|                 |   |
|-----------------|---|
| ASTM A106/A106M | (2010) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service   |
| ASTM A183       | (2003; R 2009) Standard Specification for Carbon Steel Track Bolts and Nuts   |
| ASTM A47/A47M   | (1999; R 2014) Standard Specification for Ferritic Malleable Iron Castings  |
| ASTM A53/A53M   | (2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless                                   |
| ASTM A536       | (1984; R 2009) Standard Specification for Ductile Iron Castings   |
| ASTM A653/A653M | (2015) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| ASTM A733       | (2003; R 2009e1) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples                |
| ASTM B117       | (2011) Standard Practice for Operating Salt Spray (Fog) Apparatus   |



|             |  |
|-------------|--|
| ASTM B32    | (2008) Standard Specification for Solder Metal   |
| ASTM B42    | (2010) Standard Specification for Seamless Copper Pipe, Standard Sizes   |
| ASTM B62    | (2009) Standard Specification for Composition Bronze or Ounce Metal Castings   |
| ASTM B75    | (2002; R 2010) Standard Specification for Seamless Copper Tube   |
| ASTM B813   | (2010) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube                  |
| ASTM B88    | (2009) Standard Specification for Seamless Copper Water Tube   |
| ASTM D 2000 | (2008) Standard Classification System for Rubber Products in Automotive Applications                                     |
| ASTM D 3308 | (2006) PTFE Resin Skived Tape  |
| ASTM D 520  | (2000; R 2011) Zinc Dust Pigment   |
| ASTM D 596  | (2001; R 2011) Reporting Results of Analysis of Water  |
| ASTM E 84   | (2015a) Standard Test Method for Surface Burning Characteristics of Building Materials                                   |
| ASTM F 1007 | (1986; R 2007) Pipeline Expansion Joints of the Packed Slip Type for Marine Application                                  |
| ASTM F 1120 | (1987; R 2010) Standard Specification for Circular Metallic Bellows Type Expansion Joints for Piping Applications        |
| ASTM F 1199 | (1988; R 2010) Cast (All Temperatures and Pressures) and Welded Pipe Line Strainers (150 psig and 150 degrees F Maximum) |

## EXPANSION JOINT MANUFACTURERS ASSOCIATION (EJMA)

|           |                       |
|-----------|-----------------------|
| EJMA Stds | (2008) EJMA Standards |
|-----------|-----------------------|

## HYDRAULIC INSTITUTE (HI)

|            |  |
|------------|--|
| HI 1.1-1.2 | (2008) Rotodynamic (Centrifugal) Pump for Nomenclature and Definitions |
|------------|--|

## MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

|            |  |
|------------|--|
| MSS SP-110 | (2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and |
|------------|--|

## Flared Ends

|           |  |
|-----------|--|
| MSS SP-25 | (2008) Standard Marking System for Valves, Fittings, Flanges and Unions  |
| MSS SP-58 | (2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation |
| MSS SP-67 | (2002a) Butterfly Valves   |
| MSS SP-69 | (2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)        |
| MSS SP-70 | (2006) Gray Iron Gate Valves, Flanged and Threaded Ends  |
| MSS SP-71 | (2005) Gray Iron Swing Check Valves, Flanged and Threaded Ends   |
| MSS SP-72 | (2010) Ball Valves with Flanged or Butt-Welding Ends for General Service                                       |
| MSS SP-78 | (2005a) Cast Iron Plug Valves, Flanged and Threaded Ends   |
| MSS SP-80 | (2008) Bronze Gate, Globe, Angle and Check Valves  |
| MSS SP-85 | (2002) Gray Iron Globe & Angle Valves Flanged and Threaded Ends  |

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

|            |   |
|------------|---|
| NEMA 250   | (2008) Enclosures for Electrical Equipment (1000 Volts Maximum)                     |
| NEMA MG 1  | (2009) Motors and Generators  |
| NEMA MG 11 | (1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors |

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

|          |  |
|----------|--|
| NFPA 90A | (2015) Standard for the Installation of Air Conditioning and Ventilating Systems |
|----------|--|

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

|               |   |
|---------------|---|
| CID A-A-50541 | (Basic; Notice 2) Valves, Tank Float, Angle and Globe Pattern (Inch-Pound |
|---------------|---|

## 1.2 SYSTEM DESCRIPTION

Provide the water systems having the minimum service (design) temperature-pressure rating indicated. Provision of the piping systems, including materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with

the required and advisory provisions of ASME B31.9 except as modified or supplemented by this specification section or design drawings. This specification section covers the water systems piping which is located within, on, and adjacent to building(s) within the building(s) 5 foot line.

### 1.3 SUBMITTALS

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

#### SD-03 Product Data

Grooved Mechanical Connections For Steel

Grooved Mechanical Connections For Copper

Calibrated Balancing Valves

Automatic Flow Control Valves

Pump Discharge Valve

Water Temperature Mixing Valve

Water Temperature Regulating Valves

Water Pressure Reducing Valve

Pressure Relief Valve

Combination Pressure and Temperature Relief Valves

Expansion Joints

Pumps

Combination Strainer and Pump Suction Diffuser

Expansion Tanks

Air Separator Tanks

Water Treatment Systems

#### SD-06 Test Reports

Piping welds NDE report

Pressure tests reports

Report shall be provided in bound 8-1/2 by 11 inch booklets. In the reports, document all phases of the tests performed. Include initial test summaries, all repairs/adjustments made, and the final test results.

#### SD-07 Certificates

### Employer's Record Documents (For Welding)

#### Welding Procedures and Qualifications

Certificates shall be submitted showing conformance with the referenced standards contained in this section.

### SD-10 Operation and Maintenance Data

Requirements for data packages are specified Section 01 78 23 OPERATION AND MAINTENANCE DATA, except as supplemented and modified by this specification section.

Submit spare parts data for each different item of equipment specified, with operation and maintenance data packages. Include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of the parts recommended by the manufacturer to be replaced on a routine basis.

Submit a list of qualified permanent service organizations with operation and maintenance data packages. Include service organization addresses and service area or expertise. The service organizations shall be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

#### Water Treatment Systems

An operation manual in bound 8-1/2 by 11 inch booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown. Include testing procedures used in determining water quality.

A maintenance manual in bound 8-1/2 by 11 inch booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide.

Calibrated Balancing Valves, Data Package 3

Automatic Flow Control Valves, Data Package 3

Pump Discharge Valve, Data Package 2

Water Temperature Mixing Valve, Data Package 3

Water Temperature Regulating Valves, Data Package 3

Water Pressure Reducing Valve, Data Package 3

Pressure Relief Valve, Data Package 2

Combination Pressure and Temperature Relief Valves, Data Package 2

Expansion Joints, Data Package 2

Pumps, Data Package 3

Combination Strainer and Pump Suction Diffuser, Data Package 2

Expansion Tanks, Data Package 2

Air Separator Tanks, Data Package 2

#### 1.4 MODIFICATIONS TO 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.

##### 1.4.1 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."

##### 1.4.2 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.

#### 1.5 SAFETY REQUIREMENTS

Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Safety devices shall be installed so that proper operation of equipment is not impaired.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

Protect stored items from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material both before and during installation shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, cap piping and similar openings to keep out dirt and other foreign matter. Any porous materials found to be contaminated with mold or mildew will be replaced at the Contractor's expense. Non-porous materials found to be contaminated with mold or mildew

will be disinfected and cleaned prior to installation.

## 1.7 PROJECT/SITE CONDITIONS

### 1.7.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

### 1.7.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and shall arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions.

### 1.7.3 Accessibility

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

## PART 2 PRODUCTS

### 2.1 STANDARD COMMERCIAL PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening.

The two year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures.

Products having less than a 2 year field service record shall be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. System components shall be environmentally suitable for the indicated locations.

The equipment items shall be supported by service organizations. 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.

### 2.2 STEEL PIPING

Water piping shall be steel pipe or copper tubing. Provide steel piping with a ANSI/ASME Class 125 service rating, which for 150 degrees F, the pressure rating is 175 psig.

### 2.2.1 Pipe

Steel pipe, conform to ASTM A53/A53M, Schedule 40, Type E or S, Grades A or B. Do not use Type F pipe.

### 2.2.2 Fittings and End Connections (Joints)

Piping and fittings 1 inch and smaller shall have threaded connections. Piping and fittings larger than 1 inch and smaller than 3 inches shall have either threaded, grooved, or welded connections. Piping and fittings 3 inches and larger shall have grooved, welded, or flanged connections. The manufacturer of each fitting shall be permanently identified on the body of the fitting in accordance with MSS SP-25.

#### 2.2.2.1 Threaded Connections

Use threaded valves and pipe connections conforming to ASME B1.20.1. Used threaded fitting conforming to ASME B16.3. Use threaded unions conforming to ASME B16.39. Use threaded pipe nipples conforming to ASTM A733.

#### 2.2.2.2 Flanged Connections

Flanges shall conform to ASME B16.1, Class 150. Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type. These gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR). Bolts, nuts, and bolt patterns shall conform to ASME B16.1.

#### 2.2.2.3 Welded Connections

Welded valves and pipe connections (both butt-welds and socket-welds types) shall conform to ASME B31.9. Butt-welded fittings shall conform to ASME B16.9. Socket-welded fittings shall conform to ASME B16.11. Welded fittings shall be identified with the appropriate grade and marking symbol.

#### 2.2.2.4 Grooved Mechanical Connections For Steel

Rigid grooved mechanical connections may only be used in serviceable aboveground locations where the temperature of the circulating medium does not exceed 230 degrees F. Flexible grooved connections shall be used only as a flexible connector with grooved pipe system. Unless otherwise specified, grooved piping components shall meet the corresponding criteria specified for the similar welded, flanged, or threaded component specified herein.

Each grooved mechanical joint shall be a system, including coupling housing, gasket, fasteners, all furnished by the same manufacturer. Joint installation shall be in compliance with joint manufacturer's written instructions.

Use fitting and coupling houses of malleable iron conforming to ASTM A47/A47M, Grade 32510; ductile iron conforming to ASTM A536, Grade 65-45-12; or steel conforming to ASTM A106/A106M, Grade B or ASTM A53/A53M. Use gaskets of molded synthetic rubber with central cavity, pressure responsive configuration and conforming to ASTM D 2000 Grade No. 2CA615A15B44F17Z for circulating medium up to 230 degrees F or Grade No. M3BA610A15B44Z for circulating medium up to 200 degrees F. Grooved mechanical connections shall conform to AWWA C606. Coupling nuts and bolts

shall be steel and shall conform to ASTM A183. Pipe connections and fittings shall be the product of the same manufacturer. Provide joint installation be in compliance with joint manufacturer's written instructions.

#### 2.2.2.5 Dielectric Waterways and Flanges

Provide dielectric waterways with a water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint. When dry, insulation barrier shall be able to withstand a 600-volt breakdown test. Provide dielectric waterways constructed of galvanized steel and have threaded end connections to match connecting piping. Dielectric waterways shall be suitable for the required operating pressures and temperatures. Provide dielectric flanges with the same pressure ratings as standard flanges and provide complete electrical isolation between connecting pipe and/or equipment as described herein for dielectric waterways.

### 2.3 COPPER TUBING

Provide copper tubing and fittings with a ANSI/ASME Class 125 service rating, which for 150 degrees F., the pressure rating is 175 psig.

#### 2.3.1 Tube

Use copper tube conforming to ASTM B88, Type L or M for aboveground tubing, and Type K for buried tubing.

#### 2.3.2 Fittings and End Connections (Solder and Flared Joints)

Wrought copper and bronze solder joint pressure fittings, including unions and flanges, shall conform to ASME B16.22 and ASTM B75. Provide adapters as required. Cast copper alloy solder-joint pressure fittings, including unions and flanges, shall conform to ASME B16.18. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B62. ASTM B42 copper pipe nipples with threaded end connections shall conform to ASTM B42.

Copper tubing of sizes larger than 4 inches shall have brazed joints. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment.

Extracted brazed tee joints may be used if produced with an acceptable tool and installed in accordance with tool manufacturer's written procedures.

#### 2.3.3 Grooved Mechanical Connections For Copper

Rigid grooved mechanical connections may only be used in serviceable aboveground locations where the temperature of the circulating medium does not exceed 230 degrees F. Flexible grooved connections shall be used only as a flexible connector with grooved pipe system. Unless otherwise specified, grooved piping components shall meet the corresponding criteria specified for the similar welded, flanged, or threaded component specified herein.

Each grooved mechanical joint shall be a system, including coupling housing, gasket, fasteners, all furnished by the same manufacturer. Joint installation shall be in compliance with joint manufacturer's written instructions.



Grooved fitting and mechanical coupling housing shall be ductile iron conforming to ASTM A536. Provide gaskets for use in grooved joints shall constructed of molded synthetic polymer of pressure responsive design and shall conform to ASTM D 2000 for circulating medium up to 230 degrees F. Provide grooved joints in conformance with AWWA C606.

#### 2.3.4 Solder

Provide solder in conformance with ASTM B32, grade Sb5, tin-antimony alloy. Solder flux shall be liquid or paste form, non-corrosive and conform to ASTM B813.

#### 2.3.5 Brazing Filler Metal

Filler metal shall conform to AWS A5.8/A5.8M, Type BAg-5 with AWS Type 3 flux, except Type BCuP-5 or BCuP-6 may be used for brazing copper-to-copper joints.

### 2.4 VALVES

Provide valves with a ANSI/ASME Class 125 service rating, which for 150 degrees F, the pressure rating is 175 psig.

Valves in sizes larger than 1 inch and used on steel pipe systems, may be provided with rigid grooved mechanical joint ends. Such grooved end valves shall be subject to the same requirements as rigid grooved mechanical joints and fittings and, shall be furnished by the same manufacturer as the grooved pipe joint and fitting system.

#### 2.4.1 Gate Valve

Gate valves 2-1/2 inches and smaller shall conform to MSS SP-80 Class 125 and shall be bronze with wedge disc, rising stem and threaded, soldered, or flanged ends. Gate valves 3 inches and larger shall conform to MSS SP-70, Class 125, cast iron with bronze trim, outside screw and yoke, and flanged or threaded ends.

#### 2.4.2 Globe and Angle Valve

Globe and angle valves 2-1/2 inches and smaller shall conform to MSS SP-80, Class 125. Globe and angle valves 3 inches and larger shall conform to MSS SP-85, Class 125.

#### 2.4.3 Check Valve

Check valves 2-1/2 inches and smaller shall conform to MSS SP-80. Check valves 3 inches and larger shall conform to MSS SP-71, Class 125.

#### 2.4.4 Butterfly Valve

Butterfly valves shall conform to MSS SP-67, Type 1 and shall be either the wafer or lug type. Valves smaller than 8 inches shall have throttling handles with a minimum of seven locking positions. Valves 8 inches and larger shall have totally enclosed manual gear operators with adjustable balance return stops and position indicators.

#### 2.4.5 Plug Valve

Plug valves 2 inches and larger shall conform to MSS SP-78, have flanged or threaded ends, and have cast iron bodies with bronze trim. Valves 2 inches and smaller shall be bronze with NPT connections for black steel pipe and brazed connections for copper tubing. Valve shall be lubricated, non-lubricated, or tetrafluoroethylene resin-coated type. Valve shall be resilient, double seated, trunnion mounted with tapered lift plug capable of 2-way shutoff. Valve shall operate from fully open to fully closed by rotation of the handwheel to lift and turn the plug. Valves 8 inches or larger shall be provided with manual gear operators with position indicators.

#### 2.4.6 Ball Valve

Full port design. Ball valves 1/2 inch and larger shall conform to MSS SP-72 or MSS SP-110 and shall be cast iron or bronze with threaded, soldered, or flanged ends. Valves 8 inches or larger shall be provided with manual gear operators with position indicators. Ball valves may be provided in lieu of gate valves.

#### 2.4.7 Square Head Cocks

Provide copper alloy or cast-iron body with copper alloy plugs, suitable for 125 psig water working pressure.

#### 2.4.8 Calibrated Balancing Valves

Copper alloy or cast iron body, copper alloy or stainless internal working parts. Provide valve calibrated so that flow can be determined when the temperature and pressure differential across valve is known. Valve shall have an integral pointer which registers the degree of valve opening. Valve shall function as a service valve when in fully closed position. Valve shall be constructed with internal seals to prevent leakage and shall be supplied with preformed insulation.

Provide valve bodies with tapped openings and pipe extensions with positive shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable differential pressure meter connections to verify the pressure differential. Provide metal tag on each valve showing the gallons per minute flow for each differential pressure reading.

#### 2.4.9 Automatic Flow Control Valves

Valve shall automatically maintain the constant flow indicated on the design drawings. Valve shall modulate by sensing the pressure differential across the valve body. Valve shall be selected for the flow required and provided with a permanent nameplate or tag carrying a permanent record of the factory-determined flow rate and flow control pressure levels. Provide valve that controls the flow within 5 percent of the tag rating. Valve materials shall be the same as specified for the ball or plug valves.

Provide valve that are electric type as indicated. Valve shall be capable of positive shutoff against the system pump head, valve bodies shall be provided with tapped openings and pipe extensions with shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings and differential meter, suitable for the operating pressure specified. Provide the meter complete with hoses, vent,

integral metering connections, and carrying case as recommended by the valve manufacturer.

#### 2.4.10 Pump Discharge Valve

Valve shall perform the functions of a nonslam check valve, a manual balancing valve, and a shutoff. Valve shall be of cast iron or ductile iron construction with bronze and/or stainless steel accessories. Provide an integral pointer on the valve which registers the degree of valve opening. Flow through the valve shall be manually adjustable from bubble tight shutoff to full flow. Valves smaller than 2 inches shall have NPT connections. Valves 2 inches and larger shall have flanged or grooved end connections. Valve design shall allow the back seat for the stem to be replaced in the field under full line pressure.

#### 2.4.11 Water Temperature Mixing Valve

Valve, ASSE 1017 for water service.

#### 2.4.12 Water Temperature Regulating Valves

Provide copper alloy body, direct acting, pilot operated, for the intended service.

#### 2.4.13 Water Pressure Reducing Valve

Valve, ASSE 1003 for water service, copper alloy body, automatic re-seating, with test lever.

#### 2.4.14 Pressure Relief Valve

Valve shall prevent excessive pressure in the piping system when the piping system reaches its maximum heat buildup. Valve, ANSI Z21.22/CSA 4.4 and shall have cast iron bodies with corrosion resistant internal working parts. The discharge pipe from the relief valve shall be the size of the valve outlet unless otherwise indicated.

#### 2.4.15 Combination Pressure and Temperature Relief Valves

ANSI Z21.22/CSA 4.4, copper alloy body, automatic re-seating, test lever, and discharge capacity based on AGA temperature steam rating.

#### 2.4.16 Float Valve

Valve, CID A-A-50541, Style A (angle pattern) or Style B (globe pattern). Where float rods are extended for tank applications, extension shall be properly supported and guided to avoid bending of float rod or stressing of valve pilot linkage.

#### 2.4.17 Drain Valves

Valves, MSS SP-80 gate valves. Valve shall be manually-operated, 3/4 inch pipe size and above with a threaded end connection. Provide valve with a water hose nipple adapter. Freeze-proof type valves shall be provided in installations exposed to freezing temperatures.

#### 2.4.18 Air Venting Valves

Manually-operated general service type air venting valves, brass or bronze

valves that are furnished with threaded plugs or caps. Air venting valves on water coils shall have not less than 1/8 inch threaded end connections. Air venting valves on water mains shall have not less than 3/4 inch threaded end connections. Air venting valves on all other applications shall have not less than 1/2 inch threaded end connections.

#### 2.4.19 Vacuum Relief Valves

ANSI Z21.22/CSA 4.4

### 2.5 PIPING ACCESSORIES

#### 2.5.1 Strainer

Strainer, ASTM F 1199, except as modified and supplemented in this specification. Strainer shall be the cleanable, basket or "Y" type, the same size as the pipeline. Strainer bodies shall be fabricated of cast iron with bottoms drilled, and tapped. Provide blowoff outlet with pipe nipple, gate valve, and discharge pipe nipple. The bodies shall have arrows clearly cast on the sides indicating the direction of flow.

Provide strainer with removable cover and sediment screen. The screen shall be made of minimum 22 gauge corrosion-resistant steel, with small perforations numbering not less than 400 per square inch to provide a net free area through the basket of at least 3.30 times that of the entering pipe. The flow shall be into the screen and out through the perforations.

#### 2.5.2 Cyclonic Separator

Metal- bodied, with removal capability of removing solids 45 microns/325 mesh in size and heavier than 1.20 specific gravity, maximum pressure drop of 5 psid, with cleanout connection.

#### 2.5.3 Combination Strainer and Pump Suction Diffuser

Angle type body with removable strainer basket and internal straightening vanes, a suction pipe support, and a blowdown outlet and plug. Strainer shall be in accordance with ASTM F 1199, except as modified and supplemented by this specification. Unit body shall have arrows clearly cast on the sides indicating the direction of flow.

Strainer screen shall be made of minimum 22 gauge corrosion-resistant steel, with small perforations numbering not less than 400 per square inch to provide a net free area through the basket of at least 3.30 times that of the entering pipe. Flow shall be into the screen and out through the perforations. Provide an auxiliary disposable fine mesh strainer which shall be removed 30 days after start-up. Provide warning tag for operator indicating scheduled date for removal.

Casing shall have connection sizes to match pump suction and pipe sizes, and be provided with adjustable support foot or support foot boss to relieve piping strains at pump suction. Provide unit casing with blowdown port and plug. Provide a magnetic insert to remove debris from system.

#### 2.5.4 Flexible Pipe Connectors

Provide flexible bronze or stainless steel piping connectors with single braid. Equip flanged assemblies with limit bolts to restrict maximum travel to the manufacturer's standard limits. Unless otherwise indicated,

the length of the flexible connectors shall be as recommended by the manufacturer for the service intended. Internal sleeves or liners, compatible with circulating medium, shall be provided when recommended by the manufacturer. Provide covers to protect the bellows where indicated.

#### 2.5.5 Pressure and Vacuum Gauges

Gauges, ASME B40.100 with throttling type needle valve or a pulsation dampener and shut-off valve. Provide gauges with 4.5 inch dial, brass or aluminum case, bronze tube, and siphon. Gauge shall have a minimum of with a range from 0 psig to approximately 1.5 times the maximum system working pressure. Each gauge range shall be selected so that at normal operating pressure, the needle is within the middle-third of the range.

#### 2.5.6 Temperature Gauges

Temperature gauges, shall be the industrial duty type and be provided for the required temperature range. Provide gauges with fixed thread connection, dial face gasketed within the case; and an accuracy within 2 percent of scale range. Gauges shall have Fahrenheit scale in 2 degree graduations scale (black numbers) on a white face. The pointer shall be adjustable. Rigid stem type temperature gauges shall be provided in thermal wells located within 5 feet of the finished floor. Universal adjustable angle type or remote element type temperature gauges shall be provided in thermal wells located 5 to 7 feet above the finished floor or in locations indicated. Remote element type temperature gauges shall be provided in thermal wells located 7 feet above the finished floor or in locations indicated.

##### 2.5.6.1 Stem Cased-Glass

Stem cased-glass case shall be polished stainless steel or cast aluminum, 9 inches long, with clear acrylic lens, and non-mercury filled glass tube with indicating-fluid column.

##### 2.5.6.2 Bimetallic Dial

Bimetallic dial type case shall be not less than 3-1/2 inches, stainless steel, and shall be hermetically sealed with clear acrylic lens. Bimetallic element shall be silicone dampened and unit fitted with external calibrator adjustment.

##### 2.5.6.3 Liquid-, Solid-, and Vapor-Filled Dial

Liquid-, solid-, and vapor-filled dial type cases shall be not less than 3-1/2 inches, stainless steel or cast aluminum with clear acrylic lens. Fill shall be nonmercury, suitable for encountered cross-ambients, and connecting capillary tubing shall be double-braided bronze.

##### 2.5.6.4 Thermal Well

Thermal well shall be identical size, 1/2 or 3/4 inch NPT connection, brass or stainless steel. Where test wells are indicated, provide captive plug-fitted type 1/2 inch NPT connection suitable for use with either engraved stem or standard separable socket thermometer or thermostat. Mercury shall not be used in thermometers. Extended neck thermal wells shall be of sufficient length to clear insulation thickness by 1 inch.

### 2.5.7 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, guides, and supports: to MSS SP-58 and MSS SP-69.

### 2.5.8 Escutcheons

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Secure plates in place by internal spring tension or set screws. 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.

### 2.5.9 Expansion Joints

#### 2.5.9.1 Slip-Tube Type

Slip-tube expansion joints, ASTM F 1007, Class I or II. Joints shall be provided with internally-externally alignment guides, injected semi-plastic packing, and service outlets. End connections shall be flanged or beveled for welding as indicated. Initial settings shall be made in accordance with the manufacturer's recommendations to compensate for ambient temperature at time of installation. Pipe alignment guides shall be installed as recommended by the joint manufacturer.

#### 2.5.9.2 Flexible Ball Type

Flexible ball expansion joints shall be capable of 360 degrees rotation plus 15 degrees angular flex movement. Joints shall be constructed of carbon steel with the exterior spherical surface of carbon steel balls plated with a minimum 5 mils of hard chrome in accordance with EJMA Stds. Joint end connections shall be threaded for piping 2 inches or smaller. Joint end connections larger than 2 inches shall be grooved, flanged, or beveled for welding. Provide joint with pressure-molded composition gaskets suitable for continuous operation at twice design temperature.

#### 2.5.9.3 Bellows Type

Bellows expansion type joints, ASTM F 1120 with Type 304 stainless steel corrugated bellows, reinforced with equalizing rings, internal sleeves, and external protective covers. Joint end connections shall be grooved, flanged, or beveled for welding. Guiding of piping on both sides of expansion joint shall be in accordance with the published recommendations of the manufacturer of the expansion joint.

## 2.6 PUMPS

Pumps shall be the electrically driven, non-overloading, centrifugal type which conform to HI 1.1-1.2. Pumps shall be selected at or within 5 percent of peak efficiency. Pump curve shall rise continuously from maximum capacity to shutoff. Pump motor shall conform to NEMA MG 1, be open splash-proof, and have sufficient horsepower for the service required. Pump motor shall have the required capacity to prevent overloading with pump operating at any point on its characteristic curve. Pump speed shall not exceed 3,600 rpm, except where the pump head is less than 60 feet of water, the pump speed shall not exceed 1,750 rpm. Pump motor shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in the cover.

### 2.6.1 Construction

Each pump casing shall be designed to withstand the discharge head specified plus the static head on system plus 50 percent of the total, but not less than 125 psig. Pump casing and bearing housing shall be close grained cast iron. High points in the casing shall be provided with manual air vents; low points shall be provided with drain plugs. Provide threaded suction and discharge pressure gage tapping with square-head plugs.

Impeller shall be statically and dynamically balanced. Impeller, impeller wearing rings, glands, casing wear rings, and shaft sleeve shall be bronze. Shaft shall be carbon or alloy steel, turned and ground. Bearings shall be ball-bearings, roller-bearings, or oil-lubricated bronze-sleeve type bearings, and be efficiently sealed or isolated to prevent loss of oil or entrance of dirt or water.

Pump and motor shall be mounted on a common cast iron base having lipped edges and tapped drainage openings or structural steel base with lipped edges or drain pan and tapped drainage openings. Pump shall be provided with steel shaft coupling guard. Base-mounted pump, coupling guard, and motor shall each be bolted to a fabricated steel base which shall have bolt holes for securing base to supporting surface. Close-coupled pump shall be provided with integrally cast or fabricated steel feet with bolt holes for securing feet to supporting surface. Close-coupled pumps shall be provided with drip pockets and tapped openings. Pump shall be accessible for servicing without disturbing piping connections. Shaft seals shall be mechanical-seals or stuffing-box type.

### 2.6.2 Mechanical Shaft Seals

Seals shall be single, inside mounted, end-face-elastomer bellows type with stainless steel spring, brass or stainless steel seal head, carbon rotating face, and tungsten carbide or ceramic sealing face. Glands shall be bronze and of the water-flush design to provide lubrication flush across the face of the seal. Bypass line from pump discharge to flush connection in gland shall be provided, with filter or cyclone particle separator in line.

### 2.6.3 Stuffing-Box Type Seals

Stuffing box shall include minimum 4 rows of square, impregnated TFE (Teflon) or graphite cord packing and a bronze split-lantern ring. Packing gland shall be bronze interlocking split type.

## 2.7 EXPANSION TANKS

Tank shall be welded steel, constructed for, and tested to pressure-temperature rating of 125 psi at 150 degrees F. Provide tanks precharged to the minimum operating pressure. Tank shall have a replaceable polypropylene or butyl lined diaphragm which keeps the air charge separated from the water; shall be the captive air type.

Tanks shall accommodate expanded water of the system generated within the normal operating temperature range, limiting this pressure increase at all components in the system to the maximum allowable pressure at those components. Each tank air chamber shall be fitted with a drain, fill, an air charging valve, and system connections. Tank shall be supported by steel legs or bases for vertical installation or steel saddles for horizontal installations. The only air in the system shall be the permanent sealed-in air cushion contained within the expansion tank.

## 2.8 AIR SEPARATOR TANKS

Design to separate air from water and to direct released air to automatic air vent. Unit shall be of one piece cast-iron construction with internal baffles and two air chambers at top of unit; one air chamber shall have outlet to expansion tank and other air chamber shall be provided with automatic air release device. Tank shall be steel, constructed for, and tested to a ANSI Class 125 pressure-temperature rating.

## 2.9 WATER TREATMENT SYSTEMS

When water treatment is specified, the use of chemical-treatment products containing equivalent chromium (CPR) is prohibited.

### 2.9.1 Water Analysis

Conditions of make-up water to be supplied to the condenser and chilled water systems were reported in accordance with ASTM D 596 and are as follows:

|                                   |       |            |
|-----------------------------------|-------|------------|
| Date of Sample                    | _____ |            |
| Temperature                       | _____ | degrees F. |
| Silica (Sino 2)                   | _____ | pp (mg/1)  |
| Insoluble                         | _____ | pp (mg/1)  |
| Iron and Aluminum Oxides          | _____ | pp (mg/1)  |
| Calcium (Ca)                      | _____ | pp (mg/1)  |
| Magnesium (Mg)                    | _____ | pp (mg/1)  |
| Sodium and Potassium (Nan and AK) | _____ | pp (mg/1)  |
| Carbonate (HO 3)                  | _____ | pp (mg/1)  |
| Sulfate (SO 4)                    | _____ | pp (mg/1)  |
| Chloride (JCL)                    | _____ | pp (mg/1)  |
| Nitrate (NO 3)                    | _____ | pp (mg/1)  |
| Turbidity                         | _____ | unit       |
| pH                                | _____ |            |
| Residual Chlorine                 | _____ | pp (mg/1)  |
| Total Alkalinity                  | _____ | PM (me/1)  |
| Non-Carbonate Hardness            | _____ | PM (me/1)  |
| Total Hardness                    | _____ | PM (me/1)  |
| Dissolved Solids                  | _____ | pp (mg/1)  |
| Fluorine                          | _____ | pp (mg/1)  |
| Conductivity                      | _____ | McMahon/cm |

### 2.9.2 Chilled and Condenser Water

Water to be used in the chilled and condenser water systems shall be treated to maintain the conditions recommended by this specification as well as the recommendations from the manufacturers of the condenser and evaporator coils. Chemicals shall meet all required federal, state, and local environmental regulations for the treatment of evaporator coils and direct discharge to the sanitary sewer.

### 2.9.3 Chilled Water System

A shot feeder shall be provided on the chilled water piping as indicated. Size and capacity of feeder shall be based on local requirements and water



analysis. The feeder shall be furnished with an air vent, gauge glass, funnel, valves, fittings, and piping.

## 2.10 ELECTRICAL WORK

Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Manual or automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers including the required monitors and timed restart.

Provide high efficiency type, single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11.

Provide polyphase, squirrel-cage medium induction motors, including motors that are part of a system, that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor.

Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters complete with thermal overload protection and other necessary appurtenances. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of the enclosure.

## 2.11 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.

### 2.11.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided. The factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test.

Salt-spray fog test shall be in accordance with ASTM B117, and for that test, the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of 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.

#### 2.11.2 Shop Painting Systems for Metal Surfaces

Clean, retreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees F shall be cleaned to bare metal.

Where hot-dip galvanized steel has been cut, resulting surfaces with no galvanizing shall be coated with a zinc-rich coating conforming to ASTM D 520, Type I.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat 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.

#### 2.12 FACTORY APPLIED INSULATION

Factory insulated items installed outdoors are not required to be fire-rated. As a minimum, factory insulated items installed indoors shall have a flame spread index no higher than 75 and a smoke developed index no higher than 150. Factory insulated items (no jacket) installed indoors and which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Flame spread and smoke developed indexes shall be determined by ASTM E 84.

Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Material supplied by a manufacturer with a jacket shall be tested as a composite material. Jackets, facings, and adhesives shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in accordance with ASTM E 84.

#### 2.13 NAMEPLATES

Major equipment including pumps, pump motors, expansion tanks, and air separator tanks shall have the manufacturer's name, type or style, model or

serial number on a plate secured to the item of equipment. The nameplate of the distributing agent will not be acceptable. Plates shall be durable and legible throughout equipment life and made of stainless steel. Plates shall be fixed in prominent locations with nonferrous screws or bolts.

## 2.14 RELATED COMPONENTS/SERVICES

### 2.14.1 Drain and Make-Up Water Piping

Requirements for drain and make-up water piping and backflow preventer is specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE.

### 2.14.2 Field Applied Insulation

Requirements for field applied insulation is specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

### 2.14.3 Field Applied Insulation

Requirements for field installed insulation is specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS, except as supplemented and modified by this specification section.

### 2.14.4 Field Painting

Requirements for painting of surfaces not otherwise specified, and finish painting of items only primed at the factory, are specified in Section 09 90 00 PAINTS AND COATINGS.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Cut pipe accurately to measurements established at the jobsite, and work into place without springing or forcing, completely clearing all windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation is not permitted without written approval. Cut pipe or tubing square, remove burrs by reaming, and fashion to permit free expansion and contraction without causing damage to the building structure, pipe, joints, or hangers.

Notify the Contracting Officer in writing at least 15 calendar days prior to the date the connections are required. Obtain approval before interrupting service. Furnish materials required to make connections into existing systems and perform excavating, backfilling, compacting, and other incidental labor as required. Furnish labor and tools for making actual connections to existing systems.

#### 3.1.1 Welding

Provide welding work specified this section for piping systems in conformance with ASME B31.9, as modified and supplemented by this specification section and the accompanying drawings. The welding work includes: qualification of welding procedures, welders, welding operators, brazers, brazing operators, and nondestructive examination personnel; maintenance of welding records, and examination methods for welds.

#### 3.1.1.1 Employer's Record Documents (For Welding)

Submit for review and approval the following documentation. This documentation and the subject qualifications shall be in compliance with ASME B31.9.

- a. List of qualified welding procedures that is proposed to be used to provide the work specified in this specification section.
- b. List of qualified welders, brazers, welding operators, and brazing operators that are proposed to be used to provide the work specified in this specification section.
- c. List of qualified weld examination personnel that are proposed to be used to provide the work specified in this specification section.

#### 3.1.1.2 Welding Procedures and Qualifications

- a. Specifications and Test Results: Submit copies of the welding procedures specifications and procedure qualification test results for each type of welding required. Approval of any procedure does not relieve the Contractor of the responsibility for producing acceptable welds. Submit this information on the forms printed in ASME BPVC SEC IX or their equivalent.
- b. Certification: Before assigning welders or welding operators to the work, submit a list of qualified welders, together with data and certification that each individual is performance qualified as specified. Do not start welding work prior to submitting welder, and welding operator qualifications. The certification shall state the type of welding and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests.

#### 3.1.1.3 Examination of Piping Welds

Conduct non-destructive examinations (NDE) on piping welds and brazing and verify the work meets the acceptance criteria specified in ASME B31.9. NDE on piping welds covered by ASME B31.9 is visual inspection only. Submit a piping welds NDE report meeting the requirements specified in ASME B31.9.

#### 3.1.1.4 Welding Safety

Welding and cutting safety requirements shall be in accordance with AWS Z49.1.

#### 3.1.2 Directional Changes

Make changes in direction with fittings, except that bending of pipe 4 inches and smaller is permitted, provided a pipe bender is used and wide weep bends are formed. Mitering or notching pipe or other similar construction to form elbows or tees is not permitted. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.

#### 3.1.3 Functional Requirements

Pitch horizontal supply mains down in the direction of flow as indicated.

The grade shall not be less than 1 inch in 40 feet. Reducing fittings shall be used for changes in pipe sizes. Cap or plug open ends of pipelines and equipment during installation to keep dirt or other foreign materials out of the system.

Pipe not otherwise specified shall be uncoated. Connections to appliances shall be made with malleable iron unions for steel pipe 2-1/2 inches or less in diameter, and with flanges for pipe 3 inches and above in diameter. Connections between ferrous and copper piping shall be electrically isolated from each other with dielectric waterways or flanges.

Piping located in air plenums shall conform to NFPA 90A requirements. Pipe and fittings installed in inaccessible conduits or trenches under concrete floor slabs shall be welded. Equipment and piping arrangements shall fit into space allotted and allow adequate acceptable clearances for installation, replacement, entry, servicing, and maintenance. Electric isolation fittings shall be provided between dissimilar metals.

### 3.1.4 Fittings and End Connections

#### 3.1.4.1 Threaded Connections

Threaded connections shall be made with tapered threads and made tight with PTFE tape complying with ASTM D 3308 or equivalent thread-joint compound applied to the male threads only. Not more than three threads shall show after the joint is made.

#### 3.1.4.2 Brazed Connections

Brazing, AWS BRH, except as modified herein. During brazing, the pipe and fittings shall be filled with a pressure regulated inert gas, such as nitrogen, to prevent the formation of scale. Before brazing copper joints, both the outside of the tube and the inside of the fitting shall be cleaned with a wire fitting brush until the entire joint surface is bright and clean. Do not use brazing flux. Surplus brazing material shall be removed at all joints. Steel tubing joints shall be made in accordance with the manufacturer's recommendations. Piping shall be supported prior to brazing and not be sprung or forced.

#### 3.1.4.3 Welded Connections

Branch connections shall be made with welding tees or forged welding branch outlets. Pipe shall be thoroughly cleaned of all scale and foreign matter before the piping is assembled. During welding, the pipe and fittings shall be filled with an inert gas, such as nitrogen, to prevent the formation of scale. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.9. Weld defects shall be removed and rewelded at no additional cost to the Government. Electrodes shall be stored and dried in accordance with AWS D1.1/D1.1M or as recommended by the manufacturer. Electrodes that have been wetted or that have lost any of their coating shall not be used.

#### 3.1.4.4 Grooved Mechanical Connections

Prepare grooves in accordance with the coupling manufacturer's instructions. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial

caliper, or narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

#### 3.1.4.5 Flared Connections

When flared connections are used, a suitable lubricant shall be used between the back of the flare and the nut in order to avoid tearing the flare while tightening the nut.

#### 3.1.4.6 Flanges and Unions

Except where copper tubing is used, union or flanged joints shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items. Flanged joints shall be assembled square end tight with matched flanges, gaskets, and bolts. Gaskets shall be suitable for the intended application.

#### 3.1.5 Valves

Isolation gate or ball valves shall be installed on each side of each piece of equipment, at the midpoint of all looped mains, and at any other points indicated or required for draining, isolating, or sectionalizing purpose. Isolation valves may be omitted where balancing cocks are installed to provide both balancing and isolation functions. Each valve except check valves shall be identified. Valves in horizontal lines shall be installed with stems horizontal or above.

#### 3.1.6 Air Vents

Air vents shall be provided at all high points, on all water coils, and where indicated to ensure adequate venting of the piping system.

#### 3.1.7 Drains

Drains shall be provided at all low points and where indicated to ensure complete drainage of the piping. Drains shall be accessible, and shall consist of nipples and caps or plugged tees unless otherwise indicated.

#### 3.1.8 Flexible Pipe Connectors

Connectors shall be attached to components in strict accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the flexible pipe connector manufacturer and shall be provided at the intervals recommended.

#### 3.1.9 Temperature Gauges

Temperature gauges shall be located on coolant supply and return piping at each heat exchanger, on condenser water piping entering and leaving a condenser, at each automatic temperature control device without an integral thermometer, and where indicated or required for proper operation of equipment. Thermal wells for insertion thermometers and thermostats shall

extend beyond thermal insulation surface not less than 1 inch.

### 3.1.10 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69, except as supplemented and modified in this specification section. Pipe hanger types 5, 12, and 26 shall not be used. Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Piping subjected to vertical movement, when operating temperatures exceed ambient temperatures, shall be supported by variable spring hangers and supports or by constant support hangers.

#### 3.1.10.1 Hangers

Type 3 shall not be used on insulated piping. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

#### 3.1.10.2 Inserts

Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustments may be used if they otherwise meet the requirements for Type 18 inserts.

#### 3.1.10.3 C-Clamps

Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

#### 3.1.10.4 Angle Attachments

Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

#### 3.1.10.5 Saddles and Shields

Where Type 39 saddle or Type 40 shield are permitted for a particular pipe attachment application, the Type 39 saddle, connected to the pipe, shall be used on all pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 40 shields shall be used on all piping less than 4 inches and all piping 4 inches and larger carrying medium less than 60 degrees F. A high density insulation insert of cellular glass shall be used under the Type 40 shield for piping 2 inches and larger.

#### 3.1.10.6 Horizontal Pipe Supports

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.

#### 3.1.10.7 Vertical Pipe Supports

Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 15 feet, not more than 8 feet from end of risers, and at vent terminations.

### 3.1.10.8 Pipe Guides

Type 35 guides using, steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.

### 3.1.10.9 Steel Slides

Where steel slides do not require provisions for restraint of lateral movement, an alternate guide method may be used. On piping 4 inches and larger, a Type 39 saddle shall be used. On piping under 4 inches, a Type 40 protection shield may be attached to the pipe or insulation and freely rest on a steel slide plate.

### 3.1.10.10 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

### 3.1.10.11 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 floors or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only. Structural steel brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section. Material used for support shall be as specified under Section 05 12 00 STRUCTURAL STEEL.

### 3.1.11 Pipe Alignment Guides

Pipe alignment guides shall be provided where indicated for expansion loops, offsets, and bends and as recommended by the manufacturer for expansion joints, not to exceed 5 feet on each side of each expansion joint, and in lines 4 inches or smaller not more than 2 feet on each side of the joint.

### 3.1.12 Pipe Anchors

Anchors shall be provided where indicated. Unless indicated otherwise, anchors shall comply with the requirements specified. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed in the most effective manner to secure the desired results using turnbuckles where required.

Supports, anchors, or stays shall not be attached where they will injure the structure or adjacent construction during installation or by the weight of expansion of the pipeline. Where pipe and conduit penetrations of vapor barrier sealed surfaces occur, these items shall be anchored immediately adjacent to each penetrated surface, to provide essentially zero movement within penetration seal.



### 3.1.13 Building Surface Penetrations

Sleeves shall not be installed in structural members except where indicated or approved. Except as indicated otherwise piping sleeves shall comply with requirements specified. Sleeves in nonload bearing surfaces shall be galvanized sheet metal, conforming to ASTM A653/A653M, Coating Class G-90, 20 gauge. Sleeves in load bearing surfaces shall be uncoated carbon steel pipe, conforming to ASTM A53/A53M, Standard weight. Sealants shall be applied to moisture and oil-free surfaces and elastomers to not less than 1/2 inch depth. Sleeves shall not be installed in structural members.

#### 3.1.13.1 General Service Areas

Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface. Pipes passing through concrete or masonry wall or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall be of such size as to provide a minimum of 1/4 inch all-around clearance between bare pipe and sleeves or between jacketed-insulation and sleeves. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over-insulation and sleeve shall be sealed in accordance with Section 07 92 00 JOINT SEALANTS.

#### 3.1.13.2 Waterproof Penetrations

Pipes passing through roof or floor waterproofing membrane shall be installed through a .17 ounce copper sleeve, or a 0.032 inch thick aluminum sleeve, each within an integral skirt or flange.

Flashing sleeve shall be suitably formed, and skirt or flange shall extend not less than 8 inches from the pipe and be set over the roof or floor membrane in a troweled coating of bituminous cement. The flashing sleeve shall extend up the pipe a minimum of 2 inches above the roof or floor penetration. The annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation shall be sealed as indicated. Penetrations shall be sealed by either one of the following methods.

- a. Waterproofing Clamping Flange: Pipes up to and including 10 inches in diameter passing through roof or floor waterproofing membrane may be installed through a cast iron sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess.
- b. Modular Mechanical Type Sealing Assembly: In lieu of a waterproofing clamping flange, a modular mechanical type sealing assembly may be installed. Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion protected carbon steel bolts, nuts, and pressure plates. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut.

After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal rubber sealing elements to expand and provide a watertight seal between the pipe/conduit seal between the

pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved. The Contractor electing to use the modular mechanical type seals shall provide sleeves of the proper diameters.

#### 3.1.13.3 Fire-Rated Penetrations

Penetration of fire-rated walls, partitions, and floors shall be sealed as specified in Section 07 84 00 FIRESTOPPING.

#### 3.1.13.4 Escutcheons

Finished surfaces where exposed piping, bare or insulated, pass through floors, walls, or ceilings, except in boiler, utility, or equipment rooms, shall be provided with escutcheons. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheon shall be secured to pipe or pipe covering.

### 3.2 ELECTRICAL INSTALLATION

Install electrical equipment in accordance with NFPA 70 and manufacturers instructions.

### 3.3 CLEANING AND ADJUSTING

Pipes shall be cleaned free of scale and thoroughly flushed of all foreign matter. A temporary bypass shall be provided for all water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from all water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed.

### 3.4 FIELD TESTS

Field tests shall be conducted in the presence of the QC Manager or his designated representative to verify systems compliance with specifications. Any material, equipment, instruments, and personnel required for the test shall be provided by the Contractor.

#### 3.4.1 Equipment and Component Isolation

Prior to testing, equipment and components that cannot withstand the tests shall be properly isolated.

#### 3.4.2 Pressure Tests

Each piping system shall be hydrostatically tested at a pressure not less than 188 psig for period of time sufficient to inspect every joint in the system and in no case less than 2 hours. Test pressure shall be monitored by a currently calibrated test pressure gauge. Leaks shall be repaired and piping retested until test requirements are met. No leakage or reduction in gage pressure shall be allowed.

Leaks shall be repaired by rewelding or replacing pipe or fittings. Caulking of joints will not be permitted. Concealed and insulated piping

shall be tested in place before concealing.

Submit for approval pressure tests reports covering the above specified piping pressure tests; describe the systems tested, test results, defects found and repaired, and signature of the pressure tests' director. Obtain approval from the QC Manager before concealing piping or applying insulation to tested and accepted piping.

### 3.4.3 Related Field Inspections and Testing

#### 3.4.3.1 Piping Welds

Examination of Piping Welds is specified in the paragraph above entitled "Examination of Piping Welds".

#### 3.4.3.2 HVAC TAB

Requirements for testing, adjusting, and balancing (TAB) of HVAC water piping, and associated equipment is specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC. Coordinate with the TAB team, and provide support personnel and equipment as specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC to assist TAB team to meet the TAB work requirements.

### 3.5 INSTRUCTION TO GOVERNMENT PERSONNEL

Furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the chilled and hot water system. Instructors shall be thoroughly familiar with all parts of the installation and shall be instructed in operating theory as well as practical operation and maintenance work. Submit a lesson plan for the instruction course for approval. The lesson plan and instruction course shall be based on the approved operation and maintenance data and maintenance manuals.

Conduct a training course for the operating staff and maintenance staff selected by the Contracting Officer. Give the instruction during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be one man-day. continuous man-days. Use approximately half of the time for classroom instruction and the other time for instruction at the location of equipment or system.

When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

-- End of Section --

## SECTION 23 73 13.00 40

## MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

02/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

- |          |  |
|----------|--|
| AMCA 211 | (2005) Certified Ratings Programme - Product Rating Manual for Air Fan Performance |
| AMCA 300 | (2008) Reverberant Room Method for Sound Testing of Fans                           |
| AMCA 99  | (2010) Standards Handbook  |

## AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

- |          |  |
|----------|--|
| AHRI 430 | (2009) Central-Station Air-Handling Units  |
| AHRI 880 | (2008) Performance Rating of Air Terminals |

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

- |             |   |
|-------------|---|
| ASHRAE 51   | (2007) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating  |
| ASHRAE 52.2 | (2007; Addenda B 2008; Errata 2009, Errata 2010; INT 2010) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size |

## ASTM INTERNATIONAL (ASTM)

- |                 |   |
|-----------------|---|
| ASTM A653/A653M | (2015) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| ASTM B117       | (2011) Standard Practice for Operating Salt Spray (Fog) Apparatus   |

## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

- |            |   |
|------------|---|
| ISO 1940-1 | (2003; Cor 2005) Mechanical Vibration - Balance Quality Requirements for Rotors in a Constant (Rigid) State - Part 1: Specification and Verification of Balance |
|------------|---|

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2009) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (2015) Standard for the Installation of  
Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 900 (2004; Reprint Nov 2009) Standard for Air  
Filter Units

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

Equipment and Performance Data

Sample Warranty

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

1.3 QUALITY ASSURANCE

Submit listing of product installations for air handling units showing a minimum of 5 installed units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. Provide list that includes purchaser, address of installation, service organization, and date of installation.

1.3.1 Certification of Conformance

Submit certificates of conformance for the following items, showing conformance with the referenced standards contained in this section:

- a. Unit Cabinet
- b. Fan
- c. Drain Pans
- d. Insulation
- e. Plenums
- f. Multizone AHU

- g. Blow-Through AHU
- h. Spare Parts

#### 1.3.2 Sample Warranty

Submit sample warranty for the following items:

- a. Unit Cabinet
- b. Fan
- c. Drain Pans
- d. Insulation
- e. Plenums
- f. Multizone AHU
- g. Blow-Through AHU

#### 1.4 DELIVERY, STORAGE , AND HANDLING

Deliver, handle, and store equipments and accessories in a manner that will prevent damage or deformity.

#### 1.5 WARRANTY

Submit samples of warranty language concurrently with Certificates for review and approval by the Contracting Officer. Ensure Warranty is valid for a minimum of 5 years from the date of project closeout, showing Government as warranty recipient.

### PART 2 PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS applies to work specified in this section.

Submit equipment and performance data for air handling units in accordance with the specification. Provide data that consists of use life, total static pressure and coil face area classifications, and performance ratings.

Submit drawings and manuals that include a spare parts data sheet, with manufactures recommended stock levels.

#### 2.2 AIR HANDLING UNIT (AHU)

Provide central-station type, factory fabricated, and fully assembled air handling unit (AHU). Provide AHU that includes components and auxiliaries in accordance with AHRI 430. Balance AHU fan and motor to ISO 1940-1-2005.

Provide total static pressure and coil face area classification that conform to AMCA 99.

Fans with enlarged outlets are not permitted.

### 2.3 UNIT CABINET

Provide AHU cabinet that is suitable for pressure class shown and that has leaktight joints, closures, penetrations, and access provisions. Provide cabinet that does not expand or contract perceptibly during starting and stopping of fans and that does not pulsate during operation. Reinforce cabinet surfaces with deflections in excess of 0.004167 of unsupported span prior to acceptance. Stiffen pulsating panels, which produce low frequency noise due to diaphragming of unstable panel walls, to raise natural frequency to an easily attenuated level. Fabricate enclosure from continuous hot-dipped galvanized steel no lighter than 20 gage thickness, to match industry standard. Provide mill-galvanized sheet metal that conforms to ASTM A653/A653M and that is coated with not less than 1.25 ounces of zinc per square foot of two-sided surface. Provide mill-rolled structural steel that is hot-dip galvanized or primed and painted. Corrosion protect cut edges, burns, and scratches in galvanized surfaces. Provide primed and painted black carbon steel cabinet construction that complies with this specification.

Provide removable panels to access the interior of the unit cabinet. Provide seams that are welded, bolted or gasketed and sealed with a rubber-based mastic. Make entire floor as well as ceiling unit hot-dipped galvanized steel. Provide removable access doors on both sides of all access, filter, and fan sections for inspection and maintenance.

Provide AHU cabinet suitable for pressure class indicated with leaktight joints, closures, penetrations, and access provisions. Provide cabinet that does not expand or contract perceptibly during starting and stopping of fans and that does not pulsate during operation. Reinforce cabinet surfaces with deflections in excess of 0.002778 of unsupported span prior to acceptance by the Contracting Officer. Stiffen pulsating panels, which produce low frequency noise due to diaphragming of unstable panel walls, to raise natural frequency to an easily attenuated level. Provide enclosure that is fabricated from mill-galvanized or primed and painted carbon steel sheet of required thickness. Provide mill-galvanized sheet metal that conforms to ASTM A653/A653M and that is coated with not less than 1.25 ounces of zinc per square foot of two-sided surface. Provide mill-rolled structural steel that is hot-dip galvanized or primed and painted. Corrosion protect edges, burns, and scratches in galvanized surfaces. Provide primed and painted black carbon steel cabinet construction that complies with this specification.

Provide removable panels to access the interior of the unit cabinet. Provide seams that are welded, bolted or gasketed and sealed with a rubber-based mastic. Make entire floor as well as ceiling unit hot-dipped galvanized steel. Provide removable access doors on both sides of all access, filter, and fan sections for inspection and maintenance.

Where cabinet size is such that personnel access is possible, strengthen cabinet floor to permit entry without damage to any component. Hinge and latch access doors and panels at a spacing sufficiently close to preclude leaks caused by distortion, and effectively gasket.

Black carbon steel cabinet construction is acceptable when the following conditions are met:

Coat all interior and exterior surfaces, including lapped contacting

surfaces, with a corrosion-protective coating.

Certify coating as passing a 500-hour exposure salt-spray fog test in accordance with ASTM B117.

Immediately after completion of the test, provide a specimen that shows no signs of wrinkling, cracking or loss of adherence, and no signs of rust creepage beyond 1/8 inch on either side of the scratch mark.

Ensure inspection of interior and exterior cabinet surfaces will pass examination for the same defects as the salt-spray fog test specimen, after 11 months of service and prior to expiration of guarantee.

Interior surfaces of cabinets constructed of intact mill-galvanized steel require no further protection.

Provide cabinets with exterior surfaces constructed of mill-galvanized steel that are painted.

Provide cabinets and casings that are double walled with 2 inch insulation. Provide interior wall that is galvanized.

Dynamically and statically balance fan wheels at the factory. Provide fan with RPM that is 25 percent less than the first critical speed. Provide fan shaft that is solid, ground and polished steel and coated with a rust inhibitor. Provide V-belt driven fans that are designed for 50 percent overload capacity. For variable air volume air handling units that are provided with variable frequency drives, have their fans balanced over the entire range of operation (20 percent - 100 percent RPM). Balancing fans of only 100 percent design of RPM is not acceptable for air handling units to be used with variable frequency drives.

Mount fans on isolation bases. Internally mount motors on same isolation bases and internally isolate fans and motors with 2-inch. Install flexible canvas ducts or vibration absorbent fan discharge seal between fan and casings to ensure complete isolation. Provide flexible canvas ducts that comply with NFPA 90A.

Weigh fan and motor assembly at air handling unit manufacturer's factory for isolator selection. Statically and dynamically balance fan section assemblies. Fan section assemblies include fan wheels, shafts, bearings, drives, belts, isolation bases and isolators. Allow isolators to free float when performing fan balance. Measure vibration at each fan shaft bearing in horizontal, vertical and axial directions.

Factory install all motors on slide bases to permit adjustment of belt tension.

Provide heavy duty, open drip-proof, operable at 460 volts, 60 hertz, 3-phase fan motors. Provide high efficiency motors.

Provide a marine-type, vapor proof service light in the fan segment. Provide 100 watt service light that is wired to an individual switch. Light requires 115 Volt, single phase, 60 Hertz service that is separate from the main power to the AHU. Provide a single 115 volt outlet at the light switch.



## 2.4 FAN

Provide an overall fan-section depth that is equal to or greater than the manufacturer's free-standing fan.

Provide single-wheel fans.

Locate fan inlet where it provides not less than one-half fan-wheel diameter clearance from cabinet wall or adjacent fan inlet where double wheels are permitted.

Mount AHU fan drive external to casing.

Install AHU fan motor and drive inside fan cabinet. Provide motor that conforms to NEMA MG 1 and is installed on an adjustable base. Provide an access door of adequate size for servicing motor and drive. Provide a belt guard inside the cabinet, or interlock the access door with the supply fan so that power to the fan is interrupted when the access door is opened.

## 2.5 DRAIN PANS

Provide intermediate-coil, 3-inch deep drip pans for each tiered coil bank.

Extend top pan 12 inches beyond face of coil, and extend bottom pan not less than 24 inches beyond face of coil. Where more than two pans are used, make pan extension proportional. Make adequate supports from the same type material as pans or hot-dip galvanized angle iron with isolation at interface. Provide pan material that is 22-gage AISI Type 304 corrosion-resistant steel with silver-soldered joints. Minimum size of drain opening is 1-1/4 inches. Pipe pan to drain.

Extend integral cabinet drain pan under all areas where condensate is collected and make watertight with welded or brazed joints, piped to drain, corrosion protect in condensate collection area, and insulate against sweating. Provide minimum 14-gage sheet metal, except that 16-gage double-drain-pan construction is acceptable.

Provide cooling coil ends that are enclosed by cabinet and are factory insulated against sweating or drain to a drain pan.

Provide drain pans that are double pan construction, thermally isolated from the exterior casing with 1-inch thick fiberglass insulation. Provide drain pans that slope to drain and drain substantially dry by gravity alone when drains are open.

Provide pans that have a double slope to the drain point.

## 2.6 INSULATION

Provide unit that is internally fitted at the factory with a sound-attenuating, thermal-attenuating, fibrous-glass material not less than 2 inch thick with 1-1/2 inch density neoprene coated fiberglass. Ensure insulation effectiveness precludes any condensation on any exterior cabinet surface under conditions normal to the unit's installed location. Provide acoustic treatment that attenuates fan noise in compliance with specified noise criteria. Apply material to the cabinet with waterproof adhesives and permanent fasteners on 100 percent coverage basis. Provide adhesive and insulating material in accordance with NFPA 90A.

## 2.7 COILS

### 2.7.1 Coil Section

Provide coil section that encases cooling coils and drain pipes. Arrange coils for horizontal air flow. Provide intermediate drain pans for multiple coils installation. Completely enclose coil headers with the insulated casing with only connections extended through the cabinet.

### 2.7.2 Coil Pressure and Temperature Ratings

Provide coils that are designed for the following fluid operating pressures and temperatures:

| <u>SERVICE</u> | <u>PRESSURE</u> | <u>TEMPERATURE</u> |
|----------------|-----------------|--------------------|
| Hot Water      | 200 PSI         | 250 degrees F      |
| Chilled Water  | 200 PSI         | 40 degrees F       |
| <u>SERVICE</u> | <u>PRESSURE</u> | <u>TEMPERATURE</u> |
| Hot Water      | 289 Pa          | 121 degrees C      |
| Chilled Water  | 289 Pa          | 4 degrees C        |

Provide coils that are air-pressure tested under water at the following minimum pressures:

| <u>SERVICE</u>          | <u>PRESSURE</u> |
|-------------------------|-----------------|
| Water (hot and chilled) | 250 PSI         |
| <u>SERVICE</u>          | <u>PRESSURE</u> |
| Water (hot and chilled) | 289 Pa          |

### 2.7.3 Coil Casings

Provide stainless steel casings. Provide cast iron, brass, or copper coil headers. Fit water coil headers with .25 inch ops spring-loaded plug drains and vent petcocks. Provide automatic air vents with ball type isolation valves for each coil piped to the drain pan.

Provide coils that are factory tested, dehydrated, vacuum tested, purged with inert gas, and sealed prior to shipment to the job site.

### 2.7.4 Chilled Water coils

Provide 0.625 inch outside diameter copper tubing for coils. Provide fins that are aluminum or copper mechanically bonded by tubing expansion with a maximum spacing of 12 fins per 1 inch unless otherwise noted. Provide coils that have supply and return connections on the same end. Provide a maximum of four coil rows.

### 2.7.5 Hot Water Coils

Provide heating coils that have copper tubing aluminum or copper fins.

### 2.7.6 Drainable Coils

Provide drainable coils that are capable of being purged free of water with compressed air.

Provide self-draining coils that have a drain point at the end of every tube and are pitched to that point. Provide drain provisions that include: drained headers; U-bends with integral plugs; or nonferrous plugs in cast-iron headers. Provide tubes that drain substantially dry by gravity alone when drains and vents are open.

## 2.8 FILTERS

### 2.8.1 Filter Housing

Provide factory fabricated filter section of the same construction and finish as unit casings. Provide filter sections that have filter guides and full height, double wall, hinged and removable access doors for filter removal. Provide air sealing gaskets to prevent air bypass around filters. Provide visible identification on media frames showing model number and airflow direction. Where filter bank is indicated or required, provide means of sealing to prevent bypass of unfiltered air. Performance in accordance with ASHRAE 52.2.

### 2.8.2 Replaceable Air Filters

UL 900, Class 1, those which, when cleaned, do not contribute fuel when attacked by flame and emit only negligible amount of smoke. Permanent frames with replaceable media, 1-inch thickness and size as indicated.

### 2.8.3 Disposable Cartridge Air Filters

UL 900, Class 2, UL classified, and factory assembled. Provide media of ultra-fine glass fibers having 50-55 percent average dust spot efficiencies with maximum final resistance 0.75 inch water gage and maximum face velocity of 500 feet per minute. Construct filter frame of 18 gage galvanized steel or aluminum with welded or riveted joints. Caulk or gasket entire assembly to prevent air leakage around frames. Ensure minimum efficiency of filter is 60 percent per ASHRAE 52.2

### 2.8.4 Outside Air Filters

The factory assembled air filters of the extended surface type with supported cartridges for removal of particulate matter in air conditioning, heating, and ventilating systems. Provide the extended surface type filter units fabricated for disposal when the dust-load limit is reached as indicated by maximum (final) pressure drop.

Filter Classification: UL approved for Class 1 or 2 conforming to UL 900.

Filter Grades, Nominal Efficiency and Application:

Grade B: 80-85 percent nominal efficiency outfitter

Grade D: 25-30 percent nominal efficiency prefilter

Filter Media: Grade B Supported (Rigid Pleated) Type: Provide media that is composed of high density glass fibers or other suitable fibers. Fastening methods used to maintain pleat shape, seal aluminum separators in

a proper enclosing frame to ensure no air leakage for life or filter. Staples and stays are prohibited.

Grade D Type: Provide media that is composed of synthetic/natural fibers. Bond a metal grid backing to the air leaving side of the media to maintain uniform pleat shape and stability for proper airflow and maximum dust loading. Provide a media frame that is constructed of high strength moisture resistant fiber or beverage board. Bond the pleated media pack on all four edges to ensure no air leakage of the life of the filter. Staples and stays are prohibited.

Filter Efficiency and Arrestance: Determine efficiency and arrestance of filters in accordance with ASHRAE 52.2 Standard Atmospheric dust spot efficiency and synthetic dust weight arrestance that is not less than the following:

|         | <u>Initial<br/>Efficiency<br/>(Percent)</u> | <u>Average<br/>Efficiency<br/>(Percent)</u> | <u>Average<br/>Efficiency<br/>(Percent)</u> |
|---------|---|---|---|
| Grade B | 58  | 79  | 98  |
| Grade D | Less than 20                                | 22  | 89  |

Maximum initial and final resistance, inches of water gauge, for each filter cartridge when operated at 500 feet per minute face velocity:

|                        | <u>Initial Resistance</u> | <u>Final Resistance</u> |
|------------------------|---------------------------|-------------------------|
| Grade B, Rigid Pleated | 0.60                      | 1.00                    |
| Grade D, 2 inches Deep | 0.32                      | 0.70                    |

Dust Holding Capacity: When tested to 1.00 inch w.g. at 500 feet per minute face velocity, provide a dust holding capacity from each 24-inch by 24-inch (face area) filter at least equal to the values listed below. For other filter sizes, provide a dust holding capacity that is proportionally higher or lower.

|                        |              |
|------------------------|--------------|
| Grade B, Rigid Pleated | 6.17 ounces  |
| Grade D, 2 inches Deep | 2.29 ounces  |
| Grade D, 4 inches Deep | 10.58 ounces |

Minimum Media Area: Provide minimum net effective area in square feet for each 24-inch by 24-inch (face area) filter at 500 feet per minute face velocity of at least the values listed below. For other filter sizes, provide a net effective media that is proportionally higher or lower.

|                        |      |
|------------------------|------|
| Grade B, Rigid Pleated | 57.0 |
| Grade D, 2 inches Deep | 14.8 |

#### 2.8.5 Air Filter Gauges

Provide manometer air filter gauges of the inclined tube differential type, of solid acrylic plastic construction with built-in level vial and with an adjustable mirror-polished scale. Equip gauges with vent valves for zeroing and over-pressure safety traps. Provide adequate gauge range for the particular installation. Provide gauges manufactured by Dwyer or approved equal.

Provide one (1) air filter gauge at each filter bank.

### PART 3 EXECUTION

#### 3.1 AHU EQUIPMENT INSTALLATION

Install equipment in accordance with manufacturer's recommendations.

Provide installation drawings in accordance with referenced standards in this section.

Submit listing of product installations for air handling units showing a minimum of 5 installed units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. Provide list that includes purchaser, address of installation, service organization, and date of installation.

#### 3.2 VIBRATION ANALYZER

Use an FFT analyzer to measure vibration levels. The following characteristics are required: A dynamic range greater than 70 dB; a minimum of 400 line resolution; a frequency response range of 5 Hz-10 KHz(300-600000 cpm); the capacity to perform ensemble averaging, the capability to use a Hanning window; auto-ranging frequency amplitude; a minimum amplitude accuracy over the selected frequency range of plus or minus 20 percent or plus or minus 1.5 dB.

Use an accelerometer, either stud-mounted or mounted using a rare earth, low mass magnet and sound disk (or finished surface) with the FFT analyzer to collect data. Ensure the mass of the accelerometer and its mounting have minimal influence on the frequency response of the system over the selected measurement range.

#### 3.3 ACCEPTANCE

Prior to final acceptance, use dial indicator gages to demonstrate that fan and motor are aligned as specified.

Prior to final acceptance, verify conformance to specifications using vibration analysis. Ensure maximum vibration levels are .075 in/sec at 1 times run speed and at fan/blade frequency, and .04 in/sec at other multiples of run speed.

#### 3.4 AHU TESTING

Performance test and rate AHU and components in accordance with AMCA 211, AMCA 300, and ASHRAE 51. Provide AHU ratings in accordance with AHRI 430.

Provide final test reports to the Contracting Officer. Provide reports with a cover letter/sheet clearly marked with the System name, Date, and the words "Final Test Reports - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

Perform air handling unit start-up in the presence of the Contracting Officer.

#### 3.5 OPERATION AND MAINTENANCE

Submit operation and maintenance manuals prior to testing the air handling

units. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

### 3.6 COORDINATION

Coordinate the size and location of concrete equipment pads, variable frequency drives, control and electrical requirements.

### 3.7 TEMPORARY CONSTRUCTION FILTERS

Have temporary construction filters in place during normal building construction whenever the air handling units are run for general ventilation, building dehumidification, and for other purposes during construction. Install two (2) layers of blanket filter at a time. Replace temporary construction filters as required during construction and after completion of duct system cleaning.

After systems have been cleaned and temporary construction filters are removed, and before test and balance operations are started, install set of final filters. Do not have final filters in place while general building construction is taking place, to avoid unnecessary loading with construction dust. Clean permanent filter bank before testing and balancing.

Submit all required installation, Fabrication and Connection drawings and obtain approval prior to the start of work detailed on these drawings.

Perform operation tests on each fire damper in the presence of the Contracting Officer by removing the fusible link and demonstrating the operation of the damper.

Maximum number of coil rows is four (4). Maximum number of fins per inch is ten (10).

Provide VAV terminal units that are AHRI 880 certified and UL listed.

### 3.8 ACCEPTANCE

Final acceptance is dependent upon providing Warranty, based on approved sample warranty, to the Contracting Officer, along with final test reports. With Warranty and final test reports, provide a cover letter/sheet clearly marked with the system name, date, and the words "Equipment Warranty" - "Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

-- End of Section --

## SECTION 23 82 19.00 40

## FAN COIL UNITS

02/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S12.23 (1989; R 2011) Method for the Designation of Sound Power Emitted by Machinery and Equipment

## AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 440 (2008) Room Fan-Coils and Unit Ventilators

## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 1940-1 (2003; Cor 2005) Mechanical Vibration - Balance Quality Requirements for Rotors in a Constant (Rigid) State - Part 1: Specification and Verification of Balance

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2009) Motors and Generators

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (2015) Standard for the Installation of Air Conditioning and Ventilating Systems

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

MIL-STD-810 (2008; Rev G) Environmental Engineering Considerations and Laboratory Tests

## UNDERWRITERS LABORATORIES (UL)

UL 1995 (2005; Reprint Jul 2009) Heating and Cooling Equipment

UL Bld Mat Dir (2011) Building Materials Directory

## 1.2 SUBMITTALS

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

## SD-03 Product Data

Equipment and Performance Data

Filters

Controls

Vibration Isolation

## SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

## 1.3 GENERAL REQUIREMENTS

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS applies to work specified in this section.

Submit the listing of product installations for fan coil units showing a minimum of 5 installed units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. Include purchaser, address of installation, service organization, and date of installation.

Submit fabrication drawings for fan coil units consisting of fabrication and assembly details to be performed in the factory.

Submit material, equipment, and product installation lists including the manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information.

Submit equipment and performance data for fan coil units consisting of use life, system functional flows, safety features, and mechanical automated details. Curves indicating tested and certified equipment response and performance characteristics shall also be submitted, including vibration isolation.

## PART 2 PRODUCTS

## 2.1 GENERAL

Include an enclosure for cabinet models and casing for concealed models.

Provide base unit complete with galvanized casing, water-coil assembly with auxiliary water or steam heating-coil, valve and piping package, drain pans, air filter, fan motor, and motor control. Sound-power-level, decibels reference, 10 to the minus 12 power watt, at the fan operating speed selected to meet the specified capacity, is not to exceed the following values at the midfrequency of each octave band:

|                      | <u>OCTAVE BANDS</u> |     |       |       |       |
|----------------------|---------------------|-----|-------|-------|-------|
|                      | 3RD                 | 4TH | 5TH   | 6TH   | 7TH   |
| Frequency<br>(hertz) | 250                 | 500 | 1,000 | 2,000 | 4,000 |



| Power Level<br>(decibels) | <u>OCTAVE BANDS</u> |    |    |    |    |
|---------------------------|---------------------|----|----|----|----|
|                           | 60                  | 55 | 53 | 50 | 48 |

Obtain sound-power-level data or values for these units in accordance with the test procedures specified in ASA S12.23. Sound-power values apply to units provided with factory-fabricated cabinet enclosures and standard grilles. Values obtained for the standard cabinet models are acceptable for concealed models without separate tests provided there is no variation between models as to the coil configuration, blowers, motor speeds, or relative arrangement of parts. Fasten each unit securely to the building structure. Capacity of the units is as indicated. Ensure room fan-coil units are certified as complying with AHRI 440 and shall meet the requirements of UL 1995.

## 2.2 ENCLOSURE

Construct enclosure of not lighter than 18-gage steel, properly reinforced and braced. Ensure front panel of enclosure is removable and provided with 1/2-inch thick insulation conforming to NFPA 90A, to prevent condensation. Ensure discharge louvers are four-way adjustable and designed to properly distribute air throughout the conditioned space. Ensure all ferrous-metal surfaces are galvanized or treated with a rust-inhibiting finish. Ensure all exposed-to-view enclosure corners and edges are rounded. Ensure discharge louvers are mounted in a top panel that is removable for coil cleaning. Ensure access doors are hinged and provided for all piping and control compartments. Ensure finish is in manufacturer's standard color as selected by the Contracting Officer.

## 2.3 CASING

Ensure casing is acoustically and thermally insulated internally with not less than 1/2-inch thick insulation conforming to NFPA 90A, fastened with waterproof and fire-resistant adhesive.

## 2.4 FAN

Ensure fan is galvanized steel or aluminum, centrifugal type with . In lieu of metal, fabricate or mold the wheels and scrolls from suitably reinforced nonmetallic compounds certified to have satisfactorily passed the low temperature, high temperature, temperature shock, and sand and dust tests for ground equipment, outlined in MIL-STD-810, without deformation, cracking, corrosion, or loss of balance characteristics. Ensure all surfaces are smooth, that assemblies are accessible for maintenance, and that disassembly and reassembly is done by mechanical fastening devices, not adhesives. Dynamically and statically balance fan to ISO 1940-1 at the factory, after assembly in unit.

## 2.5 COILS

Ensure construct of the water coils is not less than 1/2-inch outside diameter (od) seamless copper tubing with copper or aluminum plate fins mechanically bonded or soldered to the tubes and provide with not less than 5/8-inch od female solder connectors, accessory piping package with terminal connections for control valves, and manual air vent on returns. Make provisions for coil removal.

## 2.6 DRAIN PANS

Size and locate drain pans to collect condensed water dripping from any item within the unit enclosure. Do not construct drain pans of lighter than 20-gage galvanized steel, stainless steel thermally insulated to prevent condensation. Coat thermal insulation with a waterproofing compound. Provide no less than 3/4-inch National Pipe Thread (NPT) or 5/8-inch od copper drain connection in the drain pan, with a slope not less than 1/8-inch per foot to drain.

## 2.7 FILTERS

Provide filters for each unit that are glass fiber throwaway or permanent washable type, 1-inch nominal thickness, in conformance with UL Bld Mat Dir. Ensure filters are removable without tools.

## 2.8 MOTORS

Provide motors that are direct connected, two-bearing, permanent split-capacitor type with built-in overload protection, conform to NEMA MG 1, and mounted on a resilient base. Design motors for 1,060 revolutions per minute maximum on 115-volt, single-phase, 60-hertz power. Furnish motors with three built-in speeds, with four insulated leads (common, high, medium, and low) to terminate in a control-junction box.

Provide a solid-state variable speed controller capable of not less than 50 percent speed reduction in lieu of step speed control, when so specified.

## 2.9 CONTROLS

Applicable requirements of Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC applies.

Provide unit with factory-installed control valves furnished by the automatic temperature-control manufacturer.

Install the controls in a unit-mounted control panel. Provide remote-mounted controllers where indicated.

Ensure motor speed-control switch provides speed selection and off position, mounted for convenient use from an access door.

## 2.10 INSULATION

Contain all thermal and acoustical insulation within a double walled enclosure or seal with a coating impervious to moisture.

# PART 3 EXECUTION

## 3.1 INSTALLATION

Install equipment as indicated and specified and in accordance with manufacturer's recommendations. Set dampers in a fixed position to provide the outside air quantity scheduled.

Submit installation drawings for fan coil systems in accordance with referenced standards in this section.

### 3.2 TESTS

Hydrostatically test coils at 250 pounds per square inch (psi) or under water at 250 psi air pressure. Ensure the coils are suitable for 200-psi working pressure.

### 3.3 OPERATION AND MAINTENANCE

Contractor shall submit 6 copies of the operation and maintenance manuals 30 calendar days prior to testing the fan coil units. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

-- End of Section --

## SECTION 23 84 16.00 20

## DESICCANT DEHUMIDIFICATION EQUIPMENT

11/08

## PART 1 GENERAL

## 1.1 REFERENCES

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

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code

## 1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS applies to this section with the addition and modifications specified herein.

## 1.3 SUBMITTALS

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

## SD-03 Product Data

Desiccant Dehumidification Unit

## SD-10 Operation and Maintenance Data

Desiccant dehumidification unit, Data Package 5

Submit in accordance with Section 01 78 23 OPERATION MAINTENANCE DATA.

## PART 2 PRODUCTS

## 2.1 DESICCANT DEHUMIDIFICATION UNIT

## 2.1.1 Air Handling Components

All air handling components of the desiccant dehumidification unit (casing, dampers, fans vibration isolation, filter sections, mixing boxes, outside air intake, heating cooling sections and corrosion criteria as applicable) shall meet the requirements of Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS. Units shall include humidity controls (humidistat) and temperature controls (thermostat).

### 2.1.2 Desiccant Wheel

Supply and regeneration airstreams shall be counterflow. The dehumidifier shall be a rotary type designed for continuous operation. The wheel structure shall be of the extended surface type in the axial flow direction and the geometry shall provide for laminar flow over the operating range for minimum air pressure differentials. The dehumidifier shall be complete with a drive system utilizing a fractional-horsepower electric motor and speed reducer assembly driving the rotor. A slack-side tensioner shall be included for automatic take-up for belt-driven wheels. The desiccant material shall be an adsorbing type. The desiccant material shall be applied to the wheel such that the entire surface is active as a desiccant and the desiccant material does not degrade or detach from the surface of the wheel. The wheel shall be fitted with full-face, low-friction contact seals on both sides to prevent cross leakage. The rotary structure shall have underheat, overheat and rotation fault circuitry. The wheel assembly shall be warranted for a minimum of five years.

## PART 3 EXECUTION

### 3.1 PREPARATION

Provide storage for equipment and materials at the project site. Parts shall be readily accessible for inspection, repair, and renewal. Protect materials and equipment from weather.

### 3.2 INSTALLATION

Install desiccant dehumidification equipment as indicated and in accordance with the manufacturer's instructions. Provide clearance for inspection, repair, replacement, and service. Electrical work shall conform with NFPA 70 and Division 16, "Electrical". Provide overload protection in the operating disconnect switches and magnetic starters. Locate outside air intake at a minimum of 25 feet from industrial stacks, bathroom vents, and sanitary risers. Prevailing wind direction shall not be used as justification for placing air intake closer than 25 feet of exhaust stacks. Install assembled units on vibration isolators. Bolt sections together in high pressure units. Pipe drain pan to nearest floor drain.

### 3.3 FIELD QUALITY CONTROL

Schedule and administer specified tests. Provide personnel, instruments and equipment for such tests. Correct defects and repeat the respective inspection and tests. Give the Contracting Officer ample notice of the dates and times scheduled for tests and trial operations. Conduct inspection and testing in the presence of the Contracting Officer.

#### Inspection

Prior to initial operation, inspect equipment installation for conformance with drawings and specifications.

#### 3.3.1 Preliminary Tests

For each item of air handling and distribution equipment and its components, perform an operational test for a minimum period of 4 hours.

### 3.3.2 Testing and Balancing

After preliminary tests, perform air handling and distribution equipment tests adjustment, and balancing in accordance with Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.

### 3.4 FIELD TRAINING

The 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 but prior to the performance of tests. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

## SECTION 26 00 00.00 20

## BASIC ELECTRICAL MATERIALS AND METHODS

07/06

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM D709 (2013) Laminated Thermosetting Materials

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

IEEE C2 (2012; Errata 2012; INT 1-4 2012; INT 5-7 2013; INT 8-10 2014; INT 11 2015) National Electrical Safety Code

IEEE C57.12.28 (2005; INT 3 2011) Standard for Pad-Mounted Equipment - Enclosure Integrity

IEEE C57.12.29 (2005) Standard for Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2008) Enclosures for Electrical Equipment (1000 Volts Maximum)

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code

## 1.2 RELATED REQUIREMENTS

This section applies to all sections of Division 26 and 33, ELECTRICAL and UTILITIES, of this project specification unless specified otherwise in the individual sections. This section has been incorporated into, and thus, does not apply to, and is not referenced in the following sections.

Section 26 12 19.10 THREE-PHASE PAD MOUNTED TRANSFORMERS

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM

Section 26 23 00 SWITCHBOARDS AND SWITCHGEAR

Section 26 51 00 INTERIOR LIGHTING

## 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, shall be as defined in IEEE 100.
- b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.
- c. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

## 1.4 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 12.47kV primary, three phase, three wire, 60 Hz, and 208 volts secondary, three phase, four wire. Final connections to the power distribution system at the existing pad-mount transformer shall be made by the Contractor as directed by the Contracting Officer.

## 1.5 ADDITIONAL SUBMITTALS INFORMATION

Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.

## 1.5.1 Shop Drawings (SD-02)

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

## 1.5.2 Product Data (SD-03)

Submittal shall include performance and characteristic curves.

## 1.6 QUALITY ASSURANCE

## 1.6.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are



specified or indicated.

#### 1.6.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

##### 1.6.2.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

##### 1.6.2.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

#### 1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

#### 1.8 POSTED OPERATING INSTRUCTIONS

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

- a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
- b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
- c. Safety precautions.
- d. The procedure in the event of equipment failure.
- e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal

or peeling.

#### 1.9 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

#### 1.10 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

#### 1.11 WARNING SIGNS

Provide warning signs for the enclosures of electrical equipment including substations, pad-mounted transformers, pad-mounted switches, generators, and switchgear having a nominal rating exceeding 600 volts.

- a. When the enclosure integrity of such equipment is specified to be in accordance with IEEE C57.12.28 or IEEE C57.12.29, such as for pad-mounted transformers, provide self-adhesive warning signs on the outside of the high voltage compartment door(s). Sign shall be a decal and shall have nominal dimensions of 7 by 10 inches with the legend "DANGER HIGH VOLTAGE" printed in two lines of nominal 2 inch high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background. Decal shall be Panduit No. PPS0710D72 or approved equal.
- b. When such equipment is guarded by a fence, mount signs on the fence. Provide metal signs having nominal dimensions of 14 by 10 inches with the legend "DANGER HIGH VOLTAGE KEEP OUT" printed in three lines of nominal 3 inch high white letters on a red and black field.

#### 1.12 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

#### 1.13 INSTRUCTION TO GOVERNMENT PERSONNEL

Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day)

of instruction furnished shall be as specified in the individual section.

## PART 2 PRODUCTS

### 2.1 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test 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 --

## SECTION 26 12 19.10

## THREE-PHASE PAD-MOUNTED TRANSFORMERS

04/04

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 318M (2008) Metric Building Code Requirements  
for Structural Concrete and Commentary

## ASTM INTERNATIONAL (ASTM)

ASTM A 167 (2011) Standard Specification for  
Stainless and Heat-Resisting  
Chromium-Nickel Steel Plate, Sheet, and  
Strip

ASTM C 260 (2006) Standard Specification for  
Air-Entraining Admixtures for Concrete

ASTM D 92 (2005a) Standard Test Method for Flash and  
Fire Points by Cleveland Open Cup Tester

ASTM D 97 (2008) Pour Point of Petroleum Products

ASTM D 877 (2002; R 2007) Standard Test Method for  
Dielectric Breakdown Voltage of Insulating  
Liquids Using Disk Electrodes

ASTM D 1535 (1997) Specifying Color by the Munsell  
System

## U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 712-C-98-075 (1996) Fate, Transport and Transformation  
Test Guidelines - OPPTS 835.3100- "Aerobic  
Aquatic Biodegradation"

EPA 600/4-90/027F (1993) Methods for Measuring the Acute  
Toxicity of Effluents and Receiving Waters  
to Freshwater and Marine Organisms

## FM GLOBAL (FM)

FM P7825 (2005) Approval Guide

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

|                |   |
|----------------|---|
| IEEE Std 386   | (1995; R 2001) Separable Insulated Connection   |
| IEEE C2        | (2012; Errata 2012; INT 1-4 2012; INT 5-7 2013; INT 8-10 2014; INT 11 2015) National Electrical Safety Code |
| IEEE C57.12.00 | (2000) Liquid-Immersed Distribution, Power, and Regulating Transformers (IEEE)                              |
| IEEE C57.12.80 | (2002) Terminology for Power and Distribution Transformers (IEEE)   |
| IEEE C57.12.90 | (1999) Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers (IEEE)                |
| IEEE C57.98    | (1993; Correction 1998) Guide for Transformer Impulse Tests (IEEE)  |
| IEEE C62.11    | (1999) Metal-Oxide Surge Arresters for AC Power Circuits (= 1 kV) (ANSI/IEEE)                               |

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

|                |   |
|----------------|---|
| NEMA C12.10    | (2004) Physical Aspects of Watthour Meters  |
| NEMA C37.47    | (2000) High Voltage Current-Limiting Type Distribution Class Fuses and Fuse Disconnecting Switches  |
| NEMA C57.12.22 | (1993; R 1998) Transformers - Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers with High-Voltage Bushings, 2500 kVA and Smaller: High Voltage, 34 500 GrdY /19 920 Volts and Below; Low Voltage, 480 Volts and Below |
| NEMA C57.12.26 | (1993) Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 Grd Y/19 920 Volts and Below; 2500 kVA and Smaller                            |
| NEMA C57.12.28 | (1999) Pad-Mounted Equipment - Enclosure Integrity (Revision of ANSI C57.12.28-88)  |
| NEMA C57.12.29 | (1999; Errata 2000) Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments  |

## INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

|          |  |
|----------|--|
| NETA ATS | (2013) Standard for Acceptance Testing Specifications for Electrical Power |
|----------|--|

## Equipment and Systems

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code

## ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)

OECD Test 203 (1992) Fish Acute Toxicity Test

## UNDERWRITERS LABORATORIES (UL)

UL 467 (2007) Grounding and Bonding Equipment

## 1.2 RELATED REQUIREMENTS

Section 26 00 00.00 20, "Basic Electrical Materials and Methods," applies to this section, with the additions and modifications specified herein.

## 1.3 SUBMITTALS

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

As an exception to this paragraph, transformers manufactured by ABB in Jefferson City, MO; by Cooper Power Systems in Waukesha, WI; by GE in Shreveport, LA; or by Howard Industries in Laurel, MS need not meet the submittal requirements of this contract. Instead, the following shall be submitted:

- a. A certification, from the manufacturer, that the technical requirements of this specification shall be met.
- b. An outline drawing of the transformer with devices identified (paragraph entitled "Pad-Mounted Transformer Drawings", item a).
- c. ANSI nameplate data of the transformer (paragraph entitled "Pad-Mounted Transformer Drawings", item b).
- d. Routine and other tests (in PART 2, see paragraph entitled "Routine and Other Tests"), shall be conducted by the manufacturer and may be witnessed by the government (in Part 2, see paragraph entitled "Source Quality Control"). Provide transformer test schedule required by submittal item "SD-11 Closeout Submittals". Provide certified copies of the tests.
- e. Provide acceptance test reports required by submittal item "SD-06 Test Reports".
- f. Provide operation and maintenance manuals required by submittal item "SD-10 Operation and Maintenance Data".

SD-02 Shop Drawings

Pad-mounted transformer drawings

SD-03 Product Data

Pad-mounted transformers

SD-06 Test Reports

Acceptance checks and tests

SD-07 Certificates

Transformer losses

SD-09 Manufacturer's Field Reports

Pad-mounted transformer design tests

Pad-mounted transformer routine and other tests

SD-10 Operation and Maintenance Data

Transformer(s), Data Package 5

SD-11 Closeout Submittals

Transformer test schedule

1.4 QUALITY ASSURANCE

1.4.1 Pad-Mounted Transformer Drawings

Drawings shall indicate, but not be limited to the following:

- a. An outline drawing, with front, top, and side views.
- b. ANSI nameplate data.
- c. Elementary diagrams and wiring diagrams with terminals identified of watt-hour meter and current transformers.
- d. One-line diagram, including switch(es), current transformers, meters, and fuses.
- e. Manufacturer's published time-current curves (on full size logarithmic paper) of the transformer high side fuses.

1.4.2 Transformer Losses

Submit certification from the manufacturer indicating conformance with the paragraph entitled "Specified Transformer Losses."

1.4.3 Transformer Product Data

Submittal shall include manufacturer's information for each component, device, and accessory provided with the transformer.

1.4.4 Test Results

Submit report of test results as specified by paragraph entitled "Field Quality Control"

## 1.5 MAINTENANCE

### 1.5.1 Additions to Operation and Maintenance Data

In addition to requirements of Data Package 5, include the following on the actual transformer(s) provided:

- a. An instruction manual with pertinent items and information highlighted
- b. An outline drawing, front, top, and side views
- c. Prices for spare parts and supply list
- d. Routine and field acceptance test reports
- e. Fuse curves for primary fuses
- f. Actual nameplate diagram
- g. Date of purchase

### 1.5.2 Operation and Maintenance Data

Submit operation and maintenance data in accordance with Section 01 78 23, "Operation and Maintenance Data" and as specified herein.

## PART 2 PRODUCTS

### 2.1 PRODUCT COORDINATION

Products and materials not considered to be pad-mounted transformers and related accessories are specified in Section 26 20 00, "Interior Distribution System".

### 2.2 THREE-PHASE PAD-MOUNTED TRANSFORMERS

NEMA C57.12.26, NEMA C57.12.28, NEMA C57.12.29 and as specified herein.

#### 2.2.1 Compartments

The high- and low-voltage compartments shall be separated by steel isolating barriers extending the full height and depth of the compartments. Compartment doors: hinged lift-off type with stop in open position and three-point latching.

##### 2.2.1.1 High Voltage, Dead-Front

High-voltage compartment shall contain the incoming line, insulated high-voltage load-break connectors, bushing well inserts, six high-voltage bushing wells configured for loop feed application, load-break switch handle(s), access to oil-immersed fuses, dead-front surge arresters, tap changer handle, connector parking stands and ground pad.

- a. Insulated high-voltage load-break connectors: IEEE Std 386, rated 15 kV, 95 kV BIL. Current rating: 200 amperes rms continuous. Short time rating: 10,000 amperes rms symmetrical for a time duration of 0.17 seconds. Connector shall have a steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material.



- b. Bushing well inserts: IEEE Std 386, 200 amperes, 15 kV Class. Provide a bushing well insert for each bushing well unless indicated otherwise.
- c. Load-break switch

Loop feed sectionalizer switches: Provide three, two-position, oil-immersed type switches to permit closed transition loop feed and sectionalizing. Each switch shall be rated at 15 kV, 95 kV BIL, with a continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 10,000 rms amperes symmetrical. Locate the switch handles in the high-voltage compartment. Operation of switches shall be as follows:

| ARRANGE-<br>MENT NO. | DESCRIPTION<br>OF SWITCH<br>ARRANGEMENT   | SWITCH POSITION |       |           |       |   |  | XFMR. SW<br>OPEN   CLOSE |   |
|----------------------|---|-----------------|-------|-----------|-------|---|--|--------------------------|---|
|                      |   | LINE A SW.      |       | LINE B SW |       |   |  |                          |   |
|                      |   | OPEN            | CLOSE | OPEN      | CLOSE |   |  |                          |   |
| 1                    | Line A<br>connected<br>to Line B<br>and both lines<br>connected to<br>transformer |                 | X     |           | X     |   |  |                          | X |
| 2                    | Transformer<br>connected to<br>Line A only  |                 | X     | X         |       |   |  |                          | X |
| 3                    | Transformer<br>connected to<br>Line B only  | X               |       |           | X     |   |  |                          | X |
| 4                    | Transformer<br>open and<br>loop closed  |                 | X     |           | X     | X |  |                          |   |
| 5                    | Transformer<br>open and<br>loop open  | X               |       | X         |       | X |  |                          |   |

- d. Provide bayonet type, oil-immersed, expulsion fuses in series with oil-immersed, partial-range, current-limiting fuses. Bayonet fuse links shall sense both high currents and high oil temperature in order to provide thermal protection to the transformer. Coordinate transformer protection with expulsion fuse clearing low-current faults and current-limiting fuse clearing high-current faults beyond the interrupting rating of the expulsion fuse. In order to eliminate or minimize oil spills, the bayonet fuse assembly shall include an oil retention valve inside the housing which closes when the fuse holder is removed and an external drip shield. Warning shall be conspicuously displayed within the high-voltage compartment cautioning against removing or inserting fuses unless the load-break switch is in the open position and the tank pressure has been released.

Bayonet fuse assembly: 150 kV BIL.

Oil-immersed current-limiting fuses: NEMA C37.47; 50,000 rms amperes symmetrical interrupting rating at the system voltage specified.

- e. Surge arresters: IEEE C62.11, rated 10 kV, fully shielded, dead-front, metal-oxide-varistor, elbow type with resistance-graded gap, suitable for plugging into inserts. Provide three arresters for loop feed circuits.
- f. Parking stands: Provide a parking stand near each bushing well.

#### 2.2.1.2 Low Voltage

Low-voltage compartment shall contain low-voltage bushings with NEMA spade terminals, accessories, metering, stainless steel or laser-etched anodized aluminum diagrammatic transformer nameplate, and ground pad.

- a. Accessories shall include drain valve with sampler device, fill plug, pressure relief device, liquid level gage, pressure-vacuum gage, and dial type thermometer with maximum temperature indicator.
  - b. Metering: NEMA C12.10 Provide a socket-mounted electronic programmable outdoor watthour meter, surface mounted flush against the side of the low-voltage compartment as indicated. Meter shall either be programmed at the factory or shall be programmed in the field. When field programming is performed, turn field programming device over to the Contracting Officer at completion of project. Meter shall be coordinated to system requirements.
1. Design: Provide meter designed for use on a 3-phase, 4-wire, 208Y/120 volt system 3 current transformers. Include necessary KYZ pulse initiation hardware for Energy Monitoring and Control System (EMCS).
  2. Coordination: Provide meter coordinated with ratios of current transformers and transformer secondary voltage.
  3. Class: 20; Form: 9S; Accuracy:  $\pm 1.0$  percent; Finish: Class II.
  4. Cover: Polycarbonate and lockable to prevent tampering and unauthorized removal.
  5. Kilowatt-hour Register: 5 digit electronic programmable type.
  6. Demand Register
    - (a) Provide solid state
    - (b) Meter reading multiplier
      - (1) Indicate multiplier on the meter face.
    - (c) Demand interval length: shall be programmed for 15 minutes with rolling demand up to six subintervals per interval.
  7. Meter fusing: Provide a fuse block mounted in the secondary compartment containing one fuse per phase to protect the voltage input to the watthour meter. Size fuses as recommended by the meter manufacturer.
  8. Socket: IEEE C12.7. Provide NEMA Type 3R, box-mounted socket having

automatic circuit-closing bypass and having jaws compatible with requirements of the meter. Cover unused hub openings with blank hub plates. Paint box Munsell 7GY3.29/1.5 green to match the pad-mounted transformer to which the box-mounted socket is attached. The Munsell color notation is specified in ASTM D 1535.

9. Current transformer: IEEE C57.13. Provide butyl-molded window type current transformer with 600-volt insulation, 10 kV BIL and mount on the low-voltage bushing. Route current transformer leads in a location as remote as possible from the power transformer secondary cable to permit current measurements to be taken with hook-on-ammeters. Provide three current transformers per power transformer with characteristics listed in the following table.

| kVA | Sec. Volt | CT Ratio | RF  | Meter Acc. Class |
|-----|-----------|----------|-----|------------------|
| 500 | 208Y/120  | 1200/5   | 1.5 | 0.3 thru B-0.5   |

#### 2.2.2 Transformer

- a. Oil-insulated, two winding, 60 hertz, 65 degrees C rise above a 30 degrees C average ambient, self-cooled type.
- b. Transformer shall be rated 500 kVA, 95 kV BIL.
- c. Transformer voltage ratings: 12,470 Delta - 208Y/120 V.
- d. Tap changer shall be externally operated, manual type for changing tap setting when the transformer is de-energized. Provide four 2.5 percent full capacity taps, two above and two below rated primary voltage. Tap changers shall clearly indicate which tap setting is in use.
- e. Minimum tested impedance shall not be less than manufacturer's typical design impedances.
- f. Audible sound levels shall comply with the following:

| <u>kVA</u> | <u>DECIBELS (MAX)</u> |
|------------|-----------------------|
| 750        | 57                    |
| 500        | 56                    |

- g. Transformer shall include lifting lugs and provisions for jacking under base. The transformer base construction shall be suitable for using rollers or skidding in any direction. Provide transformer top with an access handhole. Transformer shall have its kVA rating conspicuously displayed on its enclosure. The transformer shall have an insulated low-voltage neutral bushing with NEMA spade terminal, and with removable ground strap.

##### 2.2.2.1 Specified Transformer Losses

No-load losses (NLL) shall be 741 watts at 20 degrees C and load losses (LL) shall be 3017 watts at 85 degrees C. The values for the specified losses shall be used for comparison with the losses determined during the routine tests. If the routine test values for no-load losses exceed the specified no-load losses by more than 10 percent, or the total losses

exceed the specified total losses (sum of no-load and load losses) by more than 6 percent, the transformer is unacceptable.

### 2.2.3 Insulating Liquid

- a. Less-flammable transformer liquids: NFPA 70 and FM P7825 for less-flammable liquids having a fire point not less than 300 degrees C tested per ASTM D 92 and a dielectric strength not less than 33 kv tested per ASTM D 877. Provide identification of transformer as "non-PCB" and "manufacturer's name and type of fluid" on the nameplate. The fluid shall be a biodegradable electrical insulating and cooling liquid classified by UL and approved by FM as "less flammable" fluids. The fluid shall meet the following fluid properties:

- 1. Pour point: ASTM D 97, less than -15 degree C
- 2. Aquatic biodegradation: EPA 712-C-98-075, 100%
- 3. Trout toxicity: OECD Test 203, zero mortality of EPA 600/4-90/027F, pass.

### 2.2.3.1 Liquid-Filled Transformer Nameplates

Power transformers shall be provided with nameplate information in accordance with IEEE C57.12.00 and as modified or supplemented by this section.

### 2.2.4 Corrosion Protection

Bases and cabinets of transformers shall be corrosion resistant and shall be fabricated of stainless steel conforming to ASTM A 167, Type 304 or 304L. Base shall include any part of pad-mounted transformer that is within 3 inches of concrete pad. Paint bases, cabinets, and tanks Munsell 7GY3.29/1.5 green. Paint coating system shall comply with NEMA C57.12.28 regardless of base, cabinet, and tank material. The Munsell color notation is specified in ASTM D 1535.

### 2.3 WARNING SIGNS

Provide as specified in Section 26 00 00.00 20, "Basic Electrical Materials and Methods."

### 2.4 GROUNDING AND BONDING

UL 467. Provide grounding and bonding as specified.

### 2.5 CAST-IN-PLACE CONCRETE

Shall be composed of fine aggregate, coarse aggregate, portland cement, and water so proportioned and mixed as to produce a plastic, workable mixture. Fine aggregate shall be of hard, dense, durable, clean, and uncoated sand. The coarse aggregate shall be reasonably well graded from 3/16 inch to 1 inch. The fine and coarse aggregates shall be free from injurious amounts of dirt, vegetable matter, soft fragments or other deleterious substances. Water shall be fresh, clean, and free from salts, alkali, organic matter, and other impurities. Concrete associated with electrical work for other than encasement of underground ducts shall be 4000 psi minimum 28-day compressive strength unless specified otherwise. Slump shall not exceed 4 inches. Retempering of concrete will not be permitted. Exposed, unformed

concrete surfaces shall be given a smooth, wood float finish. Concrete shall be cured for a period of not less than 7 days, and concrete made with high early strength portland cement shall be repaired by patching honeycombed or otherwise defective areas with cement mortar as directed by the Contracting Officer. Air entrain concrete exposed to weather using an air-entraining admixture conforming to ASTM C 260. Air content shall be between 4 and 6 percent.

## 2.6 SOURCE QUALITY CONTROL

### 2.6.1 Transformer Test Schedule

The Government reserves the right to witness tests. Provide transformer test schedule for tests to be performed at the manufacturer's test facility. Submit required test schedule and location, and notify the Contracting Officer 30 calendar days before scheduled test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled date.

#### a. Test Instrument Calibration

1. The manufacturer shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.
2. The accuracy shall be directly traceable to the National Institute of Standards and Technology.
3. Instrument calibration frequency schedule shall not exceed 12 months for both test floor instruments and leased specialty equipment.
4. Dated calibration labels shall be visible on all test equipment.
5. Calibrating standard shall be of higher accuracy than that of the instrument tested.
6. Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:
  - (a) Maintain up-to-date instrument calibration instructions and procedures for each test instrument.
  - (b) Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

### 2.6.2 Design Tests

IEEE C57.12.00, and IEEE C57.12.90. Section 5.1.2 in IEEE C57.12.80 states that "design tests are made only on representative apparatus of basically the same design." Submit design test reports (complete with test data, explanations, formulas, and results), in the same submittal package as the catalog data and drawings for the specified transformer(s). Design tests shall have been performed prior to the award of this contract.

- a. Tests shall be certified and signed by a registered professional engineer.

- b. Temperature rise: "Basically the same design" for the temperature rise test means a pad-mounted transformer with the same coil construction (such as wire wound primary and sheet wound secondary), the same kVA, the same cooling type (ONAN), the same temperature rise rating, and the same insulating liquid as the transformer specified.
- c. Lightning impulse: "Basically the same design" for the lightning impulse dielectric test means a pad-mounted transformer with the same BIL, the same coil construction (such as wire wound primary and sheet wound secondary), and a tap changer, if specified. Design lightning impulse tests shall include both the primary and secondary windings of that transformer.
  - 1. IEEE C57.12.90, paragraph 10.3 entitled "Lightning Impulse Test Procedures," and IEEE C57.98.
  - 2. State test voltage levels.
  - 3. Provide photographs of oscilloscope display waveforms or plots of digitized waveforms with test report.
- d. Lifting and moving devices: "Basically the same design" requirement for the lifting and moving devices test means a test report confirming that the lifting device being used is capable of handling the weight of the specified transformer in accordance with NEMA C57.12.22.
- e. Pressure: "Basically the same design" for the pressure test means a pad-mounted transformer with a tank volume within 30 percent of the tank volume of the transformer specified.

#### 2.6.3 Routine and Other Tests

IEEE C57.12.00. Routine and other tests shall be performed by the manufacturer on each of the actual transformer(s) prepared for this project to ensure that the design performance is maintained in production. Submit test reports, by serial number and receive approval before delivery of equipment to the project site. Required tests and testing sequence shall be as follows:

- a. Cold resistance measurements (provide reference temperature)
- b. Phase relation
- c. Ratio
- d. No-load losses (NLL) and excitation current
- e. Load losses (LL) and impedance voltage
- f. Dielectric
  - 1. Impulse
    - (a) State test voltage levels
    - (b) Provide photographs of oscilloscope display waveforms or plots of digitized waveforms with test reports. As an alternative, photographs of oscilloscope display waveforms or plots of

digitized waveforms may be hand-delivered at the factory witness test.

2. Applied voltage

3. Induced voltage

g. Leak

## PART 3 EXECUTION

### 3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

### 3.2 GROUNDING

NFPA 70 and IEEE C2, except that grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms.

#### 3.2.1 Grounding Electrodes

Provide driven ground rods as specified. Connect ground conductors to the upper end of ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

#### 3.2.2 Pad-Mounted Transformer Grounding

Provide separate copper grounding conductors and connect them to the ground loop as indicated. When work in addition to that indicated or specified is required to obtain the specified ground resistance, the provision of the contract covering "Changes" shall apply.

#### 3.2.3 Connections

Make joints in grounding conductors and loops by exothermic weld or compression connector. Exothermic welds and compression connectors shall be installed as specified.

#### 3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

### 3.3 TRANSFORMER GROUNDING

Provide a 2/0 bare copper-ground girdle around transformer. Girdle shall be buried one foot deep and placed 3 feet laterally from the transformer enclosure. Connect girdle to enclosure at two opposite places using 1/0 copper. Exothermically weld joints.

### 3.4 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect pad-mounted transformers furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

### 3.5 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

Mount transformer on concrete slab. Unless otherwise indicated, the slab shall be at least 8 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Slab shall be placed on a 6 inch thick, well-compacted gravel base. Top of concrete slab shall be approximately 4 inches above finished grade with gradual slope for drainage. Edges above grade shall have 1/2 inch chamfer. Slab shall be of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

#### 3.5.1 Cast-In-Place Concrete

Cast-in-place concrete work shall conform to the requirements of ACI 318M.

#### 3.5.2 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

### 3.6 FIELD QUALITY CONTROL

#### 3.6.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

##### 3.6.1.1 Pad-Mounted Transformers

###### a. Visual and mechanical inspection

1. Compare equipment nameplate information with specifications and approved shop drawings.
2. Inspect physical and mechanical condition. Check for damaged or cracked insulators and leaks.
3. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.
4. Verify correct liquid level in tanks.
5. Perform specific inspections and mechanical tests as recommended by manufacturer.
6. Verify correct equipment grounding.

###### b. Electrical tests

1. Perform resistance measurements through all bolted connections



with low-resistance ohmmeter, if applicable.

2. Perform insulation-resistance tests.
3. Perform turns-ratio tests.
4. Perform insulation power-factor/dissipation-factor tests on windings.
5. Sample insulating liquid. Sample shall be tested for:
  - (a) Dielectric breakdown voltage
  - (b) Acid neutralization number
  - (c) Specific gravity
  - (d) Interfacial tension
  - (e) Color
  - (f) Visual condition
  - (g) Water in insulating liquid
  - (h) Measure dissipation factor or power factor
6. Perform dissolved gas analysis (DGA).
7. Test for presence of PCB.
8. Verify that the tap-changer is set at specified ratio.
9. Verify proper secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.

#### 3.6.1.2 Grounding System

##### a. Visual and mechanical inspection

1. Inspect ground system for compliance with contract plans and specifications.

##### b. Electrical tests

1. Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground testing megger in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.
2. Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding

system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

### 3.6.2 Follow-Up Verification

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times of checking and testing.

-- End of Section --

SECTION 26 20 00  
INTERIOR DISTRIBUTION 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.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|          |  |
|----------|--|
| ASTM B 1 | (2001) Hard-Drawn Copper Wire  |
| ASTM B 8 | (1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft |

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

|            |   |
|------------|---|
| NEMA C80.1 | (1994) Rigid Steel Conduit - Zinc Coated  |
| NEMA C80.3 | (1994) Electrical Metallic Tubing - Zinc Coated (EMT)                                 |
| NEMA FU 1  | (2002) Low Voltage Cartridge Fuses  |
| NEMA ICS 6 | (1993; R 2011) Enclosures   |
| NEMA KS 1  | (2001) Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum) |
| NEMA TC 14 | (2002) Filament-Wound Reinforced Thermosetting Resin Conduit (RTRC) and Fittings      |
| NEMA TC 2  | (1998) Electrical Polyvinyl Chloride (PVC) Tubing and Conduit                         |
| NEMA TC 3  | (1999) PVC Fittings for Use with Rigid PVC Conduit and Tubing                         |
| NEMA WD 1  | (1999) General Color Requirements for Wiring Devices                                  |
| NEMA WD 6  | (2002) Wiring Devices - Dimensional Specifications                                    |

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code

## UNDERWRITERS LABORATORIES (UL)

UL 1 (2000) Flexible Metal Conduit

UL 198C (1986; R 1998) High-Interrupting-Capacity Fuses, Current-Limiting Types

UL 198E (1988; R 1988) Class R Fuses

UL 198H (1988; R 1993) Class T Fuses

UL 20 (2000; R 2002, Bul. 2002) General-Use Snap Switches

UL 360 (1996; R 2001, Bul. 2002) Liquid-Tight Flexible Steel Conduit

UL 467 (2007) Grounding and Bonding Equipment

UL 489 (2013; Reprint Mar 2014) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

UL 498 (2001; R 2002) Attachment Plugs and Receptacles

UL 50 (1995; R 1999, Bul. 2001) Enclosures for Electrical Equipment

UL 514A (1996; R 2001, Bul. 2002) Metallic Outlet Boxes

UL 514B (1997; R 2002, Bul. 2002) Fittings for Cable and Conduit

UL 514C (1996; R 2002) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

UL 6 (2007; Reprint Nov 2014) Electrical Rigid Metal Conduit-Steel

UL 651 (1995; R 2002) Schedule 40 and 80 Rigid PVC Conduit

UL 67 (1993; R 2002) Panelboards

UL 797 (2000; Bul. 2002) Electrical Metallic Tubing

UL 83 (1998; R 2001, Bul. 2002) Thermoplastic-Insulated Wires and Cables

|         |   |
|---------|---|
| UL 854  | (1999; R 2002) Service-Entrance Cables                      |
| UL 869A | (1998; Bul. 2002) Reference Standard for Service Equipment  |
| UL 943  | (1993; R 2002, Bul. 2002) Ground-Fault Circuit-Interrupters |

## 1.2 RELATED REQUIREMENTS

Section 26 00 00.00 20, "Basic Electrical Materials and Methods," applies to this section with additions and modifications specified herein.

## 1.3 SUBMITTALS

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

### SD-02 Shop Drawings

Panelboards

### SD-03 Product Data

Receptacles

Circuit breakers

Switches

Enclosed circuit breakers

Manual motor starters

### SD-06 Test Reports

600-volt wiring test

Grounding system test

Ground-fault receptacle test

### SD-07 Certificates

Fuses

## 1.4 QUALITY ASSURANCE

### 1.4.1 Fuses

Submit coordination data as specified in article entitled, "FUSES" of this section.

1.5 MAINTENANCE

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials, equipment, and devices shall, as a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70.

2.2 CONDUIT AND FITTINGS

Shall conform to the following:

2.2.1 Rigid Metallic Conduit

2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit

NEMA C80.1, UL 6.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40, in accordance with NEMA TC 2, UL 651, or fiberglass conduit, in accordance with NEMA TC 14.

2.2.3 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, NEMA C80.3.

2.2.4 Flexible Metal Conduit

UL 1.

2.2.4.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

2.2.5 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.

2.2.5.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.5.2 Fittings for EMT

Steel compression type.

2.2.6 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3, UL 514B.

## 2.3 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

## 2.4 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

## 2.5 WIRES AND CABLES

Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

### 2.5.1 Conductors

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

#### 2.5.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to satisfy manufacturer's requirements.

#### 2.5.1.2 Minimum Conductor Sizes

Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; and for Class 3 low-energy, remote-control, alarm and signal circuits, No. 22 AWG.

### 2.5.2 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutral shall be white with colored (not green) stripe. Color of ungrounded conductors in different voltage systems shall be as follows:

a. 208/120 volt, three-phase

- (1) Phase A - black
- (2) Phase B - red
- (3) Phase C - blue

b. 480/277 volt, three-phase

- (1) Phase A - brown
- (2) Phase B - orange
- (3) Phase C - yellow

c. 120/240 volt, single phase: Black and red

#### 2.5.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN/THHN conforming to UL 83, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be 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.

#### 2.5.4 Bonding Conductors

ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

#### 2.5.5 Service Entrance Cables

Service Entrance (SE) and Underground Service Entrance (USE) Cables, UL 854.

### 2.6 DEVICE PLATES

Provide UL listed, one-piece device plates for outlets to suit the devices installed. For metal outlet boxes, plates on unfinished walls shall be of zinc-coated sheet steel or cast metal having round or beveled edges. For nonmetallic boxes and fittings, other suitable plates may be provided. Plates on finished walls shall be nylon or lexan, minimum 0.03 inch wall thickness. Plates shall be same color as receptacle or toggle switch with which they are mounted. Screws shall be machine-type with countersunk heads in color to match finish of plate. Sectional type device plates will not be permitted. Plates installed in wet locations shall be gasketed and UL listed for "wet locations."

### 2.7 SWITCHES

#### 2.7.1 Toggle Switches

NEMA WD 1, UL 20, single pole, double pole, three-way, and four-way, totally enclosed with bodies of thermoplastic and/or thermoset plastic and mounting strap with grounding screw. Handles shall be thermoplastic. Color shall be determined by architect. Wiring terminals shall be screw-type, side-wired. Contacts shall be silver-cadmium and contact arm shall be one-piece copper alloy. Switches shall be rated quiet-type ac only, 120/277 volts, with current rating and number of poles indicated.



## 2.7.2 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. Fused switches shall utilize Class R fuseholders and fuses, unless indicated otherwise. Switches serving as motor-disconnect means shall be horsepower rated. Provide switches in NEMA as specified on plans, enclosure as indicated per NEMA ICS 6.

## 2.8 RECEPTACLES

UL 498, hard use, heavy-duty, grounding-type. Ratings and configurations shall be as indicated. Bodies shall be of per NEMA WD 1. Color shall be determined by architect. Face and body shall be thermoplastic supported on a metal mounting strap. Dimensional requirements shall be per NEMA WD 6. Provide screw-type, side-wired wiring terminals. Connect grounding pole to mounting strap. The receptacle shall contain triple-wipe power contacts and double or triple-wipe ground contacts.

### 2.8.1 Weatherproof Receptacles

Provide in cast metal box with gasketed, weatherproof, cast-metal cover plate and gasketed cap over each receptacle opening. Provide caps with a spring-hinged flap. Receptacle shall be UL listed for use in "wet locations with plug in use."

### 2.8.2 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Device shall be capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of UL 943 for Class A GFCI devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

### 2.8.3 Special Purpose Receptacles

Special purpose receptacles shall be provided as indicated on plans.

### 2.8.4 Dryer Receptacles

Confirm exact NEMA configuration with equipment supplier, Receptacle shall be rated 30 amperes, 125/250 volts.

## 2.9 PANELBOARDS

UL 67 and UL 50 having a short-circuit current rating as indicated. Panelboards for use as service disconnecting means shall additionally conform to UL 869A. Panelboards shall be circuit breaker-equipped unless indicated otherwise. Design shall be 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. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the drawings. Use of "Subfeed Breakers" is not acceptable unless specifically indicated otherwise. Main breaker shall be "separately" mounted "above" or "below" branch breakers. Where "space only" is indicated, make provisions for future installation of breakers. Panelboard locks shall be keyed same. Directories shall indicate load served by each circuit in panelboard. Directories shall also indicate source of service to panelboard (e.g., Panel PA served from Panel MDP). Provide new directories for existing panels modified by this project as indicated. Type directories and mount in holder behind transparent protective covering. Panelboards shall be listed and labeled for their intended use.

#### 2.9.1 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Main buses and back pans shall be designed 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.

##### 2.9.1.1 Panelboard Neutrals for Non-Linear Loads

UL listed, and panelboard type shall have been specifically UL heat rise tested for use on non-linear loads. Panelboard shall be heat rise tested in accordance with UL 67, except with the neutral assembly installed and carrying 200 percent of the phase bus current during testing. Verification of the testing procedure shall be provided upon request. Two neutral assemblies paralleled together with cable is not acceptable. Nameplates for panelboard rated for use on non-linear loads shall be marked "SUITABLE FOR NON-LINEAR LOADS." Provide a neutral label with instructions for wiring the neutral of panelboards rated for use on non-linear loads.

#### 2.9.2 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 shall be mounted. Breaker terminals shall be UL listed as suitable for type of conductor provided. Series rated circuit breakers and plug-in circuit breakers are unacceptable.

##### 2.9.2.1 Multipole Breakers

Provide common trip-type with single operating handle. Breaker design shall be 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.

##### 2.9.2.2 Circuit Breaker With GFCI

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 GFCI devices, for personnel protection, and 20 milliamperes or greater per requirements of UL 943 for Class B GFCI per equipment protection.

#### 2.9.2.3 Circuit Breakers for HVAC Equipment

Circuit breakers for HVAC equipment having motors (group or individual) shall be marked for use with HACR type and UL listed as HACR type.

#### 2.10 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.

#### 2.11 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch. Time-current characteristics curves of fuses serving motors or connected in series with circuit breakers or other circuit protective devices shall be coordinated for proper operation. Submit coordination data for approval. Fuses shall have voltage rating not less than circuit voltage.

##### 2.11.1 Cartridge Fuses, Current Limiting Type (Class R)

UL 198E, Class RK-1. Associated fuseholders shall be Class R only.

##### 2.11.2 Cartridge Fuses, Current Limiting Type (Classes J, L, and CC)

UL 198C, Class J for zero to 600 amperes, Class L for 601 to 6,000 amperes, and Class CC for zero to 30 amperes.

##### 2.11.3 Cartridge Fuses, Current Limiting Type (Class T)

UL 198H, Class T for zero to 1,200 amperes, 300 volts; and zero to 800 amperes, 600 volts.

#### 2.12 MANUAL MOTOR STARTERS (MOTOR RATED SWITCHES)

Single pole designed for surface mounting with overload protection .

#### 2.13 GROUNDING AND BONDING EQUIPMENT

UL 467. Ground rods shall be sectional type, copper-clad steel, with minimum diameter of 3/4 in and minimum length of 10 ft.

#### 2.14 NAMEPLATES

Provide as specified in Section 26 00 00.00 20, "Basic Electrical Materials and Methods."

#### 2.15 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations in accordance with

## Section 07 84 00, "Firestopping."

## PART 3 EXECUTION

## 3.1 INSTALLATION

Electrical installations shall conform to requirements of NFPA 70 and to requirements specified herein.

## 3.1.1 Underground Service

Underground service conductors and associated conduit shall be continuous from service entrance equipment to outdoor power system connection.

## 3.1.2 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures shall be labeled and identified as such.

## 3.1.2.1 Labels

Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by NFPA 70, each enclosure, new and existing, shall be labeled as one of several enclosures containing service entrance disconnect devices. Label, at minimum, shall indicate number of service disconnect devices housed by enclosure and shall indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels conforming to paragraph entitled "Nameplates." Use lettering of at least 0.25 in in height, and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure, shall be provided only as permitted by NFPA 70.

## 3.1.3 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Minimum conduit size shall be 1/2 in in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings shall be made with metal conduit in fire-rated shafts. Metal conduit shall extend through shafts for minimum distance of 6 in. Conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors shall be firestopped in accordance with Section 07 84 00, "Firestopping".

## 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.

#### 3.1.3.2 Restrictions Applicable to Nonmetallic Conduit

##### a. PVC Schedule 40 and PVC Schedule 80

(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 entitled "Flexible Connections."

#### 3.1.3.4 Service Entrance Conduit, Underground

PVC, Type-EPC 40, galvanized rigid steel or steel IMC. Underground portion shall be encased in minimum of 3 in of concrete and shall be installed minimum 18 in below slab or grade.

#### 3.1.3.5 Underground Conduit Other Than Service Entrance

Plastic-coated rigid steel; plastic-coated steel IMC; PVC, Type EPC-40  
Plastic coating shall extend minimum 6 in above floor.

#### 3.1.3.6 Conduit in Floor Slabs

Rigid steel; steel IMC; fiberglass, or PVC, Type EPC-40.

#### 3.1.4 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 in away from

parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project.

#### 3.1.4.1 Conduit Installed Under Floor Slabs

Conduit run under floor slab shall be located a minimum of 12 in below the vapor barrier. Seal around conduits at penetrations thru vapor barrier.

#### 3.1.4.2 Conduit Through Floor Slabs

Where conduits rise through floor slabs, curved portion of bends shall not be visible above finished slab.

#### 3.1.4.3 Conduit Support

Support conduit by pipe straps, wall brackets, 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. Load applied to fasteners shall not exceed one-fourth proof test load. Fasteners attached to concrete ceiling shall be vibration resistant and shock-resistant. Holes cut to depth of more than 1 1/2 in in reinforced concrete beams or to depth of more than 3/4 in in concrete joints shall not cut main reinforcing bars. 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 shall be supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Installation shall be coordinated with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Where conduit crosses building expansion joints, provide suitable expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 in inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

#### 3.1.4.4 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

#### 3.1.4.5 Pull Wire

Install pull wires in empty conduits. Pull wire shall be plastic having minimum 200-lb tensile strength. Leave minimum 36 in of slack at each end of pull wire.

#### 3.1.4.6 Conduit Installed in Concrete Floor Slabs

Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Do not stack conduits. Space conduits horizontally not closer than three diameters, except at cabinet locations. Curved portions of bends shall not be visible above finish slab. Increase slab thickness as necessary to provide minimum one inch cover over conduit. Where embedded conduits cross building and/or expansion joints, provide suitable watertight expansion/deflection fittings and bonding jumpers. Expansion/deflection fittings shall allow horizontal and vertical movement of raceway. Conduit larger than one inch trade size shall be parallel with or at right angles to main reinforcement; when at right angles to reinforcement, conduit shall be close to one of supports of slab.

#### 3.1.4.7 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

#### 3.1.4.8 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 in above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

#### 3.1.4.9 Flexible Connections

Provide flexible steel conduit between 3 and 6 ft in length for recessed and semirecessed lighting fixtures. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size shall be 1/2 in diameter. Provide liquidtight flexible conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections.

#### 3.1.5 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be 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 ft above floors and walkways, and when specifically indicated. Boxes in other locations shall be sheet steel, except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit system. Each box shall have volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures shall be minimum 4 in 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 shall be 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; fixtures shall be readily removable for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 in from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

#### 3.1.5.1 Boxes

Boxes for use with raceway systems shall be minimum 1 1/2 in deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 4 in square, except that 4 by 2 in boxes may be used where only one raceway enters outlet. Telephone outlets shall be minimum of 4 in square by 2 1/8 in deep, except for wall mounted telephones.

#### 3.1.5.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of code-gauge aluminum or galvanized sheet steel, except where cast-metal boxes are required in locations specified herein. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

#### 3.1.5.3 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.

#### 3.1.6 Mounting Heights

Mount panelboards, enclosed circuit breakers, and disconnecting switches so height of operating handle at its highest position is maximum 78 in above floor. Mount lighting switches 48 in above finished floor, receptacles 18 in above finished floor unless otherwise indicated, and other devices as indicated. Measure mounting heights of receptacle outlet boxes in the to the bottom of the outlet box.

#### 3.1.7 Conductor Identification

Provide conductor identification within each enclosure where tap, splice,



or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves.

### 3.1.8 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

### 3.1.9 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 in. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

### 3.1.10 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings in accordance with Section 07 84 00, "Firestopping."

### 3.1.11 Grounding and Bonding

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, telephone 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. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

#### 3.1.11.1 Resistance

Maximum resistance-to-ground of grounding system shall not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

### 3.1.12 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this

section of the specifications but shall be provided under the section specifying the associated equipment.

### 3.1.13 Repair of Existing Work

Repair of existing work, demolition, and modification of existing electrical distribution systems shall be performed as follows:

#### 3.1.13.1 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.

#### 3.1.13.2 Existing Concealed Wiring to be Removed

Existing concealed wiring to be removed shall be disconnected from its source. Remove conductors; cut conduit flush with floor, underside of floor, and through walls; and seal openings.

#### 3.1.13.3 Removal of Existing Electrical Distribution System

Removal of existing electrical distribution system equipment shall include equipment's associated wiring, including conductors, cables, exposed conduit, surface metal raceways, boxes, and fittings, back to equipment's power source as indicated.

### 3.2 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to tests.

#### 3.2.1 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

#### 3.2.2 600-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 shall be 250,000 ohms.

#### 3.2.3 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.

#### 3.2.4 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 --

## SECTION 26 23 00

## SWITCHBOARDS AND SWITCHGEAR

07/06

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

|                 |   |
|-----------------|---|
| ASTM A123/A123M | (2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products   |
| ASTM A153/A153M | (2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware   |
| ASTM A167       | (2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip                            |
| ASTM A653/A653M | (2015) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| ASTM A780/A780M | (2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings  |
| ASTM D1535      | (2013) Specifying Color by the Munsell System   |
| ASTM D709       | (2013) Laminated Thermosetting Materials  |

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

|                |   |
|----------------|---|
| IEEE 100       | (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms   |
| IEEE 81        | (2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System |
| IEEE C2        | (2012; Errata 2012; INT 1-4 2012; INT 5-7 2013; INT 8-10 2014; INT 11 2015) National Electrical Safety Code     |
| IEEE C57.12.28 | (2005; INT 3 2011) Standard for Pad-Mounted Equipment - Enclosure Integrity                                     |

IEEE C57.12.29 (2005) Standard for Pad-Mounted Equipment  
- Enclosure Integrity for Coastal  
Environments

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS (2013) Standard for Acceptance Testing  
Specifications for Electrical Power  
Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA PB 2.1 (2013) General Instructions for Proper  
Handling, Installation, Operation and  
Maintenance of Deadfront Distribution  
Switchboards Rated 600 V or Less

NEMA ICS 6 (1993; R 2011) Enclosures

NEMA LI 1 (1998; R 2011) Industrial Laminating  
Thermosetting Products

NEMA PB 2 (2011) Deadfront Distribution Switchboards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2  
2013; Errata 2 2013; AMD 3 2014; Errata  
3-4 2014; AMD 4-6 2014) National  
Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 489 (2013; Reprint Mar 2014) Molded-Case  
Circuit Breakers, Molded-Case Switches,  
and Circuit-Breaker Enclosures

UL 891 (2005; Reprint Oct 2012) Switchboards

1.2 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.

1.3 SUBMITTALS

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

SD-02 Shop Drawings

Switchboard Drawings

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring

for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

SD-03 Product Data

Switchboard

SD-06 Test Reports

Acceptance checks and tests

SD-10 Operation and Maintenance Data

Switchboard Operation and Maintenance, Data Package 5

SD-11 Closeout Submittals

Assembled Operation and Maintenance Manuals

Equipment Test Schedule

1.4 QUALITY ASSURANCE

1.4.1 Switchboard Product Data

Each submittal shall include manufacturer's information for each component, device and accessory provided with the switchboard including:

- a. Circuit breaker type, interrupting rating, and trip devices, including available settings
- b. Manufacturer's instruction manuals and published time-current curves (on full size logarithmic paper) of the main secondary breaker and largest secondary feeder device.

1.4.2 Switchboard Drawings

Drawings shall include, but are not limited to the following:

- a. One-line diagram including breakers
- b. Outline drawings including front elevation, section views, footprint, and overall dimensions
- c. Bus configuration including dimensions and ampere ratings of bus bars
- d. Markings and NEMA nameplate data
- e. Circuit breaker type, interrupting rating, and trip devices, including available settings
- f. Three-line diagrams and elementary diagrams and wiring diagrams with terminals identified, and indicating prewired interconnections between

items of equipment and the interconnection between the items.

- g. Manufacturer's instruction manuals and published time-current curves (on full size logarithmic paper) of the main secondary breaker and largest secondary feeder device. These shall be used by the designer of record to provide breaker settings that will ensure protection and coordination are achieved.

- h. Provisions for future extension.

#### 1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

#### 1.4.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

##### 1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

##### 1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

#### 1.5 MAINTENANCE

##### 1.5.1 Switchboard Operation and Maintenance Data

Submit Operation and Maintenance Manuals in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

##### 1.5.2 Assembled Operation and Maintenance Manuals

Manuals shall be assembled and bound securely in durable, hard covered, water resistant binders. The manuals shall be assembled and indexed in the following order with a table of contents. The contents of the assembled

operation and maintenance manuals shall be as follows:

- a. Manufacturer's O&M information required by the paragraph entitled "SD-10, Operation and Maintenance Data".
- b. Catalog data required by the paragraph entitled, "SD-03, Product Data".
- c. Drawings required by the paragraph entitled, "SD-02, Shop Drawings".
- d. Prices for spare parts and supply list.
- f. Design test reports
- g. Production test reports

#### 1.6 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

### PART 2 PRODUCTS

#### 2.1 PRODUCT COORDINATION

Products and materials not considered to be switchboards and related accessories are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

#### 2.2 SWITCHBOARD

NEMA PB 2 and UL 891.

##### 2.2.1 Ratings

The voltage rating of the switchboard shall be 208Y/120 volts AC, 4-wire 3 phase as indicated. The continuous current rating of the main bus shall be as indicated. The short-circuit current rating shall be as indicated. The switchboard shall be UL listed and labeled for its intended use as service entrance equipment.

##### 2.2.2 Construction

Switchboard shall consist of vertical sections bolted together to form a rigid assembly and shall be as indicated. All circuit breakers shall be front accessible. Where indicated, "space for future" or "space" shall mean to include bus, device supports, and connections. Provide insulating barriers in accordance with NEMA LI 1, Type GPO-3, 0.25 inch minimum thickness. Apply moisture resistant coating to all rough-cut edges of barriers. Switchboard shall be completely factory engineered and assembled, including protective devices and equipment indicated with necessary interconnections, instrumentation, and control wiring.

##### 2.2.2.1 Enclosure

The switchboard enclosure shall be a NEMA ICS 6 Type as indicated. Enclosure shall be bolted together with removable bolt-on side and rear covers. Bases, frames and channels of enclosure shall be corrosion resistant and shall be fabricated of ASTM A167 type 304 or 304L stainless



steel or galvanized steel. Base shall include any part of enclosure that is within 3 inches of concrete pad. Galvanized steel shall be ASTM A123/A123M, ASTM A653/A653M G90 coating, and ASTM A153/A153M, as applicable. Galvanize after fabrication where practicable. Paint enclosure, including bases, ASTM D1535 light gray No. 61 or No. 49. Paint coating system shall comply with IEEE C57.12.28 for galvanized steel and IEEE C57.12.29 for stainless steel.

#### 2.2.2.2 Bus Bars

Bus bars shall be copper with silver-plated contact surfaces. Plating shall be a minimum of 0.0002 inch thick. Make bus connections and joints with hardened steel bolts. The through-bus shall be rated at the full ampacity of the main throughout the switchboard. Provide minimum one-quarter by 2 inch copper ground bus secured to each vertical section along the entire length of the switchboard. The neutral bus shall be rated 100 percent of the main bus continuous current rating as indicated.

#### 2.2.2.3 Main Section

The main section shall consist of an individually mounted molded-case circuit breaker.

#### 2.2.2.4 Distribution Sections

The distribution section shall consist of individually mounted, molded-case circuit breakers as indicated.

#### 2.2.2.5 Handles

Handles for individually mounted devices shall be of the same design and method of external operation. Label handles prominently to indicate device ampere rating, color coded for device type. Identify ON-OFF indication by handle position and by prominent marking.

#### 2.2.3 Protective Device

Provide main and branch protective devices as indicated.

##### 2.2.3.1 Molded-Case Circuit Breaker

UL 489. UL listed and labeled, 100 percent rated, stationary, manually operated, low voltage molded-case circuit breaker, with a short-circuit current rating as indicated. Breaker frame size shall be as indicated. Series rated circuit breakers are unacceptable.

#### 2.3 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. This nameplate and method of attachment may be the manufacturer's standard if it contains the required information.

#### 2.4 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each switchboard, equipment enclosure, relay, switch, and device; as specified in this section or as indicated on the drawings. Each nameplate inscription shall

identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

## 2.5 SOURCE QUALITY CONTROL

### 2.5.1 Equipment Test Schedule

The Government reserves the right to witness tests. Provide equipment test schedules for tests to be performed at the manufacturer's test facility. Submit required test schedule and location, and notify the Contracting Officer 30 calendar days before scheduled test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled date.

#### a. Test Instrument Calibration

1. The manufacturer shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.
2. The accuracy shall be directly traceable to the National Institute of Standards and Technology.
3. Instrument calibration frequency schedule shall not exceed 12 months for both test floor instruments and leased specialty equipment.
4. Dated calibration labels shall be visible on all test equipment.
5. Calibrating standard shall be of higher accuracy than that of the instrument tested.
6. Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:
  - (a) Maintain up-to-date instrument calibration instructions and procedures for each test instrument.
  - (b) Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

### 3.2 GROUNDING

NFPA 70 and IEEE C2, except that grounds and grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms.

### 3.2.1 Equipment Grounding

Provide bare copper cable not smaller than No. 4/0 AWG not less than 24 inches below grade connecting to the indicated ground rods. When work in addition to that indicated or specified is directed to obtain the specified ground resistance, the provision of the contract covering "Changes" shall apply.

### 3.2.2 Connections

Make joints in grounding conductors and loops by exothermic weld or compression connector. Exothermic welds and compression connectors shall be installed as specified

## 3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect equipment furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

### 3.3.1 Switchboard

ANSI/NEMA PB 2.1.

### 3.3.2 Field Applied Painting

Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

### 3.3.3 Galvanizing Repair

Repair damage to galvanized coatings using ASTM A780/A780M, zinc rich paint, for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces that repair paint has been applied to.

### 3.3.4 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.

## 3.4 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

### 3.4.1 Interior Location

Mount switchboard on concrete slab. Unless otherwise indicated, the slab shall be at least 4 inches thick. The top of the concrete slab shall be approximately 4 inches above finished floor. Edges above floor shall have 1/2 inch chamfer. The slab shall be of adequate size to project at least 8 inches beyond the equipment. Provide conduit turnups and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 3 inches above slab surface. Concrete work shall be as specified.

### 3.5 FIELD QUALITY CONTROL

#### 3.5.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

##### 3.5.1.1 Switchboard Assemblies

###### a. Visual and Mechanical Inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.
2. Inspect physical, electrical, and mechanical condition.
3. Confirm correct application of manufacturer's recommended lubricants.
4. Verify appropriate anchorage, required area clearances, and correct alignment.
5. Inspect all doors, panels, and sections for paint, dents, scratches, fit, and missing hardware.
6. Verify that circuit breaker sizes and types correspond to approved shop drawings.
8. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.
9. Confirm correct operation and sequencing of electrical and mechanical interlock systems.
10. Clean switchboard.
11. Inspect insulators for evidence of physical damage or contaminated surfaces.
12. Verify correct barrier installation.
13. Exercise all active components.
14. Inspect all mechanical indicating devices for correct operation.
15. Verify that vents are clear.
16. Test operation, alignment, and penetration of instrument transformer withdrawal disconnects.
17. Inspect control power transformers.

###### b. Electrical Tests

1. Perform insulation-resistance tests on each bus section.
2. Perform overpotential tests.
3. Perform insulation-resistance test on control wiring; Do not perform this test on wiring connected to solid-state components.
4. Perform control wiring performance test.
5. Perform primary current injection tests on the entire current circuit in each section of assembly.

#### 3.5.1.2 Circuit Breakers - Low Voltage - Power

##### a. Visual and Mechanical Inspection

1. Compare nameplate data with specifications and approved shop drawings.
2. Inspect physical and mechanical condition.
3. Confirm correct application of manufacturer's recommended lubricants.
4. Inspect anchorage, alignment, and grounding. Inspect arc chutes. Inspect moving and stationary contacts for condition, wear, and alignment.
5. Verify that all maintenance devices are available for servicing and operating the breaker.
6. Verify that primary and secondary contact wipe and other dimensions vital to satisfactory operation of the breaker are correct.
7. Perform all mechanical operator and contact alignment tests on both the breaker and its operating mechanism.
8. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.
9. Verify cell fit and element alignment.
10. Verify racking mechanism.

##### b. Electrical Tests

1. Perform contact-resistance tests on each breaker.
2. Perform insulation-resistance tests.
3. Adjust Breaker(s) for final settings in accordance with Government provided settings.
4. Determine long-time minimum pickup current by primary current injection.

5. Determine long-time delay by primary current injection.

#### 3.5.1.3 Circuit Breakers

##### Low Voltage Molded Case with Solid State Trips

###### a. Visual and Mechanical Inspection

1. Compare nameplate data with specifications and approved shop drawings.
2. Inspect circuit breaker for correct mounting.
3. Operate circuit breaker to ensure smooth operation.
4. Inspect case for cracks or other defects.
5. Inspect all bolted electrical connections for high resistance using low resistance ohmmeter, verifying tightness of accessible bolted connections and/or cable connections by calibrated torque-wrench method, or performing thermographic survey.
6. Inspect mechanism contacts and arc chutes in unsealed units.

###### b. Electrical Tests

1. Perform contact-resistance tests.
2. Perform insulation-resistance tests.
3. Perform Breaker adjustments for final settings in accordance with Government provided settings.
4. Perform long-time delay time-current characteristic tests

#### 3.5.1.4 Grounding System

###### a. Visual and Mechanical Inspection

1. Inspect ground system for compliance with contract plans and specifications.

###### b. Electrical Tests

1. IEEE 81. Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground testing megger in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.
2. Submit the measured ground resistance of each ground rod and

grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

### 3.5.2 Follow-Up Verification

Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. Circuit breakers shall be tripped by operation of each protective device. Test shall require each item to perform its function not less than three times. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times for checks, settings, and tests.

-- End of Section --

## SECTION 26 51 00

## INTERIOR LIGHTING

04/04

## 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 A 641/A 641M (2009a; R 2014) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

## ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA HB-9 (2000) Lighting Handbook, Reference and Application

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits (ANSI/IEEE)

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA C78.81 (2001) Electric Lamps - Double-capped Fluorescent Lamps

NEMA C78.901 (2001) Electric Lamps - Single Base Fluorescent Lamps

NEMA C82.11 (2002) High-Frequency Fluorescent Lamp Ballasts

NEMA ICS 2 (2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V

NEMA LL 1 (1997; R 2002) Procedures for Linear Fluorescent Lamp Sample Preparation and the TCLP

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2



2013; Errata 2 2013; AMD 3 2014; Errata  
3-4 2014; AMD 4-6 2014) National  
Electrical Code

NFPA 101 (2015; ERTA 2015) Life Safety Code

UNDERWRITERS LABORATORIES (UL)

UL 773 (1995; R 2002, Bul. 2002) Plug-In, Locking  
Type Photocontrols for Use with Area  
Lighting

UL 773A (1995; R 1999) Nonindustrial Photoelectric  
Switches for Lighting Control

UL 924 (1995; R 2001, Bul. 2001 and 2002)  
Emergency Lighting and Power Equipment

UL 935 (2001; Reprint Aug 2014) Standard for  
Fluorescent-Lamp Ballasts

UL 1598 (2008; Reprint Oct 2012) Luminaires

## 1.2 RELATED REQUIREMENTS

Section 26 00 00.00 20, "Basic Electrical Materials and Methods," applies to this section, with the additions and modifications specified herein. Materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 26 51 00, "Interior Distribution System." Lighting fixtures and accessories mounted on exterior surfaces of buildings are specified in this section.

## 1.3 DEFINITIONS

### 1.3.1 Average Life

Time after which 50 percent will have failed and 50 percent will have survived under normal conditions.

### 1.3.2 Total Harmonic Distortion (THD)

The root mean square (RMS) of all the harmonic components divided by the total fundamental current.

## 1.4 SUBMITTALS

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

Data, drawings, and reports shall employ the terminology, classifications, and methods prescribed by the IESNA HB-9, as applicable, for the lighting system specified.

SD-03 Product Data

Fluorescent lighting fixtures

Fluorescent lamps

Lighting contactor

Time switch Photocell switch

Exit signs

Emergency lighting equipment

Occupancy sensors

Electronic dimming ballast

Dimming ballast controls

SD-06 Test Reports

Operating test

Submit test results as stated in paragraph entitled "Field Quality Control."

SD-10 Operation and Maintenance Data

#### 1.5 ELECTRONIC BALLAST WARRANTY

Furnish the electronic ballast manufacturer's warranty. The warranty period shall not be less than 5 years from the date of manufacture of the electronic ballast. Ballast assembly in the lighting fixture, transportation, and on-site storage shall not exceed 12 months, thereby permitting 4 years of the ballast 5 year warranty to be in service and energized. The warranty shall state that the malfunctioning ballast shall be exchanged by the manufacturer and promptly shipped to the using Government facility. The replacement ballast shall be identical to, or an improvement upon, the original design of the malfunctioning ballast.

## PART 2 PRODUCTS

### 2.1 FLUORESCENT LIGHTING FIXTURES

UL 1598. Fluorescent fixtures shall have electronic ballasts unless specifically indicated otherwise.

### 2.1.1.1 Fluorescent Lamp Electronic Ballasts

The electronic ballast shall as a minimum meet the following characteristics:

- a. Ballast shall comply with UL 935, NEMA C82.11, and NFPA 70 unless specified otherwise. Ballast shall provide transient immunity as recommended by IEEE C62.41. Ballast shall be designed for the wattage of the lamps used in the indicated application. Ballasts shall be designed to operate on the voltage system to which they are connected.
- b. Power factor shall be 0.95 (minimum).
- c. Ballast shall operate at a frequency of 20,000 Hertz (minimum). Ballast shall be compatible with and not cause interference with the operation of occupancy sensors or other infrared control systems. Provide ballasts operating at or above 40,000 Hertz where available.
- d. Ballast shall have light regulation of plus or minus 10 percent lumen output with a plus or minus 10 percent input voltage regulation. Ballast shall have 10 percent flicker (maximum) using any compatible lamp.
- e. Ballast shall be UL listed Class P with a sound rating of "A."
- f. Ballast shall have circuit diagrams and lamp connections displayed on the ballast.
- g. Ballasts shall be instant start unless otherwise indicated. Ballasts shall be programmed start where indicated. Instant start ballasts shall operate lamps in a parallel circuit configuration that permits the operation of remaining lamps if one or more lamps fail or are removed. Programmed start ballasts may operate lamps in a series circuit configuration. Provide series/parallel wiring for programmed start ballasts where available.
- h. Ballasts for compact fluorescent fixtures shall be programmed start.
- i. Ballasts for T-5 and smaller lamps shall have end-of-life protection circuits as required by NEMA C78.81 and NEMA C78.901 as applicable.
- j. Ballast shall be capable of starting and maintaining operation at a minimum of 0 degrees F unless otherwise indicated.
- k. Electronic ballast shall have a full replacement warranty of 5 years from date of manufacture as specified in paragraph entitled "Electronic Ballast Warranty" herein.

#### 2.1.1.1.1 T-8 Lamp Ballast

- a. Total harmonic distortion (THD): Shall be 20 percent (maximum).
- b. Input wattage.
  - 1. 32 watts (maximum) when operating one F32T8 lamp

2. 62 watts (maximum) when operating two F32T8 lamps
3. 92 watts (maximum) when operating three F32T8 lamps
4. 114 watts (maximum) when operating four F32T8 lamps

#### 2.1.1.2 F17T8 Lamp Ballast

- a. Total harmonic distortion (THD): Shall be 25 percent (maximum).
- b. Input wattage:
  1. 34 watts (maximum) when operating two F17T8 lamps.

#### 2.1.2 Fluorescent Lamp Electronic Dimming Ballast

The electronic ballast shall as a minimum meet the following characteristics:

- a. Ballast shall comply with NEMA C82.11, UL 935, and NFPA 70, unless specified otherwise. Ballast shall provide transient immunity as recommended by IEEE C62.41. Ballast dimming capability range shall be from 100 to 5 percent (minimum range) of light output, flicker free. Ballast shall start lamp at any preset light output setting without first having to go to full light output. Ballast shall be designed for the wattage of the lamps used in the indicated application. Ballasts shall be designed to operate on the voltage system to which they are connected.
- b. Power factor shall be 0.95 (minimum) at full light output, and 0.90 (minimum) over the entire dimming range.
- c. Ballast shall operate at a frequency of 20,000 Hertz (minimum). Ballast shall be compatible with and not cause interference with the operation of occupancy sensors or other infrared control systems. Provide ballasts operating at or above 40,000 Hertz where available.
- d. Ballast factor at full light output shall be between 0.85 (minimum) and 1.00 (maximum). Current crest factor shall be 1.7 (maximum).
- e. Ballast shall be UL listed Class P with a sound rating of "A".
- f. Ballast shall have circuit diagrams and lamp connections displayed on the ballast.
- g. Ballast shall be programmed start. Ballast may operate lamps in a series circuit configuration. Provide series/parallel wiring for programmed start ballasts where available.
- h. Ballasts for compact fluorescent fixtures shall be programmed start.

- i. Ballast shall be capable of starting and maintaining operation at a minimum of 0 degrees F unless otherwise indicated.
- j. Total harmonic distortion (THD): Shall be 20 percent (maximum) over the entire dimming range.
- k. Ballasts for T-5 and smaller lamps shall have end-of-life protection circuits as required by NEMA C78.81 and NEMA C78.901 as applicable.

#### 2.1.2.1 T-8 Lamp Ballast

Input wattage, for indicated lamp quantity shall be:

- a. 35 watts (maximum) when operating one F32T8 lamp.
- b. 70 watts (maximum) when operating two F32T8 lamps.
- c. 104 watts (maximum) when operating three F32T8 lamps.

#### 2.1.3 Dimming Ballast Controls

The dimming ballast controls shall be a slide dimmer with on/off control. The slide dimmer shall be compatible with the ballast and control the ballast light output over the full dimming range. Dimming ballast controls shall be approved by the ballast manufacturer.

#### 2.1.4 Fluorescent Lamps

- a. T-8 rapid start low mercury lamps shall be rated 32 watts (maximum), 2800 initial lumens (minimum), CRI of 75 (minimum), color temperature of 3500 K, and an average rated life of 20,000 hours. Low mercury lamps shall have passed the EPA Toxicity Characteristic Leachate Procedure (TCLP) for mercury by using the lamp sample preparation procedure described in NEMA LL 1.
- b. T-8 rapid start lamp, 17 watt (maximum), nominal length of 24 inches, 1300 initial lumens, CRI of 75 (minimum), color temperature of 3500 , and an average rated life of 20,000 hours.
- g. Compact fluorescent lamps shall be: CRI 80, minimum, 3500 K , 10,000 hours average rated life, and as indicated.

Average rated life is based on 3 hours operating per start.

#### 2.1.5 Compact Fluorescent Fixtures

Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballasts integral to the fixture. Providing assemblies designed to retrofit incandescent fixtures is prohibited except when specifically indicated for renovation of existing fixtures. Fixtures shall use lamps as indicated.

### 2.1.6 Open-Tube Fluorescent Fixtures

Provide with self-locking sockets, or lamp retainers (two per lamp).

## 2.2 PENDANT MOUNTED FLUORESCENT FIXTURE

Designation: P  
Manufacturer: Spectrum  
Lighting # SPC1207CF-226-DAI-8310-SG-PM-MW  
Description: 12" Flour. Cylinder Fixture (Pendant Mounted  
with Bottom of Fixture at 7'-6")  
Voltage: 120  
Ballast Type/Quantity: 1-Elec Dimming (10%)  
Number of Lamps: 2-26W DTT  
Total Watts: 55

Provide in Lobby Area shown on sheet E-104 with G designation.

Provide two "P" for each "G" designation shown in Lobby/Lounge areas. See sheet E-104 and Sheet E-108.

## 2.3 RECESS- AND FLUSH-MOUNTED FIXTURES

Provide type that can be relamped from the bottom. Access to ballast shall be from the bottom. Trim for the exposed surface of flush-mounted fixtures shall be as indicated.

## 2.4 LIGHTING CONTACTOR

NEMA ICS 2, mechanically held contactors as indicated on plans.

## 2.5 TIME SWITCH

Astronomic dial type or electronic type, arranged to turn "ON" at sunset and turn "OFF" at predetermined time between 8:30 p.m. and 2:30 a.m. or sunrise, automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise. Provide as indicated on plans.

## 2.6 PHOTOCELL SWITCH

UL 773 or UL 773A, hermetically sealed cadmium-sulfide or silicon diode type cell and rated as indicated on plans.

## 2.7 EXIT SIGNS

UL 924, NFPA 70, and NFPA 101. Exit signs shall be self-powered type.

### 2.7.1 Self-Powered LED Type Exit Signs (Battery Backup)

Provide with automatic power failure device, test switch, pilot light, and fully automatic high/low trickle charger in a self-contained power pack. Battery shall be sealed electrolyte type, shall operate unattended, and require no maintenance, including no additional water, for a period of not less than 5 years. LED exit sign shall have emergency run time of 1 1/2

hours (minimum). The light emitting diodes shall have rated lamp life of 70,000 hours (minimum).

## 2.8 EMERGENCY LIGHTING EQUIPMENT

UL 924, NFPA 70, and NFPA 101. Provide lamps in wattage indicated.

### 2.8.1 Emergency Lighting Unit

Provide as indicated. Emergency lighting units shall be rated for 12 volts, except units having no remote-mounted lamps and having no more than two unit-mounted lamps may be rated 6 volts. Provide integral self-testing module.

## 2.9 SELF-TESTING MODULE

Self-testing module for exit signs and emergency lighting equipment shall perform the following functions:

- a. Continuous monitoring of charger operation and battery voltage with visual indication of normal operation and of malfunction.
- b. Monthly discharge cycling of battery with monitoring of transfer circuit function, battery capacity and emergency lamp operation with visual indication of malfunction. The battery capacity test may be conducted by using a synthetic load.
- c. Manual test switch to simulate a discharge test cycle.
- d. Module shall have low voltage battery disconnect (LVD) and brown-out protection circuit.

## 2.10 OCCUPANCY SENSORS

UL listed. Occupancy sensors and power packs shall be designed to operate on the voltage indicated. Sensors and power packs shall have circuitry that only allows load switching at or near zero current crossing of supply voltage. Occupancy sensor mounting as indicated. Sensor shall have an LED occupant detection indicator. Sensor shall have adjustable sensitivity and adjustable delayed-off time range of 5 minutes to 15 minutes, minimum. Wall mounted sensors shall be ivory, ceiling mounted sensors shall be white. Ceiling mounted sensors shall have 360 degree coverage unless otherwise indicated.

## 2.11 SUPPORT HANGERS FOR LIGHTING FIXTURES IN SUSPENDED CEILINGS

### 2.11.1 Wires

ASTM A 641/A 641M, galvanized regular coating, soft temper, 0.1055 inches in diameter (12 gage).

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed just prior to project completion. Lamps installed and used for working light during construction shall be replaced prior to turnover to the Government if more than 15 percent of their rated life has been used. Lamps shall be tested for proper operation prior to turn-over and shall be replaced if necessary with new lamps from the original manufacturer. Provide 10 percent spare lamps of each type from the original manufacturer.

#### 3.1.2 Lighting Fixtures

Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved drawings. Installation shall meet requirements of NFPA 70. Mounting heights specified or indicated shall be to the bottom of fixture for ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting fixtures 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 fixtures shall be independently supported from the building structure by a minimum of four wires per fixture and located near each corner of each fixture. Ceiling grid clips are not allowed as an alternative to independently supported light fixtures. Round fixtures or fixtures smaller in size than the ceiling grid shall be independently supported from the building structure by a minimum of four wires per fixture spaced approximately equidistant around the fixture. Do not support fixtures by ceiling acoustical panels. Where fixtures of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support such fixtures independently and provide at least two 3/4 inch metal channels spanning, and secured to, the ceiling tees for centering and aligning the fixture. Provide wires for lighting fixture support in this section. Lighting fixtures installed in suspended ceilings shall also comply with the requirements of Section 09 51 00, "Acoustical Ceilings."

#### 3.1.3 Suspended Fixtures

Suspended fixtures shall be provided with 45 degree swivel hangers so that



they hang plumb and shall be located with no obstructions within the 45 degree range in all directions. The stem, canopy and fixture shall be capable of 45 degree swing. Pendants, rods, or chains 4 feet or longer excluding fixture shall be braced to prevent swaying using three cables at 120 degree separation. Suspended fixtures in continuous rows shall have internal wireway systems for end to end wiring and shall be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces. Aligning splines shall be used on extruded aluminum fixtures to assure hairline joints. Steel fixtures shall be supported to prevent "oil-canning" effects. Fixture finishes shall be free of scratches, nicks, dents, and warps, and shall match the color and gloss specified. Pendants shall be finished to match fixtures. Aircraft cable shall be stainless steel. Canopies shall be finished to match the ceiling and shall be low profile unless otherwise shown. Maximum distance between suspension points shall be 10 feet or as recommended by the manufacturer, whichever is less.

#### 3.1.4 Ballasts

##### 3.1.4.1 Remote Ballasts

Remote type ballasts or transformers, where indicated, shall be mounted in a well ventilated, easily accessible location, within the maximum operating distance from the lamp, as designated by the manufacturer.

##### 3.1.4.2 Electronic Dimming Ballasts

All electronic dimming ballasts controlled by the same controller shall be of the same manufacturer. All fluorescent lamps on electronic dimming ballast control shall be seasoned or burned in at full light output for 100 hours before dimming.

#### 3.1.5 Exit Signs and Emergency Lighting Units

Wire exit signs and emergency lighting units ahead of the switch to the normal lighting circuit located in the same room or area.

##### 3.1.5.1 Exit Signs

Wire exit signs on separate circuits and serve from . Signs shall have only one control, which shall be . Paint control device red and provide lockout.

##### 3.1.6 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations.

##### 3.1.7 Occupancy Sensor

Provide quantity of sensor units indicated as a minimum. Provide additional units to give full coverage over controlled area. Full coverage shall 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. Set sensor "on" duration to 15 minutes.

### 3.2 FIELD QUALITY CONTROL

Upon completion of installation, conduct an operating test to show that equipment operates in accordance with requirements of this section.

#### 3.2.1 Electronic Dimming Ballast

Test for full range of dimming capability. Observe for visually detectable flicker over full dimming range.

#### 3.2.2 Occupancy Sensor

Test sensors for proper operation. Observe for light control over entire area being covered.

-- End of Section --

## SECTION 26 56 00

## EXTERIOR LIGHTING

05/13

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

ASTM B117 (2011) Standard Practice for Operating  
Salt Spray (Fog) Apparatus

## CALIFORNIA ENERGY COMMISSION (CEC)

CEC Title 24 (2008; Effective Jan 2010) California's  
Energy Efficiency Standards for  
Residential and Nonresidential Buildings

## ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IES)

IES HB-10 (2011) IES Lighting Handbook

IES LM-80 (2008) Measuring Lumen Maintenance of LED  
Light Sources

IES RP-16 (2010; Addendum A 2008; Addenda B & C  
2009) Nomenclature and Definitions for  
Illuminating Engineering

IES TM-15 (2011) Luminaire Classification System for  
Outdoor Luminaires

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative  
Dictionary of IEEE Standards Terms

IEEE C2 (2012; Errata 2012; INT 1-4 2012; INT 5-7  
2013; INT 8-10 2014; INT 11 2015) National  
Electrical Safety Code

IEEE C62.41.1 (2002; R 2008) Guide on the Surges  
Environment in Low-Voltage (1000 V and  
Less) AC Power Circuits

IEEE C62.41.2 (2002) Recommended Practice on  
Characterization of Surges in Low-Voltage  
(1000 V and Less) AC Power Circuits

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA C78.LL 1256 (2003) Procedures for Fluorescent Lamp

Sample Preparation and the Toxicity  
Characteristic Leaching Procedure (TCLP)

|                   |   |
|-------------------|---|
| NEMA 250          | (2008) Enclosures for Electrical Equipment<br>(1000 Volts Maximum)                                |
| NEMA ANSLG C82.11 | (2011) Lamp Ballasts - High-Frequency<br>Fluorescent Lamp Ballasts                                |
| NEMA C82.77       | (2002) Harmonic Emission Limits - Related<br>Power Quality Requirements for Lighting<br>Equipment |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

|         |   |
|---------|---|
| NFPA 70 | (2014; AMD 1 2013; Errata 1 2013; AMD 2<br>2013; Errata 2 2013; AMD 3 2014; Errata<br>3-4 2014; AMD 4-6 2014) National<br>Electrical Code |
|---------|---|

UNDERWRITERS LABORATORIES (UL)

|         |   |
|---------|---|
| UL 1598 | (2008; Reprint Oct 2012) Luminaires   |
| UL 8750 | (2009; Reprint Sep 2013) UL Standard for<br>Safety Light Emitting Diode (LED)<br>Equipment for Use in Lighting Products |
| UL 935  | (2001; Reprint Aug 2014) Standard for<br>Fluorescent-Lamp Ballasts  |

1.2 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 HID, fluorescent, and induction luminaire light sources, "Average Rated Life" is the time after which 50 percent of a large group of light sources will have failed and 50 percent will have survived under normal operating conditions.
- c. For LED luminaire light sources, "Useful Life" is the operating hours before reaching 70 percent of the initial rated lumen output (L70) with no catastrophic failures under normal operating conditions. This is also known as 70 percent "Rated Lumen Maintenance Life" as defined in IES LM-80.

1.3 SUBMITTALS

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

SD-03 Product Data

Fluorescent Luminaires; G  
Luminaire Light Sources

Luminaire Ballasts

#### SD-06 Test Reports

Operating test

Submit operating test results as stated in paragraph entitled  
"Field Quality Control."

#### SD-10 Operation and Maintenance Data

Electronic Ballast Warranty

Operational Service

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.

### 1.4 QUALITY ASSURANCE

#### 1.4.1 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.

#### 1.4.2 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 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

##### 1.4.2.1 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.

#### 1.4.2.2 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.

### 1.5 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.

#### 1.5.1 Electronic Ballast Warranty

Furnish the electronic ballasts manufacturer's warranty. The warranty period shall not be less than five (5) years from the date of manufacture. Ballast assembly in the lighting fixture, transportation, and on-site storage shall not exceed twelve (12) months, thereby permitting four (4) years of the five (5) year warranty to be in service and energized. The warranty shall state that the malfunctioning ballast shall be exchanged by the manufacturer and promptly shipped to the using Government facility. The replacement ballast shall be identical to, or an improvement upon, the original design of the malfunctioning ballast.

### 1.6 OPERATIONAL SERVICE

Coordinate with manufacturer for maintenance agreement. Collect information from the manufacturer about maintenance agreement options, and submit to Contracting Officer. Services shall reclaim materials for recycling and/or reuse. Services shall not deposit materials in landfills or burn reclaimed materials. Indicate procedures for compliance with regulations governing disposal of mercury. When such a service is not available, local recyclers shall be sought after to reclaim the materials.

## 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 FLUORESCENT LUMINAIRES

UL 1598, NEMA C82.77 and UL 8750. Provide luminaires as indicated in luminaire schedule and XL plates or details on project plans. Provide luminaires complete with light sources of quantity, type, and wattage indicated. All luminaires of the same type shall be provided by the same manufacturer.

#### 2.2.1 General Requirements

- c. Luminaires shall be UL listed for wet locations per UL 1598.
- 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.
- m. 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.
- n. 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.
- q. 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 Fluorescent Light Sources

- c. Compact fluorescent (CFL) light sources shall be 4-pin base, low-mercury, programmed-start, energy-savings type, rated as indicated on plans, minimum CRI of 82, with an average rated life of 16,000 hours minimum. Light sources shall be compliant with the most current TCLP test procedure per ANSI/NEMA C78.LL 1256 at time of manufacture.

### 2.2.3 Luminaire Ballasts

#### 2.2.3.1 Fluorescent Ballasts

UL 935, NEMA ANSLG C82.11, NFPA 70 and CEC Title 24, with no magnetic core and coil components, and shall meet the following requirements:

- a. Shall provide transient protection as recommended by IEEE C62.41.1 and IEEE C62.41.2.
- b. Shall be programmed-start or instant-start type as indicated in luminaire schedule on project drawings elsewhere in this specification.
- c. Shall be UL listed Class P, have a Class A sound rating, and have a minimum power factor of 0.98.
- d. Shall be designed for the wattage and quantity of light sources powered in the luminaire specified, and have circuit diagrams and lamp connection information printed on the exterior of the ballast housing.
- e. Shall contain no PCBs and be RoHS compliant.
- f. Shall be manufactured in an ISO 9001-certified facility.
- g. Shall operate at a frequency greater than 20 kHz minimum, preferably greater than 40 kHz, and shall have a Lamp Current Crest Factor less than 1.7.
- h. Shall have a light regulation of plus or minus 10 percent of lumen output when operated within a plus or minus 10 percent range of input voltage.
- i. Shall have a full replacement warranty of 5 years from date of manufacture for a maximum case temperature of 158 degrees F and 3 years for a maximum case temperature of 194 degrees F.
- j. All ballasts provided to operate 48 in T8 light sources shall be NEMA Premium type.

#### 2.2.3.1.1 Compact Fluorescent (CFL) Electronic Ballasts

Shall be programmed start type with ballast factor greater than or equal to 0.98, maximum input current THD of 10 percent, lamp end of life protection circuitry, and have a minimum starting temperature of 0 degrees F for primary light source(s).

The ballast efficacy factor rated at 120 volts shall be:

Minimum 3.64 for one 26W CFL light source.

Minimum 2.72 for one 32W CFL light source. Minimum 2.13 for one 42W CFL light source.

The input power shall be:

Maximum 29 watts for one 26W CFL light source.

Maximum 36 watts for one 32W CFL light source.

Maximum 46 watts for one 42W CFL light source.

### 2.3 EQUIPMENT IDENTIFICATION

#### 2.3.1 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.

### 2.3.2 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. Light source tube diameter code (e.g. T-5, T-8), tube quantity configuration (e.g. twin, quad, triple), base type (e.g. G24q-2, GX 24 q-4), and nominal wattage for fluorescent and compact fluorescent luminaires.
- c. Start type (e.g. programmed-start, rapid-start, instant-start) for fluorescent and compact fluorescent luminaires.
- e. 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.

## 2.4 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 GROUNDING

Ground noncurrent-carrying parts of equipment including luminaires, mounting arms, brackets, and metallic enclosures as specified. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

#### 3.1.2 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

### 3.2 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test after 100 hours of burn-in time to show that the equipment operates in accordance with the requirements of this section.

-- End of Section --



## SECTION 28 31 76

INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM  
08/11

## 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 SUMMARY

## 1.2.1 Scope

- a. This work includes completion of design and modifying the existing fire alarm and mass notification system as described herein and on the contract drawings for BEQ 4200. Include in the system 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 mentioned or described. Provide systems complete and ready for operation.
- b. Provide equipment, materials, installation, workmanship, inspection, and testing in strict accordance with the required and advisory provisions of NFPA 72, ISO 7240-16, IEC 60268-16, except as modified herein. The system layout on the drawings show the intent of coverage and are shown in suggested locations. Submit plan view drawing showing device locations, terminal cabinet locations, junction boxes, other related equipment, conduit routing, wire counts, circuit identification in each conduit, and circuit layouts for all floors. Drawings shall comply with the requirements of NFPA 170. Final quantity, system layout, and coordination are the responsibility of the Contractor.

## 1.3 REFERENCES

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

## ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S3.2

(2009; R 2014) Method for Measuring the  
Intelligibility of Speech Over  
Communication Systems (ASA 85)

## FM GLOBAL (FM)

## FM APP GUIDE

(updated on-line) Approval Guide  
<http://www.approvalguide.com/>

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

## IEEE C62.41.1

(2002; R 2008) Guide on the Surges  
Environment in Low-Voltage (1000 V and  
Less) AC Power Circuits

## IEEE C62.41.2

(2002) Recommended Practice on  
Characterization of Surges in Low-Voltage  
(1000 V and Less) AC Power Circuits

## 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)

## ISO 7240-16

(2007) Fire Detection And Alarm Systems -  
Part 16: Sound System Control And  
Indicating Equipment

## ISO 7240-19

(2007) Fire Detection and Alarm Systems -  
Part 19: Design, Installation,  
Commissioning and Service of Sound Systems  
for Emergency Purposes

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

## NFPA 170

(2012) Standard for Fire Safety and  
Emergency Symbols

## NFPA 70

(2014; AMD 1 2013; Errata 1 2013; AMD 2  
2013; Errata 2 2013; AMD 3 2014; Errata  
3-4 2014; AMD 4-6 2014) National  
Electrical Code

## NFPA 72

(2013) National Fire Alarm and Signaling  
Code

## NFPA 90A

(2015) Standard for the Installation of  
Air Conditioning and Ventilating Systems

## UNDERWRITERS LABORATORIES (UL)

## UL 1480

(2003; Reprint Oct 2012) Standard for  
Speakers for Fire Alarm, Emergency, and  
Commercial and Professional Use

## UL 1971

(2002; Reprint Oct 2008) Signaling Devices  
for the Hearing Impaired

## UL 2017

(2008; Reprint May 2011) General-Purpose

## Signaling Devices and Systems

|                          |  |
|--------------------------|--|
| UL 464                   | (2009; Reprint Apr 2012) Standard for Audible Signal Appliances                            |
| UL 864                   | (2003; Reprint Aug 2012) Standard for Control Units and Accessories for Fire Alarm Systems |
| UL Electrical Constructn | (2012) Electrical Construction Equipment Directory   |
| UL Fire Prot Dir         | (2012) Fire Protection Equipment Directory   |

## 1.4 DEFINITIONS

Wherever mentioned in this specification or on the drawings, the equipment, devices, and functions shall be defined as follows:

## 1.4.1 Interface Device

An addressable device that interconnects hard wired systems or devices to an analog/addressable system.

## 1.4.2 Remote Fire Alarm and Mass Notification Control Unit

A control panel, electronically remote from the fire alarm and mass notification control panel, that receives inputs from automatic and manual fire alarm devices; may supply power to detection devices and interface devices; may provide transfer of power to the notification appliances; may provide transfer of condition to relays or devices connected to the control unit; and reports to and receives signals from the fire alarm control panel.

## 1.4.3 Fire Alarm Control Unit and Mass Notification Autonomous Control Unit (FMCP)

A master control panel having the features of a fire alarm and mass notification control unit and fire alarm and mass notification control units are interconnected. The panel has central processing, memory, and input and output terminals.

## 1.4.4 Local Operating Console (LOC)

A unit designed to allow emergency responders and/or building occupants to operate the MNS including delivery or recorded and/or live messages, initiate strobe and textural visible appliance operation and other relayed functions.

## 1.4.5 Terminal Cabinet

A steel cabinet with locking, hinge-mounted door that terminal strips are securely mounted.

## 1.5 SUBMITTALS

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

SD-02 Shop Drawings

- Wiring Diagrams
- System Layout
- System Operation
- Notification Appliances

## SD-03 Product Data

- Batteries
- Battery chargers
- Annunciator
- Notification appliances
- Addressable interface devices

## SD-05 Design Data

- Battery power

## SD-06 Test Reports

- Field Quality Control
- Testing Procedures
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## SD-07 Certificates

- Installer
- Formal Inspection and Tests
- Final Testing

## SD-09 Manufacturer's Field Reports

- System Operation
- Fire Alarm/Mass Notification System

## SD-11 Closeout Submittals

- As-Built Drawings

## 1.6 QUALITY ASSURANCE

Equipment and devices shall be compatible and operable with existing station fire alarm system and shall not impair reliability or operational functions of existing supervising station fire alarm system.

- a. In NFPA publications referred to herein, consider advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; interpret reference to "authority having jurisdiction" to mean the Naval Facilities Engineering Command, Mid-Atlantic, 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 Design Services

Installations requiring completion of installation drawings and specification or modifications of fire detection, fire alarm, mass notification system, fire suppression systems or mass notification systems shall require the services and review of a qualified engineer. For the purposes of meeting this requirement, a qualified engineer is defined as an individual meeting the following condition:

- a. A registered professional engineer (P.E.) in fire protection engineering.

#### 1.6.1.2 Supervisor

NICET Fire Alarm Technicians to perform the installation of the system. A NICET Level III Fire Alarm Technician shall supervise the installation of the fire alarm system/mass notification system. The Fire Alarm technicians supervising the installation of equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

#### 1.6.1.3 Technician

Fire Alarm Technicians with a minimum of four years of experience utilized to install and terminate fire alarm/mass notification devices, 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 drawings.

#### 1.6.1.4 Installer

Fire Alarm installer with a minimum of two years of experience utilized to assist in the installation of fire alarm/mass notification devices, cabinets and panels. An electrician shall be allowed to install wire, cable, conduit and backboxes for the fire alarm system/mass notification system. The Fire Alarm installer shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

#### 1.6.1.5 Test Personnel

Fire Alarm Technicians with a minimum of eight years of experience (NICET Level III) utilized to test and certify the installation of the fire alarm/mass notification devices, 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 drawings.

#### 1.6.1.6 Manufacturer's Representative

The fire alarm and mass notification equipment manufacturer's representative shall be present for the connection of wiring to the control panel. The Manufacturer's Representative shall be an employee of the manufacturer with necessary technical training (NICET Level III) on the system being installed.

#### 1.6.1.7 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 protected premises fire alarm system, complete, conforming to NFPA 72, except as otherwise or additionally specified herein.

#### 1.6.2 Regulatory Requirements

##### 1.6.2.1 Requirements for Fire Protection Service

Equipment and material shall have been tested by UL and listed in UL Fire Prot Dir or approved by FM and listed in FM APP GUIDE. Where the terms "listed" or "approved" appear in this specification, they shall mean listed in UL Fire Prot Dir or FM APP GUIDE. The omission of these terms under the description of any item of equipment described shall not be construed as waiving this requirement. All listings or approval by testing laboratories shall be from an existing ANSI or UL published standard.

##### 1.6.2.2 Fire Alarm/Mass Notification System

Furnish equipment that is compatible and is UL listed, FM approved, or listed by a nationally recognized testing laboratory for the intended use. All listings by testing laboratories shall be from an existing ANSI or UL published standard. Submit a unique identifier for each device, including the control panel and initiating and indicating devices, with an indication of test results, and signature of the factory-trained technician of the control panel manufacturer and equipment installer. Include the NFPA 72 Record of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports.

##### 1.6.2.3 Fire alarm Testing Services or Laboratories

Construct fire alarm and fire detection equipment in accordance with UL Fire Prot Dir, UL Electrical Constructn, or FM APP GUIDE.

#### 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.

### PART 2 PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

Submit annotated catalog data as required in the paragraph SUBMITTAL, 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 ISO A1. Also provide UL or FM listing cards for equipment provided.

##### 2.1.1 Standard Products

Provide materials, equipment, and devices that have been tested by a nationally recognized testing laboratory, such as UL or FM Approvals, LLC (FM), and listed or approved for fire protection service when so required by NFPA 72 or this specification. Select material from one manufacturer, where possible, and not a combination of manufacturers, for any particular classification of materials. 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.

## 2.2 GENERAL PRODUCT REQUIREMENT

All fire alarm and mass notification equipment shall be listed for use under the applicable reference standards. Interfacing of Listed UL 864 or similar approved industry listing with Mass Notification Panels listed to UL 2017 shall be done in a laboratory listed configuration, if the software programming features cannot provide a listed interface control. If a field modification is needed, such as adding equipment like relays, the manufacturer of the panels being same or different brand from manufacturer shall provide the installing contractor for review and confirmation by the installing contractor. As part of the submittal documents, provide this information.

## 2.3 SYSTEM OPERATION

The Addressable Interior Fire Alarm and Mass Notification 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 alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset and the control panel is reset and restored to normal. The system may be placed in the alarm mode by local microphones, LOC, or remotely from authorized locations/users.

Submit data on each circuit to indicate that there is at least 25 percent spare capacity for notification appliances, 25 percent spare capacity for initiating devices. Annotate data for each circuit on the drawings. Submit a complete description of the system operation in matrix format on the drawings. Submit a complete list of device addresses and corresponding messages.

### 2.3.1 Alarm Initiating Devices and Notification Appliances (Visual/Voice)

- a. Connect alarm initiating devices to initiating device circuits (IDC) that match the existing circuit classification, or to signal line circuits (SLC) that match the existing circuit classification and installed in accordance with NFPA 72.
- b. Connect alarm notification appliances and speakers to notification appliance circuits (NAC) that match the existing circuit classification.
- c. The system shall operate in the alarm mode upon actuation of any alarm initiating device or a mass notification signal. The system shall remain in the alarm mode until initiating device(s) or mass notification signal is/are reset and the control panel is manually reset and restored to normal. Audible, and visual appliances and systems shall comply with NFPA 72 and as specified herein. Fire alarm system/mass notification system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc.

### 2.3.2 Functions and Operating Features

The system shall provide the following functions and operating features:

- a. The FMCP shall provide power, annunciation, supervision, and control for the system. Addressable systems shall be microcomputer

(microprocessor or microcontroller) based with a minimum word size of eight bits with sufficient memory to perform as specified.

- b. For Class "A" or "X" circuits with conductor lengths of 10 feet or less, the conductors shall be permitted to be installed in the same raceway in accordance with NFPA 72.
- c. Provide notification appliance circuits. The visual alarm notification appliances shall have the flash rates synchronized as required by NFPA 72.
- d. Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel.
- e. Provide an audible and visual trouble signal to activate upon a single break or open condition, or ground fault (or short circuit for Class "X"). The trouble signal shall also operate upon loss of primary power (AC) supply, absence of a battery supply, low battery voltage, or removal of alarm or supervisory panel modules. Provide a trouble alarm silence feature that shall silence the audible trouble signal, without affecting the visual indicator. After the system returns to normal operating conditions, the trouble signal shall again sound until the trouble is acknowledged. A smoke sensor in the process of being verified for the actual presence of smoke shall not initiate a trouble condition.
- f. Provide program capability via switches in a locked portion of the FACP to bypass the automatic notification appliance circuits, fire reporting system, and air handler shutdown features. Operation of this programming shall indicate this action on the FACP display and history log.
- g. Alarm, supervisory, and/or trouble signals shall be automatically transmitted to the fire department.
- h. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.
- i. The system shall be capable of being programmed from the panels keyboard. Programmed information shall be stored in non-volatile memory.
- j. The system shall be capable of operating, supervising, and/or monitoring both addressable and non-addressable alarm and supervisory devices.
- k. There shall be no limit, other than maximum system capacity, as to the number of addressable devices, that may be in alarm simultaneously.
- l. Where the fire alarm/mass notification 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 in the vicinity of the emergency control device.
- m. 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 control panel (FACP/MNCP), and on the annunciator.
  - (3) Continuous actuation of all alarm notification appliances.
  - (4) Recording of the event via electronically in the history log of the fire control system unit.
  - (5) Operation of a duct smoke sensor shall shut down the appropriate air handler in accordance with NFPA 90A in addition to other requirements of this paragraph and as allowed by NFPA 72.
- n. A supervisory signal shall automatically initiate the following functions:
- (1) Visual indication of the device operated on the FACP, and on the annunciator, and sound the audible alarm at the respective panel.
  - (2) Transmission of a supervisory signal to the fire department.
  - (3) Recording of the event electronically in the history log of the control unit.
- o. A trouble condition shall automatically initiate the following functions:
- (1) Visual indication of the system trouble on the FACP, and on the annunciator, and sound the audible alarm at the respective panel.
  - (2) Transmission of a trouble signal to the fire department.
  - (3) Recording of the event in the history log of the control unit.
- p. The maximum permissible elapsed time between the actuation of an initiating device and its indication at the FACP is 10 seconds.
- r. The maximum elapsed time between the occurrence of the trouble condition and its indication at the FACP is 200 seconds.
- r. Activation of a LOC pushbutton shall activate the audible and visual alarms in the facility. The audible message shall be the one associated with the pushbutton activated.

## 2.4 SYSTEM MONITORING

### 2.4.1 Valves

Each valve affecting the proper operation of a fire protection system, including automatic sprinkler control valves, sprinkler service entrance valve, and valves at backflow preventers, whether supplied under this contract or existing, shall be electrically monitored to ensure its proper position. Provide each tamper switch with a separate address.

## 2.5 OVERVOLTAGE AND SURGE PROTECTION

### 2.5.1 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.

#### 2.5.2 Sensor 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(s):

- 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.

#### 2.6 ADDRESSABLE INTERFACE DEVICES

The initiating device being monitored shall be configured to match the existing wiring classification for 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 waterflow switches, valve supervisory switches, fire pump monitoring, independent smoke detection systems, relays for output function actuation, etc. 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 and is visible through the device cover plate. Pull stations with a monitor module in a common backbox are not required to have an LED.

#### 2.7 ADDRESSABLE CONTROL MODULE

The control module shall be capable of operating as a relay (dry contact form C) 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" notification appliance circuits. 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. 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 and is visible through the device cover plate. Control Modules shall be located in environmental areas that reflect the conditions to which they were listed.

## 2.8 SMOKE SENSORS

### 2.8.1 Smoke Sensor Testing

Smoke sensors shall be tested in accordance with NFPA 72 and manufacturer's recommended calibrated test method. Submit smoke sensor testing procedures for approval. In addition to the NFPA 72 requirements, smoke detector sensitivity shall be tested during the preliminary tests.

## 2.9 ELECTRIC POWER

### 2.9.1 Primary Power

Power shall be 120 VAC service for the FMCP from the AC service to the building in accordance with NFPA 72.

### 2.10 SECONDARY POWER SUPPLY

Provide for system operation in the event of primary power source failure. Transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power shall be automatic and shall not cause transmission of a false alarm.

#### 2.10.1 Batteries

Provide additional sealed, maintenance-free, batteries that match existing if required as the source for emergency power to the FMCP. Batteries shall contain suspended electrolyte. The battery system shall be maintained in a fully charged condition by means of a solid state battery charger.

##### 2.10.1.1 Capacity

Battery size shall be the greater of the following two capacities.

- a. Sufficient capacity to operate the fire alarm system under supervisory and trouble conditions, including audible trouble signal devices for 48 hours and audible and visual signal devices under alarm conditions for an additional 15 minutes.
- b. Sufficient capacity to operate the mass notification for 60 minutes after loss of AC power.

##### 2.10.1.2 Battery Power Calculations

- a. Verify that battery capacity exceeds supervisory and alarm power requirements.
  - (1) Substantiate the battery calculations for alarm, alert, and supervisory power requirements. Include ampere-hour requirements for each system component and each panel component, and compliance with UL 864.
  - (2) Provide complete battery calculations for both the alarm, alert, and supervisory power requirements. Submit ampere-hour requirements for each system component with the calculations.

- (3) A voltage drop calculation to indicate that sufficient voltage is available for proper operation of the system and all components, at the minimum rated voltage of the system operating on batteries.

- 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 Amp-Hours for the specified standby time, and then calculate the required Amp-Hours for the specified alarm time. Calculate the nominal battery voltage after operation on batteries for the specified time period. Using this voltage perform a voltage drop calculation for circuit containing device and/or appliances remote from the power sources.

#### 2.10.2 Battery Chargers

Replace existing batter charger if required with a solid state, fully automatic, variable charging rate battery charger. The charger shall be capable of providing 120 percent of the connected system load and shall maintain the batteries at full charge. In the event the batteries are fully discharged (20.4 Volts dc), the charger shall recharge the batteries back to 95 percent of full charge within 48 hours after a single discharge cycle as described in paragraph CAPACITY above. 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.

#### 2.11 ANNUNCIATOR

##### 2.11.1 Annunciator Panel

Provide an annunciator that includes an LCD display. The display shall indicate the device in trouble/alarm or any supervisory device. Display the device name, address, and actual building location.

A building floor plan shall be provided mounted (behind plexiglass or similar protective material) at the annunciator location. The floor plan shall indicate all rooms by name and number including the locations of stairs and elevators. The floor plan shall show all devices and their programmed address to facilitate their physical location from the LCD display information.

##### 2.11.2 Programming

Where programming for the operation of the annunciator is accomplished by a separate software program than the software for the FMCP, the software program shall not require reprogramming after loss of power. The software shall be reprogrammable in the field.

#### 2.12 NOTIFICATION APPLIANCES

##### 2.12.1 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. 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 70.7 VRMs and 25 VRMs, by means of selectable tap settings. Tap settings shall include taps of 1/8, 1/4, 1/2, 1, and 2 watt. Speakers shall incorporate a high efficiency speaker for maximum output at minimum power across a frequency range of 150 Hz to 10,000 Hz, and shall have a sealed back construction. Speakers shall be capable of installation on standard 4 inch square electrical boxes. 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 FMCP.

- b. Provide speaker mounting plates constructed of cold rolled steel having a minimum thickness of 16 gauge or molded high impact plastic 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.
- c. Speakers shall utilize screw terminals for termination of all field wiring.

#### 2.12.2 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and conform to the Architectural Barriers Act (ABA). 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. 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 1 flash per second and a minimum of 15 candela (actual output after derating for tinted lens) based on the UL 1971 test. Strobe shall be surface mounted. Where more than two appliances are located in the same room or corridor or field of view, provide synchronized operation. Devices shall use screw terminals for all field wiring.

#### 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. NFPA 70 accepted fire alarm cables that do not require the use of raceways except as modified herein are permitted.

##### 2.13.1 Alarm Wiring

The SLC wiring shall match existing in accordance with the manufacturers requirements. Copper signaling line circuits and initiating device circuit field wiring shall match existing AWG size twisted and shielded solid conductors at a minimum. Visual notification appliance circuit conductors, that contain audible alarm appliances, shall be solid copper No. 14 AWG size conductors at a minimum. Speaker circuits shall match existing AWG size twisted and shielded conductors at a minimum. Wire size shall be sufficient to prevent voltage drop problems. Circuits operating at 24 VDC shall not operate at less than the UL listed voltages for the sensors and/or appliances. Power wiring, operating at 120 VAC minimum, shall be a minimum No. 12 AWG solid copper having similar insulation. Acceptable power-limited cables are FPL, FPLR or FPLP as appropriate with red colored covering. Nonpower-limited cables shall comply with NFPA 70.

## PART 3 EXECUTION

## 3.1 INSTALLATION OF FIRE ALARM INITIATING DEVICES AND NOTIFICATION APPLIANCES

## 3.1.1 FMCP

Relocate the FMCP where indicated on the drawings. Surface mount the enclosure with the top of the cabinet 6 feet above the finished floor or center the cabinet 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 in the FMCP.

## 3.1.2 Notification Appliance Devices

Locate/relocate notification appliance devices where indicated. Mount assemblies on walls as required by NFPA 72 and to meet the intelligibility requirements. Ceiling mounted speakers shall conform to NFPA 72.

## 3.1.3 Smoke Sensors

Relocate sensors as indicated on a 4 inch mounting box. Locate smoke sensors on the ceiling. Smoke sensors are permitted to be on the wall no lower than 12 inches from the ceiling with no minimum distance from the ceiling. Install smoke sensors no closer than 5 feet from air handling supply outlets.

## 3.1.4 Annunciator

Locate the annunciator as shown on the 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.

## 3.1.5 Water Flow Detectors and Tamper Switches

Connect to water flow detectors and tamper switches.

## 3.1.6 Local Operating Console (LOC)

Relocate the LOC as required by NFPA 72 and as indicated. Mount the console so that the top message button is no higher than 44 inches above the floor.

## 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 screw-type terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. The use of wire nuts or similar devices is prohibited. Conform wiring to NFPA 70.

Indicate the following in the wiring diagrams.

- a. 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 FACP and remote fire alarm control units, initiating circuits, switches, relays and terminals.

- b. Complete riser diagrams indicating the wiring sequence of devices and their connections to the control equipment. Include a color code schedule for the wiring. Include floor plans showing the locations of devices and equipment.

### 3.2.2 Alarm Wiring

Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Provide all wiring in electrical metallic conduit. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. The use of flexible conduit not exceeding a 6 foot length shall be permitted in initiating device or notification appliance circuits. Run conduit or tubing (rigid, IMC, EMT, FMC, etc. as permitted by NFPA 72 and NFPA 70) concealed unless specifically indicated otherwise.

Protect any exposed (as defined in NFPA 70) cables against physical damage by the use of magnetic raceways which shall also be red colored. Utilize shielded wiring where recommended by the manufacturer. For shielded wiring, ground the shield at only one point, that is in or adjacent to the FMCP. Pigtail or T-tap connections to signal line circuits, initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. Color coding is required for circuits and shall be maintained throughout the circuit. Conductors used for the same functions shall be similarly color coded. Conform wiring to NFPA 70.

### 3.2.3 Conductor Terminations

Labeling of conductors at terminal blocks in terminal cabinets, FMCP, and remote FMCP and the LOC shall be provided at each conductor connection. Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet, FMCP, and remote FMCP 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 FIRESTOPPING

Provide firestopping for holes at conduit penetrations through floor slabs, fire rated walls, partitions with fire rated doors, corridor walls, and vertical service shafts in accordance with Section 07 84 00 FIRESTOPPING.

### 3.4 PAINTING

Paint exposed electrical, fire alarm conduit, and surface metal raceway to match adjacent finishes in exposed areas. Paint junction boxes red in unfinished areas and conduits and surface metal raceways shall be painted with a 1-inch wide red band every 10 feet in unfinished areas. Painting shall comply with Section 09 90 00 PAINTS AND COATINGS.

### 3.5 FIELD QUALITY CONTROL

#### 3.5.1 Testing Procedures

Submit detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level III 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, Guard's Tour 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; similar to the forms in NFPA 72) 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 all Initiating Device Circuits (IDC), Notification Appliance Circuits (NAC), Voice Notification System Circuits (NAC Audio), 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. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

#### 3.5.2 Tests Stages

##### 3.5.2.1 Preliminary Testing

Conduct preliminary tests to ensure that devices and circuits are functioning properly. Tests shall meet the requirements of paragraph entitled "Minimum System Tests." After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that panel functions were tested and operated properly. The letter shall include the names and titles of the witnesses to the preliminary tests. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.

### 3.5.2.2 Request for Formal Inspection and Tests

When tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection and tests to the Naval Facilities Engineering Command, Mid-Atlantic, Fire Protection Engineer.

### 3.5.2.3 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 following are provided at the job site:

- a. The systems manufacturer's technical representative
- b. Marked-up red line drawings of the system as actually installed
- c. Megger test results
- d. Loop resistance test results
- e. Complete program printout including input/output addresses

The final tests will be witnessed by the Naval Facilities Engineering Command, Mid-Atlantic, Fire Protection Engineer. At this time, any and all required tests shall be repeated at their discretion.

### 3.5.2.4 System Acceptance

Following acceptance of the system, as-built drawings and O&M manuals shall be delivered to the Contracting Officer for review and acceptance. Submit six sets of detailed as-built drawings. The drawings shall show the system as installed, including deviations from both the project drawings and the approved shop drawings. These drawings shall be submitted within two weeks after the final acceptance test of the system. At least one set of as-built (marked-up) drawings shall be provided at the time of, or prior to the final acceptance test.

- a. Furnish one set of CD or DVD discs containing software back-up and CAD based drawings in latest version of AutoCAD and DXF format of as-built drawings and schematics.
- b. Include complete wiring diagrams showing connections between devices and equipment, both factory and field wired.
- c. Include a riser diagram and drawings showing the as-built location of devices and equipment.

### 3.5.3 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:

- 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 device and notification appliance and circuit for proper operation and response at the control unit. Smoke sensors shall be tested in accordance with manufacturer's recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors shall comply with the requirements of NFPA 72 except that, for item 12(e) (Supervision) in Table 14.4.2.2, disconnect at least 20 percent of devices. If there is a failure at these devices, then supervision shall be tested at each device.
- 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 FACP. 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 sensors during tests to minimize the amount of smoke needed to activate the sensor. Testing of smoke sensors shall be conducted using real smoke or the use of canned smoke which is permitted.
- p. Measure the voltage drop at the most remote appliance (based on wire

length) on each notification appliance circuit.

#### 3.5.3.1 Intelligibility Test for First Floor Central Core

Intelligibility testing of the System shall be accomplished in accordance with NFPA 72 for Voice Evacuation Systems, IEC 60268-16, and ASA S3.2. Following are the specific requirements for intelligibility tests:

- a. Intelligibility Requirements: Verify intelligibility by measurement after installation.
- b. Ensure that a CIS value greater than the required minimum value is provided in each area where building occupants typically could be found. The minimum required value for CIS is 0.7.
- c. Areas of the building provided with hard wall and ceiling surfaces (such as metal or concrete) that are found to cause excessive sound reflections may be permitted to have a CIS score less than the minimum required value if approved by the DOD installation, and if building occupants in these areas can determine that a voice signal is being broadcast and they must walk no more than 33 feet to find a location with at least the minimum required CIS value within the same area.
- d. Areas of the building where occupants are not expected to be normally present are permitted to have a CIS score less than the minimum required value if personnel can determine that a voice signal is being broadcast and they must walk no more than 50 feet to a location with at least the minimum required CIS value within the same area.
- e. Take measurements near the head level applicable for most personnel in the space under normal conditions (e.g., standing, sitting, sleeping, as appropriate).
- f. The distance the occupant must walk to the location meeting the minimum required CIS value shall be measured on the floor or other walking surface as follows:
  - (1) Along the centerline of the natural path of travel, starting from any point subject to occupancy with less than the minimum required CIS value.
  - (2) Curving around any corners or obstructions, with a 12 inches clearance there from.
  - (3) Terminating directly below the location where the minimum required CIS value has been obtained.

Use commercially available test instrumentation to measure intelligibility as specified by ISO 7240-19 and ISO 7240-16 as applicable. Use the mean value of at least three readings to compute the intelligibility score at each test location.

#### 3.6 EXTRA MATERIALS

##### 3.6.1 Repair Service/Replacement Parts

Repair services and replacement parts for the system shall be available for a period of 10 years after the date of final acceptance of this work by the Contracting Officer. 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.

#### 3.6.2 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.

#### 3.6.3 Spare Parts

Spare parts shall be delivered to the Contracting Officer at the time of the final acceptance testing. Furnish the following spare parts and accessories:

- a. Four fuses for each fused circuit
- b. Two of each type of notification appliance added to the system (e.g. speaker, FA strobe, MNS strobe, etc.)
- c. Two of each type of initiating device added to the system (e.g. smoke detector, thermal detector, manual station, etc.)

#### 3.6.4 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.

-- End of Section --

SECTION 31 11 00

CLEARING AND GRUBBING  
08/08

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 store at 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 TREE WOUND PAINT

Submit samples in cans with manufacturer's label of bituminous based paint of standard manufacture specially formulated for tree wounds.

2.2 HERBICIDE

Comply with Federal Insecticide, Fungicide, and Rodenticide Act (Title 7 U.S.C. Section 136) for requirements on Contractor's licensing, certification and record keeping. Contact the command Pest Control Coordinator prior to starting work. Submit samples in cans with manufacturer's label.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2 Trees, Shrubs, and Existing Facilities

Protection shall be in accordance with Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the

circumstances require.

### 3.1.3 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 repairs 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.

### 3.3 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.

### 3.4 PRUNING

Prune 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.

### 3.5 GRUBBING

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed 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. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

### 3.6 DISPOSAL OF MATERIALS

#### 3.6.1 Saleable Timber

1. The Government shall, 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.

#### 3.6.2 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 in the designated waste disposal area, 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 --

## SECTION 31 23 00.00 20

## EXCAVATION AND FILL

02/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## ASTM INTERNATIONAL (ASTM)

|               |   |
|---------------|---|
| ASTM C136     | (2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates  |
| ASTM C33/C33M | (2013) Standard Specification for Concrete Aggregates   |
| ASTM D1140    | (2000; R 2006) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve   |
| ASTM D1556    | (2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method   |
| ASTM D1557    | (2009) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft <sup>3</sup> ) (2700 kN-m/m <sup>3</sup> ) |
| ASTM D2487    | (2011) Soils for Engineering Purposes (Unified Soil Classification System)  |
| ASTM D4318    | (2010) Liquid Limit, Plastic Limit, and Plasticity Index of Soils   |
| ASTM D6938    | (2010) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)                                  |
| ASTM D698     | (2007e1) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))  |

## 1.2 DEFINITIONS

## 1.2.1 Degree of Compaction

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D698, for general soil types, abbreviated as percent laboratory maximum density.

### 1.2.2 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

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

Submit 15 days prior to starting work.

#### 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

Do not furnish or transport soils onto MCAS Cherry Point or outlying fields when such act would violate the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) or the General Statutes of North Carolina.

The contractor shall provide documentation certifying that all soil furnished under the contract contains no petroleum or hazardous or toxic materials as stated in DoD Instruction 4715.6, which implements 10 U.S.C. 2692. This documentation shall include the Soil Authorization Form (SAF) showing the volume of soil needed, analytical test data to support the environmental condition of the soil, and a copy of the State-issued "mining permit" for the borrow pit source. The MCAS Cherry Point Environmental Affairs Department (EAD) will review these documents before off site soil is considered approved for use.

The following methods shall be used to determine if soil meets the requirements for off site soil (RFOSS).

If the total amount of soil to be brought onto MCAS Cherry Point for a single contract is less than 200 cubic yards, the contractor shall certify the soil meets the RFOSS by inspecting for "apparent contamination" as determined by visual or other indications of contamination including abnormal or unnatural color, chemical or petroleum odors, or saturation with a chemical or petroleum. If the soil shows no apparent contamination, the contractor shall provide to EAD a signed SAF certifying the soil contains no apparent contamination. Soil showing apparent contamination shall not be utilized aboard MCAS Cherry Point or outlying fields.

If the total amount of soil to be brought aboard MCAS Cherry Point for a single contract is equal to or greater than 200 cubic yards, the soil shall be analyzed by a North Carolina certified laboratory. The laboratory must be certified by North Carolina in the specific tests to be performed. Sampling must be conducted by qualified personnel following proper field sampling methodology and proper chain-of-custody protocol must be followed. Otherwise, the sampling will be considered invalid. Consult with the selected laboratory about the specific sample handling procedures required by the analytical methods. Sample containers, sample volumes, and timeframes differ depending on the analytical method.

Sampling requirements are summarized below and are for a single soil source only.

- (a) One representative sample for soil volumes of 200 cubic yards to 1,000 cubic yards needed.
- (b) For soil volumes greater than 1,000 cubic yards, one additional representative sample is required for each additional 2,000 cubic yards or portion thereof.

A representative sample is achieved by collecting multiple samples in a defined area (e.g. soil stockpile or borrow pit) and directing the laboratory to combine them into a "composite sample" for analysis. The composite or representative sample is intended to represent the soil source as a whole.

Samples shall be collected by qualified personnel following proper field sampling methodology. For each representative sample, 3 "primary samples" from each of 2 soil borings (or excavation pits) shall be obtained for a total of 6 primary samples. The 3 primary samples collected from each

boring/pit shall be obtained at even intervals throughout the soil column (i.e. upper, middle, lower) and placed into individual sampling containers. Samples shall not be combined in the field. The 6 primary samples shall be sent to the NC certified laboratory where they will be combined into one "composite sample" for analysis.

Soil sample(s) shall be analyzed for Gasoline Range Organics (GRO), Diesel Range Organics (DRO), Oil and Grease (O&G), and eight Metals (Arsenic; Barium; Cadmium; Chromium; Lead; Mercury; Selenium; and Silver). The laboratory method detection limits must be set below the State action levels or the testing will be considered invalid. All units are to be reported in milligrams per kilograms (mg/kg).

Soil samples should be analyzed for the following parameters:

- (a) Gasoline Range Organics - use Standard Method 5030
- (b) Diesel Range Organics - use Standard Method 5030
- (c) Oil & Grease - use EPA Method 9071 with a silica gel wash
- (d) Total Metals - use EPA 6010 (Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, and Silver)
- (e) Total Metals - use EPA 7471 (Mercury only)

If test results are greater than the allowed detection limits for petroleum constituents (GRO, DRO, O&G) or the standards for the eight metals (as provided by the EPA), the soil from which the sample was taken shall not be approved for use.

## 1.7 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.

## 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 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.

### 3.2.1 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.

### 3.2.2 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.

### 3.2.3 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."

### 3.2.4 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.

### 3.3 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Minimum subgrade density shall be as specified herein.

#### 3.3.1 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 and paved areas 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.

### 3.4 FILLING AND BACKFILLING

Fill and backfill to contours, elevations, and dimensions indicated. Compact each lift before placing overlaying lift.

#### 3.4.1 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.



### 3.5 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved borrow materials shall be obtained as specified herein.

### 3.6 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.

#### 3.6.1 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.

#### 3.6.2 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.

#### 3.6.3 Adjacent Area

Compact areas within 5 feet of structures to 90 percent of ASTM D698.

#### 3.6.4 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.

### 3.7 FINISH OPERATIONS

#### 3.7.1 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.

#### 3.7.2 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.

### 3.8 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.

### 3.9 FIELD QUALITY CONTROL

#### 3.9.1 Sampling

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

#### 3.9.2 Testing

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

##### 3.9.2.1 Select Material Testing

Test select material in accordance with ASTM C136 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.

##### 3.9.2.2 Porous Fill Testing

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

##### 3.9.2.3 Density Tests

Test density in accordance with ASTM D1556, or ASTM D6938. When ASTM D6938 density tests are used, verify density test results by performing an ASTM D1556 density test at a location already ASTM D6938 tested as specified herein. Perform an ASTM D1556 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.

-- End of Section --

## SECTION 32 17 23.00 20

## PAVEMENT MARKINGS

04/06

## PART 1 GENERAL

## 1.1 REFERENCES

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

## INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI)

ICRI 03732 (1997) Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-P-1952 (Rev D) Paint, Traffic and Airfield Markings, Waterborne

## 1.2 SUBMITTALS

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

## SD-03 Product Data

Paints for roads and streets

Equipment

Lists of proposed equipment, including descriptive data, and notifications of proposed Contractor actions as specified in this section. List of removal equipment shall include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation.

Qualifications

Documentation on personnel qualifications, as specified.

## SD-06 Test Reports

Paints for roads and streets

Certified reports from sampling and testing made in accordance with paragraph entitled "Sampling and Testing" prior to the use of the materials at the jobsite. Testing shall be performed in an approved independent laboratory.

## SD-07 Certificates

Paints for roads and streets

Volatile Organic Compound (VOC)

Certificate stating that the proposed pavement marking paint meets the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located.

Construction equipment list

SD-08 Manufacturer's Instructions

Paints for roads and streets

Submit manufacturer's Material Safety Data Sheets.

### 1.3 DELIVERY AND STORAGE

Deliver paints, paint materials and thermoplastic compound materials in original sealed containers that plainly show the designated name, specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer. Provide storage facilities at the job site for maintaining materials at temperatures recommended by the manufacturer.

### 1.4 WEATHER LIMITATIONS

Apply paint to clean, dry surfaces, and unless otherwise approved, only when the air and pavement surface temperature is at least 5 degrees above the dew point and the air and pavement temperatures are above 40 degrees F and less than 95 degrees F for oil-based materials; above 50 degrees F and less than 110 degrees F for water-based materials. Maintain paint temperature within these same limits.

### 1.5 EQUIPMENT

Machines, tools, and equipment used in the performance of the work shall be approved by the Contracting Officer and maintained in satisfactory operating condition. Submit construction equipment list for approval by the Contracting Officer.

#### 1.5.1 Mobile and Maneuverable

Application equipment shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.

#### 1.5.2 Paint Application Equipment

##### 1.5.2.1 Hand-Operated, Push-Type Machines

Provide hand-operated push-type applicator machine of a type commonly used for application of paint to pavement surfaces. Paint applicator machine shall be acceptable for marking small street and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage

specified. Applicator for water-based markings shall be equipped with non-stick coated hoses; metal parts in contact with the paint material shall be constructed of grade 302, 304, 316, or equal stainless steel.

#### 1.5.2.2 Self-Propelled or Mobile-Drawn Pneumatic Spraying Machines

Provide self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. Provide machine having a speed during application capable of applying the stripe widths indicated at the paint coverage rate specified herein and of even uniform thickness with clear-cut edges. Provide equipment used for marking streets and highways capable of placing the prescribed number of lines at a single pass as solid lines, intermittent lines, or a combination of solid and intermittent lines using a maximum of three different colors of paint as specified. Provide paint applicator with paint reservoirs or tanks of sufficient capacity and suitable gages to apply paint in accordance with requirements specified. Equip tanks with suitable air-driven mechanical agitators. Equip spray mechanism with quick-action valves conveniently located, and include necessary pressure regulators and gages in full view and reach of the operator. Install paint strainers in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Provide pneumatic spray guns for hand application of paint in areas where the mobile paint applicator cannot be used. Applicator for water-based markings shall be equipped with non-stick coated hoses; metal parts in contact with the paint material shall be constructed of grade 302, 304, 316, or equal stainless steel.

#### 1.5.3 Surface Preparation Equipment

##### 1.5.3.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 150 cfm of air at a pressure of not less than 90 psi at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

##### 1.5.3.2 Waterblast Equipment

The water pressure shall be specified at 2600 psi at 140 degrees F in order to adequately clean the surfaces to be marked.

#### 1.5.4 Marking Removal Equipment

Equipment shall be mounted on rubber tires and shall be capable of removing markings from the pavement without damaging the pavement surface or joint sealant. Waterblasting equipment shall be capable of producing an adjustable, pressurized stream of water. Sandblasting equipment shall include an air compressor, hoses, and nozzles. The compressor shall be equipped with traps to maintain the air free of oil and water.

##### 1.5.4.1 Shotblasting Equipment

Shotblasting equipment shall be capable of producing an adjustable depth of removal of marking and pavement. Each unit shall be self-cleaning and

self-contained, shall be able to confine dust and debris from the operation, and shall be capable of recycling the abrasive for reuse.

#### 1.5.4.2 Chemical Equipment

Chemical equipment shall be capable of application and removal of chemicals from the pavement surface, and shall leave only non-toxic biodegradeable residue.

#### 1.5.5 Traffic Controls

Suitable warning signs shall be placed near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

### 1.6 MAINTENANCE OF TRAFFIC

#### 1.6.1 Roads, Streets, and Parking Areas

When traffic must be rerouted or controlled to accomplish the work, the necessary warning signs, flagpersons, and related equipment for the safe passage of vehicles shall be provided.

### 1.7 WEATHER LIMITATIONS FOR REMOVAL

Pavement surface shall be free of snow, ice, or slush. Surface temperature shall be at least 40 degrees F and rising at the beginning of operations, except those involving shot or sand blasting. Operation shall cease during thunderstorms. Operation shall cease during rainfall, except for waterblasting and removal of previously applied chemicals. Waterblasting shall cease where surface water accumulation alters the effectiveness of material removal.

### 1.8 QUALIFICATIONS

The Contractor shall submit documentation certifying that pertinent personnel are qualified for equipment operation and handling of chemicals.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Provide materials conforming to the requirements specified herein.

#### 2.1.1 Paints for Roads and Streets

FS TT-P-1952, color as indicated.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Allow new pavement surfaces to cure for a period of not less than 30 days before application of marking materials. Thoroughly clean surfaces to be marked before application of the paint. Remove dust, dirt, and other

granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods as required. Remove rubber deposits, existing paint markings, residual curing compounds, and other coatings adhering to the pavement by water blasting. For Portland Cement Concrete pavement, grinding, light shot blasting, and light scarification, to a resulting profile equal to ICRI 03732 CSP 2, CSP 3, and CSP 4, respectively, can be used in addition to water blasting, to either remove existing coatings or for surface preparation on most pavements: shot blasting shall not be used on airfield pavements due to the potential of Foreign Object Damage (FOD) to aircraft. Scrub affected areas, where oil or grease is present on old pavements to be marked, with several applications of trisodium phosphate solution or other approved detergent or degreaser and rinse thoroughly after each application. After cleaning oil-soaked areas, seal with shellac or primer recommended by the manufacturer to prevent bleeding through the new paint. Do not commence painting in any area until pavement surfaces are dry and clean.

### 3.1.1 Early Painting of Asphalt Pavements

For asphalt pavement systems requiring painting application at less than 30 days, apply the paint and beads at half the normal application rate, followed by a second application at the normal rate after 30 days.

## 3.2 APPLICATION

### 3.2.1 Testing for Moisture

Apply pavement markings to dry pavement only. The Contractor shall test the pavement surface for moisture before beginning work after each period of rainfall, fog, high humidity, or cleaning, or when the ambient temperature has fallen below the dew point. Do not commence marking until the pavement is sufficiently dry and the pavement condition has been approved by the CO or authorized representative. Employ the "plastic wrap method" to test the pavement for moisture as follows: Cover the pavement with a 300 mm by 300 mm (12 inch by 12 inch) section of clear plastic wrap and seal the edges with tape. After 15 minutes, examine the plastic wrap for any visible moisture accumulation inside the plastic. Do not begin marking operations until the test can be performed with no visible moisture accumulation inside the plastic wrap.

### 3.2.2 Rate of Application

#### 3.2.2.1 Nonreflective Markings

Apply paint evenly to the pavement surface to be coated at a rate of 105 plus or minus 5 square feet per gallon.

### 3.2.3 Painting

Apply paint pneumatically with approved equipment at rate of coverage specified herein. Provide guidelines and templates as necessary to control paint application. Take special precautions in marking numbers, letters, and symbols. Manually paint numbers, letters, and symbols. Sharply outline all edges of markings. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. Discontinue painting operations if there is a deficiency in drying of the markings until cause of the slow drying is determined and corrected.

### 3.3 FIELD TESTING, INSPECTION, AND DEMONSTRATIONS

#### 3.3.1 Sampling and Testing

As soon as the paint and reflective and thermoplastic materials are available for sampling, obtain by random selection from the sealed containers, two quart samples of each batch in the presence of the Contracting Officer. Accomplish adequate mixing prior to sampling to ensure a uniform, representative sample. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Clearly identify samples by designated name, specification number, batch number, project contract number, intended use, and quantity involved. At the discretion of the Contracting Officer, samples provided may be tested by the Government for verification.

#### 3.3.2 Inspection

Examine material at the job site to determine that it is the material referenced in the report of test results or certificate of compliance. A certificate of compliance shall be accompanied by test results substantiating conformance to the specified requirements.

#### 3.3.3 Surface Preparations and Application Procedures

Surface preparations and application procedures will be examined by the Contracting Officer to determine conformance with the requirements specified. Approve each separate operation prior to initiation of subsequent operations.

##### 3.3.3.1 Test Stripe Demonstration

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

##### 3.3.3.2 Application Rate Demonstration

During the Test Stripe Demonstration, demonstrate compliance with the application rates specified herein. Document the equipment speed and operating pressures required to meet the specified rates in each configuration of the equipment and provide a copy of the documentation to the Contracting Officer or authorized representative 3 days prior to proceeding with the work.

##### 3.3.3.3 Level of Performance Demonstration

The Contracting Officer or authorized representative will be present the application demonstrations to observe the results obtained and to validate the operating parameters of the vehicle(s) and equipment. If accepted by the Contracting Officer or authorized representative, the test stripe shall be the measure of performance required for this project. Work shall not proceed until the demonstration results are satisfactory to the Contracting Officer or authorized representative.



### 3.4 TRAFFIC CONTROL AND PROTECTION

Place warning signs near the beginning of the work site and well ahead of the work site for alerting approaching traffic from both directions. Place small markers along newly painted lines to control traffic and prevent damage to newly painted surfaces. Mark painting equipment with large warning signs indicating slow-moving painting equipment in operation. Do not use foil-backed material for temporary pavement marking because of its potential to conduct electricity during accidents involving downed power lines.

### 3.5 QUALITY ASSURANCE

Demonstrate success of bond of reflective media, new paint marking and the pavement surface, vacuum cured surface of new marking after a seven (7) day dry time. Inspect newly applied markings for signs of bond failure based on visual inspection and comparison to results from Test Stripe Demonstration paragraph.

-- End of Section --

## SECTION 33 11 00

## WATER DISTRIBUTION

04/06

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.5.2.1M (1981; R 1995) Metric Round Head Short Square Neck Bolts

## AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300 (2010; Addenda 2011) Hypochlorites

AWWA B301 (2010) Liquid Chlorine

AWWA C104 (1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

AWWA C105 (2005) Polyethylene Encasement for Ductile-Iron Pipe Systems

AWWA C110 (2003) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1219 mm), for Water

AWWA C111 (2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

AWWA C115 (1999) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges

AWWA C151 (2002) Ductile-Iron Pipe, Centrifugally Cast, for Water

AWWA C153 (2000) Ductile-Iron Compact Fittings for Water Service

AWWA C500 (2002; A C500a-95) Metal-Seated Gate Valves for Water Supply Service

AWWA C509 (2001) Resilient-Seated Gate Valves for Water Supply Service

AWWA C600 (2005) Installation of Ductile-Iron Water Mains and Their Appurtenances

AWWA C651 (2005; Errata 2005) Standard for Disinfecting Water Mains

|           |  |
|-----------|--|
| AWWA C800 | (2005) Underground Service Line Valves and Fittings            |
| AWWA M11  | (2004) Manual: Steel Pipe: A Guide for Design and Installation |
| AWWA M23  | (2002) Manual: PVC Pipe - Design and Installation              |

## ASME INTERNATIONAL (ASME)

|                 |  |
|-----------------|--|
| ASME B16.1      | (2010) Gray Iron Threaded Fittings; Classes 25, 125 and 250  |
| ASME B16.26     | (2013) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes   |
| ASME B18.2.2    | (2010) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series) |
| ASME B18.5.2.2M | (1982; R 2000) Metric Round Head Square Neck Bolts   |

## ASTM INTERNATIONAL (ASTM)

|                 |   |
|-----------------|---|
| ASTM A 307      | (2014) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength           |
| ASTM A 47/A 47M | (1999; R 2014) Standard Specification for Ferritic Malleable Iron Castings                            |
| ASTM A 48/A 48M | (2003) Gray Iron Castings   |
| ASTM A 536      | (1984e1; R 2004) Standard Specification for Ductile Iron Castings                                     |
| ASTM A 563      | (2015) Standard Specification for Carbon and Alloy Steel Nuts   |
| ASTM B 61       | (2002) Steam or Valve Bronze Castings   |
| ASTM B 62       | (2002) Composition Bronze or Ounce Metal Castings   |
| ASTM C 94/C 94M | (2015) Standard Specification for Ready-Mixed Concrete  |
| ASTM D 1785     | (2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120 |
| ASTM D 2000     | (2008) Standard Classification System for Rubber Products in Automotive Applications                  |
| ASTM D 2241     | (2005) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)                                    |

|             |   |
|-------------|---|
| ASTM D 2464 | (1999e1) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80   |
| ASTM D 2466 | (2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40                         |
| ASTM D 2467 | (2005) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80  |
| ASTM D 2564 | (2004; R 2009e1) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems       |
| ASTM D 2774 | (2004) Underground Installation of Thermoplastic Pressure Piping  |
| ASTM D 2855 | (1996; R 2010) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings   |
| ASTM F 402  | (1993; R 1999) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings |

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)

|           |   |
|-----------|---|
| MSS SP-80 | (2008) Bronze Gate, Globe, Angle and Check Valves |
|-----------|---|

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

|            |  |
|------------|--|
| NFPA 24    | (2013) Standard for the Installation of Private Fire Service Mains and Their Appurtenances |
| NFPA 325-1 | (1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids             |
| NFPA 49    | (3003) Hazardous Chemicals Data  |
| NFPA 704   | (2001) Identification of the Hazards of Materials for Emergency Response                   |

UNDERWRITERS LABORATORIES (UL)

|        |   |
|--------|---|
| UL 262 | (2004) Standard for Gate Valves for Fire-Protection Service |
| UL 789 | (2004) Indicator Posts for Fire-Protection Service          |

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

|               |   |
|---------------|---|
| UBPPA UNI-B-8 | (2000) Recommended Practice for the Direct Tapping of Polyvinyl Chloride (PVC) Pressure Water Pipe (Nominal Diameters |
|---------------|---|

6-12 Inch)

## 1.2 DESIGN REQUIREMENTS

### 1.2.1 Water Distribution Mains

Provide water distribution mains indicated as 4 through 12 inch diameter pipe sizes of ductile-iron pipe. Provide ductile iron pipe for 12 inch diameter or larger pipe sizes. Also provide water main accessories, gate valves as specified and where indicated.

### 1.2.2 Water Service Lines

Provide water service lines indicated as less than 4 inch lines from water distribution main to building service at the points indicated. Water service lines shall be polyvinyl chloride (PVC) plastic pipe. Provide water service line appurtenances as specified and where indicated.

## 1.3 SUBMITTALS

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

### SD-03 Product Data

#### Piping Materials

Water distribution main piping, fittings, joints, valves, and coupling

Water service line piping, fittings, joints, valves, and coupling

Indicator posts

Corporation stops

Valve boxes Submit manufacturer's standard drawings or catalog cuts. Include information concerning gaskets with submittal for joints and couplings.

### SD-06 Test Reports

#### Bacteriological Disinfection

Test results from commercial laboratory verifying disinfection

### SD-07 Certificates

Water distribution main piping, fittings, joints, valves, and coupling

Water service line piping, fittings, joints, valves, and coupling

Shop-applied lining and coating

Lining

### SD-08 Manufacturer's Instructions

## Installation procedures for water piping

### 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. 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, and valves free of dirt and debris.

#### 1.4.2 Handling

Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place any other material or pipe inside a pipe or fitting after the coating has been applied. 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. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced 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.

##### 1.4.2.1 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, with classification as indicated in NFPA 49 and NFPA 325-1.

## PART 2 PRODUCTS

### 2.1 WATER DISTRIBUTION MAIN MATERIALS

#### 2.1.1 Piping Materials

##### 2.1.1.1 Ductile-Iron Piping

- a. Pipe and Fittings: Pipe, AWWA C151, Pressure Class 350. Flanged pipe, AWWA C115. Fittings, AWWA C110 or AWWA C153. Fittings shall have pressure rating at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the specified joints. Pipe and fittings shall have cement-mortar lining, AWWA C104, standard thickness.

- b. Joints and Jointing Material:

- (1) Joints: Joints for pipe and fittings shall be push-on joints

or mechanical joints unless otherwise indicated. Provide mechanical joints where indicated. Provide flanged joints where indicated. Provide mechanically coupled type joints using a sleeve-type mechanical coupling. Joints made with sleeve-type mechanical coupling may be used in lieu of push-on joint, subject to the limitations specified in paragraph entitled "Sleeve-Type Mechanical Couplings."

(2) Push-On Joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly, AWWA C111.

(2) Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets, AWWA C111.

(3) Flanged Joints: Bolts, nuts, and gaskets for flanged connections as recommended in the Appendix to AWWA C115. Flange for setscrewed flanges shall be of ductile iron, ASTM A 536, Grade 65-45-12, and conform to the applicable requirements of ASME B16.1, Class 250. Setscrews for setscrewed flanges shall be 190,000 psi tensile strength, heat treated and zinc-coated steel. Gasket and lubricants for setscrewed flanges, in accordance with applicable requirements for mechanical-joint gaskets specified in AWWA C111. Design of setscrewed gasket shall provide for confinement and compression of gasket when joint to adjoining flange is made.

(6) Sleeve-Type Mechanical Coupled Joints: As specified in paragraph entitled "Sleeve-Type Mechanical Couplings."

## 2.1.2 Valves and Other Water Main Accessories

### 2.1.2.1 Gate Valves on Buried Piping

AWWA C500, AWWA C509, or UL 262. Unless otherwise specified, valves conforming to: (1) AWWA C500 shall be nonrising stem type with double-disc gates and mechanical-joint ends or push-on joint ends as appropriate for the adjoining pipe, (2) AWWA C509 shall be nonrising stem type with mechanical-joint ends, and (3) UL 262 shall be inside-screw type with operating nut, double-disc or split-wedge type gate, designed for a hydraulic working pressure of 350 psi, and shall have mechanical-joint ends or push-on joint ends as appropriate for the pipe to which it is joined. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have O-ring stem seals. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair. Where a post indicator is shown, the valve shall have an indicator post flange; indicator post flange for AWWA C500 valve shall conform to the applicable requirements of UL 262.

### 2.1.2.2 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 at 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.

#### 2.1.2.3 Indicator Posts

The indicator post shall comply with the requirements of UL 789. Provide for gate valves where indicated. Provide lockable type post indicator valve.

#### 2.1.2.4 Valve Boxes

Provide a valve box for each gate valve on buried piping, except where indicator post is shown. Valve boxes shall be of cast iron or precast concrete of a size suitable for the valve on which it is to be used and shall be adjustable. Cast-iron boxes shall have a minimum cover and wall thickness of 3/16 inch. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches. Cast-iron box shall have a heavy coat of bituminous paint.

#### 2.1.2.5 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 D 2000 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.

#### 2.1.2.6 Sleeve-Type Mechanical Couplings

Couplings shall be designed to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. The coupling shall consist 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 shall be true circular

sections free from irregularities, flat spots, and surface defects; the design shall provide for confinement and compression of the gaskets. For ductile iron pipe, the middle ring shall be of cast-iron or steel; and the follower rings shall be of malleable or ductile iron. Cast iron, ASTM A 48/A 48M, not less than Class 25. Malleable and ductile iron shall, conform to ASTM A 47/A 47M and ASTM A 536, respectively. Steel shall have a strength not less than that of the pipe. Gaskets shall be designed for resistance to set after installation and shall meet the applicable requirements specified for gaskets for mechanical joint in AWWA C111. Bolts shall be track-head type, ASTM A 307, Grade A, with nuts, ASTM A 563, Grade A; or round-head square-neck type bolts, ANSI B18.5.2.1M and ASME B18.5.2.2M with hex nuts, ASME B18.2.2. Bolts shall be 5/8 inch in diameter. Bolt holes in follower rings shall be of a shape to hold fast the necks of the bolts used. Mechanically coupled joints using a sleeve-type mechanical coupling shall not be used as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint. Mechanical couplings shall provide a tight flexible joint under all reasonable conditions, such as pipe movements caused by expansion, contraction, slight setting or shifting in the ground, minor variations in trench gradients, and traffic vibrations. Couplings shall be of strength not less than the adjoining pipeline.

## 2.2 WATER SERVICE LINE MATERIALS

### 2.2.1 Piping Materials

#### 2.2.1.1 Plastic Piping

Plastic pipe and fittings shall bear the seal of the National Sanitation Foundation (NSF) for potable water service. Plastic pipe and fittings shall be supplied from the same manufacturer.

- a. Polyvinyl Chloride (PVC) Plastic Piping with Screw Joints:  
ASTM D 1785, Schedule 40; or ASTM D 2241, with SDR as necessary to provide 150 psi minimum pressure rating. Fittings, ASTM D 2466 or ASTM D 2467. Pipe and fittings shall be of the same PVC plastic material and shall be one 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. Solvent cement for jointing, ASTM D 2564. Pipe couplings, when used shall be tested as required by ASTM D 2464.

- b. Polyvinyl Chloride (PVC) Plastic Piping with Elastomeric-Gasket Joints:

Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 40, with joints meeting the requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified.

- c. Polyvinyl Chloride (PVC) Plastic Piping with Solvent Cement Joints:

Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure.

#### 2.2.1.2 Insulating Joints

Joints between pipe of dissimilar metals shall have a rubber-gasketed or

other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact between adjacent sections of piping.

## 2.2.2 Water Service Line Appurtenances

### 2.2.2.1 Corporation Stops

Ground key type; bronze, ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops, AWWA C800; coupling nut for connection to flared copper tubing, ASME B16.26.

### 2.2.2.2 Curb or Service Stops

Ground key, round way, inverted key type; made of bronze, ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be as appropriate for connection to the service piping. Arrow shall be cast into body of the curb or service stop indicating direction of flow.

### 2.2.2.3 Service Clamps

Service clamps used for repairing damaged cast-iron, steel, PVC or asbestos-cement pipe shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

### 2.2.2.4 Goosenecks

Type K copper tubing. Joint ends for goosenecks shall be appropriate for connecting to corporation stop and service line. Length of goosenecks shall be in accordance with standard practice.

### 2.2.2.5 Dielectric Fittings

Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

### 2.2.2.6 Check Valves

Check valves shall be designed for a minimum working pressure of 150 psi or as indicated. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge pressure, and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. The size of the valve, working pressure, manufacturer's name, initials, or trademark shall be cast on the body of each valve. Valves 2 inches and larger shall be outside lever and spring type.

- a. Valves 2 inches and smaller shall be all bronze designed for screwed fittings, and shall conform to MSS SP-80, Class 150, Types 3 and 4 as suitable for the application.

#### 2.2.2.7 Gate Valves 3 Inch Size and Larger on Buried Piping

Gate valves 3 inch size and larger on buried piping AWWA C500 or UL 262 and of one manufacturer. Valves, AWWA C500, nonrising stem type with double-disc gates. Valves, UL 262, inside-screw type with operating nut, split wedge or double disc type gate, and designed for a hydraulic working pressure of 175 psi. Materials for UL 262 valves conforming to the reference standards specified in AWWA C500. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have O-ring stem seals and shall be bolted and constructed so as to permit easy removal of parts for repair. Valves shall have ends suitable for joining to the pipe used.

#### 2.2.2.8 Gate Valves Smaller than 3 Inch in Size on Buried Piping

Gate valves smaller than 3 inch size on Buried Piping MSS SP-80, Class 150, solid wedge, nonrising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve. Provide handwheel operators.

#### 2.2.2.9 Curb Boxes

Provide a curb box for each curb or service stop. Curb boxes shall be of cast iron of a size suitable for the stop on which it is to be used. Provide a round head. Cast the word "WATER" on the lid. Each box shall have a heavy coat of bituminous paint.

#### 2.2.2.10 Valve Boxes

Provide a valve box for each gate valve on buried piping. Valve boxes shall be of cast iron of a size suitable for the valve on which it is to be used and shall be adjustable. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches. Cast-iron box shall have a heavy coat of bituminous paint.

#### 2.2.2.11 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 150 psi. Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 50 foot-pound.

#### 2.2.2.12 Check Valve Enclosure

Enclosure shall be certified to ASSE Standard 1060, Class I.

#### 2.2.2.13 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

### PART 3 EXECUTION

#### 3.1 INSTALLATION OF PIPELINES

##### 3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to all pipeline installation except where specific exception is made in the "Special Requirements..." paragraphs.

##### 3.1.1.1 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 or electric wiring.

All water piping shall be laid with a minimum cover of 36 inches.

##### a. Water Piping Installation Parallel With Sewer Piping

Normal Conditions: Lay water piping at least 10 feet horizontally from a sewer or sewer manhole whenever possible. Measure the distance edge-to-edge.

Unusual Conditions: When local conditions or barriers prevent a 10-foot lateral separation, then:

- (1) The water main shall be laid in a separate trench and the bottom (invert) of the water piping shall be at least 18 inches above the top (crown) of the sewer piping. The water main can be laid in the same trench; however, the water main shall be laid on the opposite side of the trench on an undisturbed bench constructed 18-inches above the top of the sewer pipe.
- (2) Where the horizontal separation cannot be obtained, the sewer and water piping shall be constructed of AWWA-ferrous pipe. All pipe shall be pressure tested in place without leakage prior to backfilling.
- (3) The sewer manhole shall be of watertight construction and tested in place.

##### b. Installation of Water Piping Crossing Sewer Piping

- (1) Normal Conditions: Water piping shall be laid to cross above sewer piping with a separation of at least 18 inches between the bottom of the water piping and the top of the sewer piping.
- (2) Unusual Conditions: When local conditions prevent a routing or vertical separation as described above, use the following construction:
  - (a) Water piping passing over sewer piping without a vertical separation of at least 18 inches between the top of the sewer

piping and the bottom of the water piping; the provide adequate structural support for the water piping to prevent excessive deflection of the joints and the settling on and breaking of the sewer piping; and both the water piping and sewer piping shall be constructed of AWWA ferrous materials with joints equivalent to water main standards for a minimum distance of 10 feet on each side of the point of crossing. For water and sewer mains, a 20 foot minimum section of AWWA ferrous piping shall be centered at the point of crossing so that joints shall be equidistant and as far as possible from the sewer piping.

(b) Water piping passing under sewer piping shall 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 crossingso that joints shall be equidistant and as far as possible from the sewer piping.

- c. Sewer Piping or Sewer Manholes: No water piping shall pass through or come in contact with any part of a sewer manhole.

#### 3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 23 00.00 20, EXCAVATION AND FILL.

#### 3.1.1.3 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. Do not under any circumstances drop or dump pipe, fittings, valves, or any other water line material into trenches. Cut pipe in a neat workmanlike manner accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be 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 proper elevation and grade. Secure firm, uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. 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. Depth of cover over top of pipe shall not be less than 2 1/2 feet.

#### 3.1.1.4 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.

#### 3.1.1.5 Connections to Existing Water Lines

Make connections to existing water lines after approval is obtained 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.

### 3.1.2 Special Requirements for Installation of Water Mains

#### 3.1.2.1 Installation of Ductile-Iron Piping

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "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. 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 to make up for misalignment of bolt holes or for any other purpose 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 proper flanged joint as specified, replace it by one of proper dimensions. 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: The maximum allowable deflection shall be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide 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 C 94/C 94M, 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. Provide joint restraints where thrust blocks dont rest against undisturbed soil.

- d. Exterior Protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet, using Class A polyethylene film, in accordance with AWWA C105.

#### 3.1.2.2 Installation of Valves

- a. Installation of 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, 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. Make and assemble joints to gate valves as specified for making and assembling the same type joints between pipe and fittings.

#### 3.1.3 Installation of Water Service Piping

##### 3.1.3.1 Location

Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 5 feet from the building line at the points indicated; such water service lines shall be closed with plugs or caps.

##### 3.1.3.2 Service Line Connections to Water Mains

Connect service lines 2 inch size to the main as indicated. Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps. Connect service lines to PVC plastic water mains in accordance with UBPPA UNI-B-8 and the recommendations of AWWA M23, Chapter 9, "Service Connections." Connect service lines to steel water mains in accordance with the recommendations of the steel water main pipe manufacturer and with the recommendations for special and valve connections and other appurtenances in AWWA M11, Chapter 13, "Supplementary Design Data and Details."

#### 3.1.4 Special Requirements for Installation of Water Service Piping

##### 3.1.4.1 Installation of Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the applicable requirements of ASTM D 2774 and ASTM D 2855, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F 402.

- a. Jointing: Make solvent-cemented joints for PVC plastic piping using the solvent cement previously specified for this material; assemble joints in accordance with ASTM D 2855. Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.
- b. 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.

#### 3.1.4.2 Service Lines for Sprinkler Supplies

Water service lines used to supply building sprinkler systems for fire protection shall be connected to the water distribution main in accordance with NFPA 24.

#### 3.1.5 Disinfection

Prior to disinfection, obtain Contracting Officer approval of the proposed method for disposal of waste water from disinfection procedures. 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 satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplying nonpotable water is not required.

### 3.2 FIELD QUALITY CONTROL

#### 3.2.1 Field Tests and Inspections

Prior to hydrostatic testing, obtain Contracting Officer approval of the proposed method for disposal of waste water from hydrostatic testing. The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the drawings and specifications. Do not begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 5 days after placing of the concrete.

#### 3.2.2 Testing Procedure

##### 3.2.2.1 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:

$$L = (S \times D \times (P)^{\frac{1}{2}}) / 133,200$$

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.

#### 3.2.2.2 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.

#### 3.2.2.3 Leakage Testing

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

#### 3.2.2.4 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 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --