

CONTRACT N40085-12-B-0121

NAVFAC SPECIFICATION  
NO. 05-12-0121

BOILER MODIFICATIONS, VARIOUS FACILITIES FRENCH CREEK

AT THE

MARINE CORPS BASE, CAMP LEJEUNE, NORTH CAROLINA

DESIGN BY:

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RICHMOND, VIRGINIA

A/E Contract: N40085-08-D-8419

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05120121

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Contract drawings are as follows:

NAVFAC DWG NO.	SHEET NO.	TITLE
60011308	G-001	COVER SHEET
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60011310	C-101	OVERALL PLAN
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60011313	C-201	SEEDING
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60011322	M-101	BUILDING FC400 MECHANICAL DEMOLITION AND NEW WORK PLAN
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## SECTION 01 11 00

## SUMMARY OF WORK

09/08

## PART 1 GENERAL

## 1.1 WORK COVERED BY CONTRACT DOCUMENTS

## 1.1.1 Project Description

The work includes the provision of new gas-fired boilers; new boiler buildings including earthwork, foundations, and utilities; demolition of steam lines and related HVAC components at each of 16 individual buildings and incidental related work.

## 1.1.2 Location

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

## 1.2 EXISTING WORK

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

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

## 1.3 LOCATION OF UNDERGROUND FACILITIES

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

## 1.3.1 Notification Prior to Excavation

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

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --



## SECTION 01 14 00

## WORK RESTRICTIONS

01/07

## PART 1 GENERAL

## 1.1 SPECIAL SCHEDULING REQUIREMENTS

- a. The new boilers shall be ready for operation as approved by Contracting Officer before demolition work is started on the steam lines at each building which would interfere with normal operation.
- b. Each building will remain in operation during the entire construction period. The Contractor shall conduct his operations so as to cause the least possible interference with normal operations of the activity.
- c. Permission to interrupt any Station roads, railroads, and/or utility service shall be requested in writing a minimum of 15 calendar days prior to the desired date of interruption.

## 1.2 CONTRACTOR ACCESS AND USE OF PREMISES

## 1.2.1 Station Regulations

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

## 1.2.2 Working Hours

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

## 1.2.3 Work Outside Regular Hours

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

## 1.2.4 Occupied and Existing Buildings

The Contractor shall be working in an existing building and/or around existing buildings which are occupied.

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

1.2.5 Utility Cutovers and Interruptions

- a. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in the paragraph "Work Outside Regular Hours."
- b. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.
- c. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, compressed air, shall be considered utility cutovers pursuant to the paragraph entitled "Work Outside Regular Hours." This time limit includes time for deactivation and reactivation.
- d. Operation of Station Utilities: The Contractor shall not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor shall notify the Contracting Officer giving reasonable advance notice when such operation is required.

1.3 SECURITY REQUIREMENTS

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

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

## SECTION 01 20 00

## PRICE AND PAYMENT PROCEDURES

04/12

## PART 1 GENERAL

## 1.1 REFERENCES

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

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE EP-1110-1-8

(1995) 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 Contracting Officer a schedule of prices (construction contract) on the forms furnished by the Government. Provide a detailed breakdown of the contract price, giving quantities for each of the various kinds of work, unit prices, and extended prices therefor. Schedule of prices shall be separated by individual building numbers with subtotals for each building.

## 1.3.2 Schedule Instructions

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

## 1.3.3 Schedule Requirements for HVAC TAB

The field work Section 23 05 92, "HVAC Testing/Adjusting/Balancing" 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 [COE EP-1110-1-8](#).

#### 1.5 CONTRACTOR'S PAYMENT REQUEST

##### 1.5.1 Proper Payment Request

A proper request for payment/invoice shall comply with all requirements

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

- a. Contractor's Invoice on NAVFAC Form 7300/30, which shall show the basis for arriving at the amount of the invoice. Submit one original and two copies.
- b. Contractor's Monthly Estimate for Voucher (LANTNAVFACENCOM Form 4-4330/110). Submit original and two copies.
- c. Payment Certification. Furnish as specified in "FAR Clause 52.232-5 (c) Payments under Fixed-Price Construction Contracts." Submit one original.
- d. QC Invoice Certification. Furnish as specified in Section 01 45 10, "Quality Control." Submit one original.

#### 1.5.1.1 Progress Payments

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

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

#### 1.5.1.2 Final Payments

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

- a. A final release executed on the standard form provided by the Contracting Officer. Submit two originals with final payment request.
- b. NC Tax certified statement and report for the prime and each subcontractor (FAR 52.229-7). Submit two copies.
- c. As-built drawings (if applicable).
- d. Warranties (if applicable).
- e. O&M manuals (if applicable).
- f. Final payrolls (FAR 52.222-6).
- g. A release for an assignment of claims (if applicable). Submit

three originals.

#### 1.5.2 Procedures for Submitting Payment Request

- a. The Contractor may submit only one invoice for payment each month as the work progresses.
- b. The invoice shall be delivered to the ROICC Office, Administrative Branch, between five calendar days before and five calendar days after the contract award date. Invoices received outside this schedule shall be returned to the Contractor unprocessed. The Contractor will have to wait until the following month to submit their next invoice.
- c. Invoices shall be delivered during normal work hours from 7:30 AM up to 4:00 PM (EST), Monday through Friday, excluding holidays.

#### 1.6 PAYMENTS TO THE CONTRACTOR

Payments will be made on submission of a proper payment request/invoice by the Contractor.

##### 1.6.1 Obligation of Government Payments

The obligation of the Government to make payments required under the provisions of this contract will, at the discretion of the Contracting Officer, be subject to the following:

- a. Reasonable retention and/or deductions due to defects in material or workmanship; potential liquidated damages; and/or failure to comply with any other requirements of the contract.
- b. Claims which the Government may have against the Contractor under or in connection with this contract; and
- c. Unless otherwise adjusted, repayment to the Government upon demand for overpayments made to the Contractor.
- d. Failure to provide up to date record drawings not current as stated in Contract Clause "FAC 5252.236-9310, Record Drawings"; NC State tax certified statement and report in accordance with FAR 52.229-2; labor payrolls in accordance with FAR 52.222-6; as-built drawings in accordance with Section 01 45 10, "Quality Control"; warranties and O&M manuals; and any other requirements in the contract.

##### 1.6.2 Payment for Onsite and Offsite Materials

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

- a. FAR 52.232-5(b) Payments Under Fixed Price Construction Contracts.
- b. Materials delivered on the site but not installed, including completed preparatory work, and off- site materials to be considered for progress payment shall be major high cost, long lead, special order, or specialty items, not susceptible to deterioration or physical damage in storage or in transit to the

construction site. Examples of materials acceptable for payment considerations include, but are not limited to, structural steel, non-magnetic steel, non-magnetic aggregate, equipment, machinery, large pipe and fittings, precast/ prestressed concrete products, plastic lumber (e.g. fender piles/ curbs), and high-voltage electrical cable. Materials no acceptable for payment include consumable materials such as nails, fasteners, conduits, gypsum board, glass, insulation, and wall coverings.

- c. Materials to be considered for progress payment prior to installation shall be specifically and separately identified in the Contractor's estimates of work submitted for the Contracting Officer's approval in accordance with Earned Value Report requirement of this contract. Requests for progress payment considerations for such items shall be supported by documents establishing their value and that the title requirements of the clause at FAR 52.232-5 have been met.
- d. Materials are adequately insured and protected from theft and exposure.
- e. Provide a written consent from the surety company with each payment request for offsite materials.
- f. Materials to be considered for progress payments prior to installation shall be stored in the Continental United States.

#### PART 2 PRODUCTS

Not used.

#### PART 3 EXECUTION

Not used.

-- End of Section --





## SECTION 01 30 00

## ADMINISTRATIVE REQUIREMENTS

03/12

## PART 1 GENERAL

## 1.1 SUBMITTALS

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

SD-01 Preconstruction Submittals

List of contact personnel

## 1.2 MINIMUM INSURANCE REQUIREMENTS

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

- a. Comprehensive general liability: \$500,000 per occurrence
- b. Automobile liability: \$200,000 per person, \$500,000 per occurrence, \$20,000 per occurrence for property damage
- c. Workmen's compensation as required by Federal and State workers' compensation and occupational disease laws,
- d. Employer's liability coverage of \$100,000, except in States where workers compensation may not be written by private carriers,
- e. Others as required by State law.

## 1.3 ELECTRONIC MAIL (EMAIL)

- a. The Contractor is required to establish and maintain electronic mail (email) capability along with the capability to open various electronic attachments in Microsoft, Adobe Acrobat, and other similar formats.
- b. Within 10 days after contract award; the Contractor shall provide the Contracting Officer a single (only one) email address for the ROICC office to send communications related to this contract correspondence. The ROICC office may also use email to notify the Contractor of base access conditions when emergency conditions warrant, such as hurricanes, terrorist threats, etc.
- c. Multiple email addresses are not authorized.
- d. It is the Contractor's responsibility to make timely distribution of all ROICC email within its own organization, including field office(s).
- e. The Contractor shall promptly notify the Contracting Officer, in writing, of any changes to their email address.

#### 1.4 CONTRACTOR PERSONNEL REQUIREMENTS

##### 1.4.1 Subcontractors and Personnel

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

##### 1.4.2 Identification Badges

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

##### 1.4.3 Business Access Security Requirements

###### 1.4.3.1 Business Access Definition

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

###### 1.4.3.2 Installation Security Access Requirements

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

###### 1.4.3.3 Business Access Identification Badge Requirement

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

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

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

MCAS New River, NC. Report as follows:

1. Pass and Identification Office, Bldg AS-187 for badge (910-449-7695) and vehicle pass (910-449-5513).

###### 1.4.3.4 Proof of Employee Citizenship or Legal Alien Status

Employers may participate in the E-verify program (1-888-464-4218, [www.DHS.gov/e-verify](http://www.DHS.gov/e-verify)) allowing U.S. employers to verify name, DOB, and SSN along with immigration information for non-citizens, against federal

databases in order to verify the employment eligibility of both citizens and non-citizen new hires.

#### 1.4.3.5 Proof of Criminal Records Check

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

#### 1.4.3.6 Letter Provided By Contracting Officer Indicating Contract

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

#### 1.4.3.7 Photo ID

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

#### 1.4.3.8 National Crime Investigation Center (NCIC) Check

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

#### 1.4.4 Denial of Access

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

- a. Is on the National Terrorist Watch List
- b. Is illegally present in the United States.
- c. Is subject to an outstanding warrant.
- d. Has knowingly submitted an employment questionnaire with false or fraudulent information.
- e. Has been issued a debarment order and is currently banned from military installations.
- f. Is a Registered Sexual Offender.
- g. Has been convicted of a felony or a drug crime within the past five years.

- h. Individuals who have received a DUI/DWI in the last year may be allowed access to the installation, but will not be permitted to drive on the installation.
- i. Any reason the Installation Commander deems reasonable for the good order and discipline.

#### 1.4.5 Appeal Process

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

#### 1.4.6 Display of Badges

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

#### 1.4.7 Contractor and Subcontractor Vehicle Requirements

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

- a. An installation sponsor request forwarded to provost Marshall office
- b. A valid form of Federal or state government I.D.
- c. If driving a motor vehicle, a valid driver's license, vehicle registration and proof of insurance

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

#### 1.4.8 Security Checks

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

#### 1.4.9 Subcontractor Special Requirements

##### 1.4.9.1 Space Temperature Control, HVAC TAB, and Apparatus Inspection

All contract requirements of Section 23 09 23.13, BACnet Direct Digital Control Systems for HVAC; Section 23 05 92 Testing/Adjusting/Balancing:Small Heating/Ventilating/Cooling Systems shall be accomplished directly by a first tier subcontractor.

#### 1.5 DISCLOSURE OF INFORMATION

Contractor shall comply as follows:

- (a) The Contractor shall not release to anyone outside the Contractor's organization any unclassified information, regardless of medium (e.g., film, tape, document), pertaining to any part of this contract or any program related to this contract, unless -
  - (1) The Contracting Officer has given prior written approval; or
  - (2) The information is otherwise in the public domain before the date of release.
- (b) Requests for approval shall identify the specific information to be released, the medium to be used, and the purpose for the release. The Contractor shall submit its request to the Contracting Officer at least 45 days before the proposed date for release.
- (c) The Contractor agrees to include a similar requirement in each subcontract under this contract. Subcontractors shall submit requests for authorization to release through the prime contractor to the Contracting Officer.

#### 1.6 SUPERVISION

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

**NOTE:** If training and experience requirements of Section 01 45 10, "Quality Control" and 01 35 29, "Safety and Occupational Health Requirements" have been met the supervisor may also serve as QC Manager and Site Safety and Health Officer (SSHO).

#### 1.7 PRECONSTRUCTION CONFERENCE

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

#### PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 32 16

CONSTRUCTION PROGRESS DOCUMENTATION

04/12

PART 1 GENERAL

1.1 SUBMITTALS

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

SD-01 Preconstruction Submittals

Construction schedule

Equipment delivery schedule

1.2 CONSTRUCTION SCHEDULE

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

1.2.1 HVAC TAB Milestones

Requirements for the milestones related to HVAC TAB work, Section 23 05 92 "Testing/Adjusting/Balancing: Small Heating/Ventilating/Cooling Systems," are specified in Section 01 20 00, "Price and Payment Procedures."

1.3 EQUIPMENT DELIVERY SCHEDULE

1.3.1 Initial Schedule

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

- a. Description.
- b. Date of the purchase order.
- c. Promised shipping date.
- d. Name of the manufacturer or supplier.
- e. Date delivery is expected.
- f. Date the material or equipment is required, according to the current construction schedule.

#### 1.4 NETWORK ANALYSIS SYSTEM (NAS)

The Contractor shall use the critical path method (CPM) to schedule and control construction activities. The schedule shall identify as a minimum:

- a. Construction time for all major systems and components;
- b. Manpower requirements for each activity;
- c. Major submittals and submittal processing time; and
- d. Major equipment lead time.

##### 1.4.1 CPM Submittals and Procedures

The Contractor shall use the critical path method (CPM) to schedule and control project activities. Project schedules shall be prepared and maintained using Primavera P6, Primavera SureTrak or current mandated scheduling program. Save files in Concentric P6 or current mandated scheduling program file format, compatible with the Governments version of the scheduling program. The network analysis system shall be kept current, with changes made to reflect the actual progress and status of the construction.

#### 1.5 UPDATED SCHEDULES

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

#### PART 2 PRODUCTS

Not used.

#### PART 3 EXECUTION

Not used.

-- End of Section --



## SECTION 01 33 00

## SUBMITTAL PROCEDURES

12/10

## PART 1 GENERAL

## 1.1 SUMMARY

## 1.1.1 Government-Furnished Information

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

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

Column (d): Lists each submittal description (SD No. and type, e.g. SD-04 Drawings) required in each specification section.

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

Column (f): Indicate approving authority for each submittal. The Contracting Officer is approving authority for all submittals.

## 1.2 DEFINITIONS

## 1.2.1 Submittal

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

## 1.2.2 Types of Submittals

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

- a. Shop drawings: As used in this section, drawings, schedules, diagrams, and other data prepared specifically for this contract, by contractor or through contractor by way of subcontractor, manufacturer, supplier, distributor, or other lower tier contractor, to illustrate portion of work.
- b. Product data: Preprinted material such as illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer's descriptive literature, catalog data, and other data to illustrate portion of work, but not prepared exclusively for this contract.
- c. Samples: Physical examples of products, materials, equipment,

assemblies, or workmanship that are physically identical to portion of work, illustrating portion of work or establishing standards for evaluating appearance of finished work or both.

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

### 1.2.3 Submittal Descriptions (SD)

#### SD-01 Preconstruction Submittals

Certificates of insurance  
Surety bonds  
List of proposed subcontractors  
List of proposed products  
Construction Progress Schedule  
Submittal schedule  
Schedule of values  
Health and safety plan  
Work plan  
Quality control plan  
Environmental protection plan

#### SD-02 Shop Drawings

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

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

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

#### SD-03 Product Data

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

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

#### SD-04 Samples

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

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

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

#### SD-06 Test Reports

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

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

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

Investigation reports

Daily checklists

Final acceptance test and operational test procedure

#### SD-07 Certificates

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

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

Confined space entry permits.

#### SD-08 Manufacturer's Instructions

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

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

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

Factory test reports.

#### SD-10 Operation and Maintenance Data

Data intended to be incorporated in operations and maintenance manuals.

#### SD-11 Closeout Submittals

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

As-built drawings

Special warranties

Posted operating instructions

Training plan

#### 1.2.4 Approving Authority

Person authorized to approve submittal.

#### 1.2.5 Work

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

### 1.3 SUBMITTALS

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

#### SD-11 Closeout Submittals

Submittal register

Complete Submittal Package 1 CD

### 1.4 USE OF SUBMITTAL REGISTER

Prepare and maintain submittal register, as the work progresses. Use the hard copy submittal register furnished by the Government or other approved format. Do not change data which is output in columns (c), (d), (e), and (f) as delivered by government; retain data which is output in columns (a), (g), (h), and (i) as approved.

#### 1.4.1 Submittal Register

Submit submittal register as a hard copy. Submit with quality control plan and project schedule required by Section 01 45 10 and Section 01 32 16, "Construction Progress Documentation." Do not change data in columns (c), (d), (e), and (f) as delivered by the government. Verify that all submittals required for project are listed and add missing submittals. Complete the following on the register:

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

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

Column (h) Contractor Approval Date: Date contractor needs approval of

submittal.

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

1.4.2 Contractor Use of Submittal Register

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

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

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

Column (l) List date of submittal transmission.

Column (q) List date approval received.

1.4.3 Approving Authority Use of Submittal Register

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

Column (b).

Column (l) List date of submittal receipt.

Column (m) through (p).

Column (q) List date returned to contractor.

1.4.4 Contractor Action Code and Action Code

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

NR - Not Received

AN - Approved as noted

A - Approved

RR - Disapproved, Revise, and Resubmit

1.4.5 Copies Delivered to the Government

Deliver one copy of submitted register updated by contractor to government with each invoice request.

1.5 PROCEDURES FOR SUBMITTALS

1.5.1 Reviewing, Certifying, Approving Authority

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

### 1.5.2 Constraints

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

### 1.5.3 Scheduling

- a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential requirements to resubmit.
- b. Except as specified otherwise, allow review period, beginning with receipt by approving authority, that includes at least 15 working days for submittals for QC manager approval and 20 working days for submittals for contracting officer approval. Period of review for submittals with contracting officer approval begins when Government receives submittal from QC organization. Period of review for each resubmittal is the same as for initial submittal.
- c. For submittals requiring review by fire protection engineer, allow review period, beginning when government receives submittal from QC organization, of 45 working days for return of submittal to the contractor. Period of review for each resubmittal is the same as for initial submittal.

### 1.5.4 Variations

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

#### 1.5.4.1 Considering Variations

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

#### 1.5.4.2 Proposing Variations

When proposing variation, deliver written request to the contracting officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to government. If lower cost is a benefit, also include an estimate of the cost saving. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

#### 1.5.4.3 Warranting That Variation Are Compatible

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

#### 1.5.4.4 Review Schedule Is Modified

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

#### 1.5.5 Contractor's Responsibilities

- a. Determine and verify field measurements, materials, field construction criteria; review each submittal; and check and coordinate each submittal with requirements of the work and contract documents.
- b. Transmit submittals to QC organization in accordance with schedule on approved Submittal Register, and to prevent delays in the work, delays to government, or delays to separate contractors.
- c. Advise contracting officer of variation, as required by paragraph entitled "Variations."
- d. Correct and resubmit submittal as directed by approving authority. When resubmitting disapproved transmittals or transmittals noted for resubmittal, the contractor shall provide copy of that previously submitted transmittal including all reviewer comments for use by approving authority. Direct specific attention in writing or on resubmitted submittal, to revisions not requested by approving authority on previous submissions.
- e. Furnish additional copies of submittal when requested by contracting officer, to a limit of 20 copies per submittal.
- f. Complete work which must be accomplished as basis of a submittal in time to allow submittal to occur as scheduled.
- g. Ensure no work has begun until submittals for that work have been returned as "approved," or "approved as noted", except to the extent that a portion of work must be accomplished as basis of submittal.

#### 1.5.6 QC Organization Responsibilities

- a. Note date on which submittal was received from contractor on each submittal.
- b. Review each submittal; and check and coordinate each submittal with requirements of work and contract documents.
- c. Review submittals for conformance with project design concepts and compliance with contract documents.
- d. Act on submittals, determining appropriate action based on QC organization's review of submittal.

(1) When QC manager is approving authority, take appropriate action on submittal from the possible actions defined in paragraph entitled, "Actions Possible."

(2) When contracting officer is approving authority or when variation has been proposed, forward submittal to Government with certifying statement or return submittal marked "not reviewed" or "revise and resubmit" as appropriate. The QC organization's review of submittal determines appropriate action.

- e. Ensure that material is clearly legible.
- f. Stamp each sheet of each submittal with QC certifying statement or approving statement, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.

(1) When approving authority is contracting officer, QC organization will certify submittals forwarded to contracting officer with the following certifying statement:

"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated with contract Number N40085-12-B-0121, is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval.

Certified by Submittal Reviewer \_\_\_\_\_, Date \_\_\_\_\_  
(Signature when applicable)

Certified by QC manager \_\_\_\_\_, Date \_\_\_\_\_"  
(Signature)

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

1.5.7 Government's Responsibilities

When approving authority is contracting Officer, the Government will:

- a. Note date on which submittal was received from QC manager, on each submittal for which the contracting officer is approving authority.
- b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with contract documents.
- c. Identify returned submittals with one of the actions defined in paragraph entitled "Actions Possible" and with markings



appropriate for action indicated.

#### 1.5.8 Actions Possible

Submittals will be returned with one of the following notations:

- a. Submittals marked "not reviewed" will indicate submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by contractor or for being incomplete, with appropriate action, coordination, or change.
- b. Submittals marked "approved" "approved as submitted" authorize contractor to proceed with work covered.
- c. Submittals marked "approved as noted" authorize contractor to proceed with work as noted provided contractor takes no exception to the notations.
- d. Submittals marked "revise and resubmit" or "disapproved" indicate submittal is incomplete or does not comply with design concept or requirements of the contract documents and shall be resubmitted with appropriate changes. No work shall proceed for this item until resubmittal is approved.

#### 1.6 FORMAT OF SUBMITTALS

##### 1.6.1 Complete Submittal Package

Contractor shall make electronic copies of all submittals, including the transmittal sheet, and provide a CD/DVD containing all submittals for project close out.

The CD/DVD shall be marked "Complete Submittal Package - Contract #N40085-12-B-0121."

##### 1.6.2 Transmittal Form

Transmit each submittal, except sample installations and sample panels, to office of approving authority. Transmit submittals with transmittal form prescribed by contracting officer and standard for project. The transmittal form shall identify contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled "Identifying Submittals." Process transmittal forms to record actions regarding sample panels and sample installations.

##### 1.6.3 Identifying Submittals

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

- a. Project title and location.
- b. Construction contract number.

- c. Section number of the specification section by which submittal is required.
- d. Submittal description (SD) number of each component of submittal.
- e. When a resubmission, alphabetic suffix on submittal description, for example, SD-10A, to indicate resubmission.
- f. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other second tier contractor associated with submittal.
- g. Product identification and location in project.

#### 1.6.4 Format for Product Data

- a. Present product data submittals for each section as a complete, bound volume. Include table of contents, listing page and catalog item numbers for product data.
- b. Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.
- c. Supplement product data with material prepared for project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for project.

#### 1.6.5 Format for Shop Drawings

- a. Shop drawings shall not be less than 8 1/2 by 11 inches nor more than 30 by 42 inches.
- b. Present 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.
- c. Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled "Identifying Submittals."
- d. Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Shop drawing dimensions shall be the same unit of measure as indicated on the contract drawings. Identify materials and products for work shown.

#### 1.6.6 Format of Samples

- a. Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:
  - (1) Sample of Equipment or Device: Full size.
  - (2) Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.

- (3) Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.
  - (4) Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.
  - (5) Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.
  - (6) Color Selection Samples: 2 by 4 inches.
  - (7) Sample Panel: 4 by 4 feet.
  - (8) Sample Installation: 100 square feet.
- b. Samples Showing Range of Variation: Where variations are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range.
  - c. Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples shall be in undamaged condition at time of use.
  - d. Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final clean up of project.
  - e. When color, texture or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

#### 1.6.7 Format of Administrative Submittals

- a. When submittal includes a document which is to be used in project or become part of project record, other than as a submittal, do not apply contractor's approval stamp to document, but to a separate sheet accompanying document.
- b. Operation and Maintenance Manual Data: Include components required in that section and the various technical sections.

### 1.7 QUANTITY OF SUBMITTALS

#### 1.7.1 Number of Copies of Product Data

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

#### 1.7.2 Number of Copies of Shop Drawings

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

1.7.3 Number of Samples

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

1.7.4 Number of Copies of Administrative Submittals

- a. Unless otherwise specified, submit administrative submittals compliance with quantity requirements specified for product data.
- b. Submit administrative submittals required under "SD-19 Operation and Maintenance Manuals".

1.8 FORWARDING SUBMITTALS

1.8.1 Samples and Submittalsr

Except as otherwise noted, submit samples and submittals to:

Wiley|Wilson  
 6606 W.Broad Street, Suite 500  
 Richmond, VA 23230

1.8.1.1 Administrative Submittals

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

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

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

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

# SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

Boiler Modifications, Various Facilities French Creek

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE		DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 20 00	SD-01 Preconstruction Submittals														
			Schedule of prices	1.3													
		01 30 00	SD-01 Preconstruction Submittals														
			List of contact personnel	1.4.1													
		01 32 16	SD-01 Preconstruction Submittals														
			Construction schedule	1.2													
			Equipment delivery schedule	1.3													
		01 33 00	SD-11 Closeout Submittals														
			Submittal register	1.4.1													
			Complete Submittal Package	1.6.1													
		01 35 29	SD-01 Preconstruction Submittals														
			Accident Prevention Plan (APP)	1.9													
			Activity Hazard Analysis (AHA)	1.10													
			Crane Critical Lift Plan	1.9.1													
			Crane Work Plan	1.9.1													
			Crane Operators	1.7.1.6													
			SD-06 Test Reports														
			Reports	1.14													
			Accident Reports	1.14.1													
			Monthly Exposure Reports	1.14.3													
			Regulatory Citations and Violations	1.14.4													
			Crane Reports	1.14.5													
			SD-07 Certificates														
			Confined Space Entry Permit	1.11													
			Certificate of Compliance	1.14.6													

# SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

Boiler Modifications, Various Facilities French Creek

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE		DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 35 29	Third Party Certification of Barge-Mounted Mobile Cranes	1.14.7													
		01 45 10	SD-11 Closeout Submittals QC PLAN	1.6													
		01 57 19	SD-11 Closeout Submittals Solid waste disposal permit Disposal permit for hazardous waste Environmental training documentation Permit to transport hazardous waste Hazardous waste certification Annual Report of Products Containing Recovered Materials	1.4.1 1.4.2 1.2 1.4.3 1.4.4 2.1													
		01 60 00	SD-07 Certificates Certificate of North Carolina Licensed Applicator SD-11 Closeout Submittals Field Pesticide/Herbicide Management Record Form	1.1.1 1.1.2													
		01 78 00	SD-10 Operation and Maintenance Data Equipment/product warranty list SD-11 Closeout Submittals As-built drawings	1.3.1 1.2.1													

# SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

Boiler Modifications, Various Facilities French Creek

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE			DATE OF ACTION
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		01 78 00	Record of materials	1.2.2													
			Maximo requirements	1.2.3													
			Complete Submittal Package	1.4													
			Equipment/product warranty tag	1.3.2													
		02 41 00	SD-01 Preconstruction Submittals														
			Existing Conditions	1.10													
			SD-07 Certificates														
			Demolition Plan	1.2.1													
			Notification	1.7													
		03 30 00	SD-02 Shop Drawings														
			Reinforcing steel	1.6.2.1													
			SD-03 Product Data														
			Materials for curing concrete	2.4.7													
			Joint sealants	2.4.9													
			Joint filler	2.4.8													
			Vapor retarder	2.4.6													
			Bonding Materials	2.6													
			Reinforcement	2.5													
			SD-05 Design Data														
			mix design	2.3.2													
			SD-06 Test Reports														
			Concrete mix design	1.6.3.1													
			Fly ash	1.6.3.2													
			Pozzolan	1.6.3.2													
			Ground granulated blast-furnace slag	1.6.3.3													

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		03 30 00	Aggregates	1.6.3.4													
			Compressive strength tests	3.11.2.3													
			Air Content	3.11.2.4													
			Slump	3.11.2.1													
			Air Entrainment	2.4.5.1													
		04 20 00	SD-02 Shop Drawings														
			Drawings	1.4.4													
			SD-03 Product Data														
			Concrete Masonry Units	3.2.2													
			Clay or Shale Brick	2.2													
			Cement	2.6.4													
			SD-04 Samples														
			Clay or Shale Brick	2.2													
			Expansion-Joint Materials	2.13													
			SD-05 Design Data														
			Pre-mixed Mortar	2.6.5													
			Unit Strength Method	1.2.2.1													
			SD-06 Test Reports														
			Efflorescence Test	3.20.2													
			Field Testing of Grout	3.20.1													
			Masonry Cement	2.6.4													
			SD-07 Certificates														
			Clay or Shale Brick	2.2													
			Concrete Masonry Units (CMU)	2.4													
			Anchors, Ties, and Bar Positioners	2.9													



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		04 20 00	Expansion-Joint Materials	2.13													
			Joint Reinforcement	2.10													
			Masonry Cement	2.6.4													
			Admixtures for Masonry Mortar	2.6.1													
			Admixtures for Grout	2.8.1													
			SD-08 Manufacturer's Instructions														
			Masonry Cement	2.6.4													
		05 30 00	SD-02 Shop Drawings														
			Fabrication Drawings	1.3.3													
			Ridge and Valley Plates	2.3.2.1													
			Metal Closure Strips	2.3.2.2													
			SD-03 Product Data														
			Accessories	2.2													
			Deck Units	2.3.1													
			Galvanizing Repair Paint	2.1.5													
			Joint Sealant Material	2.1.4													
			SD-04 Samples														
			Accessories	2.2													
			SD-05 Design Data														
			Deck Units	2.3.1													
		05 40 00	SD-02 Shop Drawings														
			Framing Components	1.6.1													
			SD-03 Product Data														
			joists	3.2.1													
			SD-05 Design Data														

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		05 40 00	Metal truss and framing calculations	1.6.2													
		05 50 13	SD-02 Shop Drawings angles and plates	2.3													
		06 10 00	SD-06 Test Reports Preservative-treated	1.4.3													
		07 11 13	SD-03 Product Data Materials	1.3													
			SD-07 Certificates Materials	1.3													
		07 22 00	SD-03 Product Data Fasteners	2.4													
			Insulation	2.1													
		07 31 13	SD-03 Product Data Shingles	2.1.1													
			SD-04 Samples Shingles	2.1.1													
			Color charts	2.1.1													
			SD-08 Manufacturer's Instructions Application	3.3													
		07 40 00	SD-04 Samples Custom trim shapes	2.3													
			SD-03 Product Data 'J' channels	2.2													
			Trim	2.2													
			Trim	2.2													

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		07 40 00	SD-07 Certificates														
			vinyl siding	2.1													
		07 92 00	SD-03 Product Data														
			Sealants	2.1													
			Primers	2.2													
			Bond breakers	2.3													
			Backstops	2.4													
			SD-07 Certificates														
			Sealant	2.1.1													
			Sealant	3.3.5													
		08 11 13	SD-02 Shop Drawings														
			Doors	2.1													
			Doors	2.1													
			Frames	2.5													
			Frames	2.5													
			Accessories	2.3													
			SD-03 Product Data														
			Doors	2.1													
			Frames	2.5													
			Accessories	2.3													
		08 71 00	SD-02 Shop Drawings														
			Hardware schedule	1.3													
			Keying system	2.2.4													
			SD-03 Product Data														
			Hardware items	2.2													
			SD-08 Manufacturer's Instructions														

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		08 71 00	Installation	3.1													
			SD-11 Closeout Submittals														
			Key Bitting	1.4													
		08 91 00	SD-02 Shop Drawings														
			Wall louvers	1.4													
			Wall louvers	1.5													
			SD-03 Product Data														
			Metal Wall Louvers	2.2													
			SD-04 Samples														
			Wall louvers	1.4													
			Wall louvers	1.5													
		09 90 00	SD-03 Product Data														
			Coating	2.1													
			Manufacturer's Technical Data	2.1													
			Sheets														
			SD-04 Samples														
			Color	1.9													
			SD-07 Certificates														
			Applicator's qualifications	1.3													
			Qualification Testing	1.10.3.1													
			SD-08 Manufacturer's Instructions														
			Mixing	3.5.2													
			Manufacturer's Material Safety	1.7.2													
			Data Sheets														
		10 52 20	SD-03 Product Data														
			Fire extinguishers	2.1													

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		22 00 00	SD-03 Product Data														
			Water heaters	2.6													
			Pumps	2.8													
			Backflow prevention assemblies	3.7.1.1													
			SD-06 Test Reports														
			Tests, Flushing and Disinfection	3.7													
			Test of Backflow Prevention Assemblies	3.7.1.1													
			SD-10 Operation and Maintenance Data														
			Plumbing System	3.7.1													
		23 05 15	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-06 Test Reports														
			Hydrostatic Tests	3.1													
			System Operation Tests	3.1													
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Manuals	3.9													
		23 05 92	SD-06 Test Reports														

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		23 05 92	Certified TAB Report	1.4.1													
		23 07 00	SD-03 Product Data														
			Piping insulation	2.1													
			Piping insulation finishes	2.1.8													
			Accessory materials	2.4													
			Adhesives, sealants, and coating compounds	2.3													
		23 09 23.13	SD-02 Shop Drawings														
			Control system drawings title sheet	1.3.1.1													
			List of I/O Points	1.3.1.2													
			Control System Components List	1.3.1.3													
			Control system schematics	1.3.1.4													
			HVAC Equipment Electrical	1.3.1.5													
			Ladder diagrams														
			Component wiring diagrams	1.3.1.6													
			Terminal strip diagrams	1.3.1.7													
			BACnet communication architecture schematic	1.3.1.8													
			SD-03 Product Data														
			Direct Digital Controllers	2.1.3													
			BACnet Gateways	2.1.3.13													
			Sensors and Input Hardware	2.2													
			Output Hardware	2.3													
			Surge and transient protection	2.4.2													
			SD-05 Design Data														

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		23 09 23.13	Performance Verification Testing Plan	3.5.2													
			Pre-Performance Verification Testing Checklist	3.5.4													
			SD-06 Test Reports														
			Performance Verification Testing Report	3.5.11													
			SD-07 Certificates														
			Contractor's Qualifications	1.5.6													
			SD-09 Manufacturer's Field Reports														
			Pre-PVT Checklist	3.5.1													
			SD-10 Operation and Maintenance Data														
			BACnet Direct Digital Control Systems	1.3													
			Controls System Operators Manuals	3.4													
			VFD Service Manuals	1.5.8													
			SD-11 Closeout Submittals														
			Training documentation	3.6.1													
		23 52 43.00 20	SD-02 Shop Drawings														
			Fuel train	1.3.1													
			Wiring diagram	1.3.1													
			SD-03 Product Data														
			Boilers	2.1													

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		23 52 43.00 20	Boiler trim and control equipment	2.3													
			Burners and control equipment	2.2													
			SD-06 Test Reports														
			Operational tests	3.4.1													
			Water analysis	1.3.2													
			SD-07 Certificates														
			Boilers	2.1													
			Boilers	2.1													
			Burners and control equipment	2.2													
			Burners and control equipment	2.2													
			Boiler trim and control equipment	2.3													
			Boiler trim and control equipment	2.3													
			SD-08 Manufacturer's Instructions														
			Boilers	2.1													
			SD-10 Operation and Maintenance														
			Data														
			Boilers	2.1													
			SD-11 Closeout Submittals														
			boilers	2.1													
		23 73 33	SD-02 Shop Drawings														
			Temperature control systems	1.3.1													
			Automatic Flow Control Valves (AFCV)	1.3.2													
			Unit heaters	2.1.1													
			Pumps	2.1.2													
			Exhaust fans	2.1.3													



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		23 73 33	Expansion tanks	2.4.7													
			Air separators	2.4.8													
			Pipe hangers and supports	2.4.1													
			Flexible pipe connectors	2.4.6													
			Valves	2.3.6													
			Pipe and fittings	2.3													
			SD-08 Manufacturer's Instructions														
			Installation manual	1.3.4													
			SD-10 Operation and Maintenance														
			Data														
			Unit heaters	2.1.1													
			Pumps	2.1.2													
			Exhaust fans	2.1.3													
		26 20 00	SD-02 Shop Drawings														
			Panelboards	2.9													
			Wireways	2.20													
			SD-03 Product Data														
			Receptacles	2.8													
			Circuit breakers	2.9.2													
			Circuit breakers	2.10.2													
			Switches	2.7													
			Enclosed circuit breakers	2.11													
			Motor controllers	2.14													
			Manual motor starters	2.15													
			SD-06 Test Reports														
			600-volt wiring test	3.2.2													

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		26 20 00	Grounding system test	3.2.4													
			Ground-fault receptacle test	3.2.3													
			SD-07 Certificates														
			Fuses	2.12													
			SD-10 Operation and Maintenance														
			Data														
			Electrical Systems	1.5.1													
		26 29 23	SD-02 Shop Drawings														
			Schematic diagrams	1.5.1													
			Installation drawings	1.5.3													
			SD-03 Product Data														
			Variable frequency drives	2.1													
			Wires and cables	2.3													
			Equipment schedule	1.5.4													
			SD-06 Test Reports														
			VFD Test	3.2.1													
			Performance Verification Tests	3.2.2													
			Endurance Test	3.2.3													
			SD-08 Manufacturer's Instructions														
			Installation instructions	1.5.5													
			SD-09 Manufacturer's Field														
			Reports														
			VFD Factory Test Plan	2.5.1													
			Factory test results	1.5.6													
			SD-10 Operation and Maintenance														
			Data														

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		26 29 23	Variable frequency drives	2.1													
		26 51 00	SD-03 Product Data														
			Fluorescent lighting fixtures	2.1													
			Fluorescent electronic ballasts	1.5.1													
			Fluorescent lamps	2.1.3													
			High-intensity-discharge (HID) lighting fixtures	2.2													
			HID ballasts	2.2.1													
			High-pressure sodium (HPS) lamps	2.2.2													
			Metal-halide lamps	2.2.3													
			Lighting contactor	2.5													
			Time switch	2.6													
			Power hook fixture hangers	2.8													
			Emergency lighting equipment	2.10													
			Occupancy sensors	2.12													
			SD-06 Test Reports														
			Operating test	3.2													
			SD-10 Operation and Maintenance Data														
			Lighting Control System	1.5.3													



## SECTION 01 35 29

## SAFETY AND OCCUPATIONAL HEALTH REQUIREMENTS

06/11

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

## ASME INTERNATIONAL (ASME)

ASME B30.3 (1996) Construction Tower Cranes

ASME B30.5 (2000) Mobile and Locomotive Cranes

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

ASME B30.22 (2000) Articulating Boom Cranes

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10 (2002) Potable Fire Extinguishers

NFPA 241 (2000) Safeguarding Construction, Alteration, and Demolition Operations

NFPA 51B (2003) Fire Prevention During Welding, Cutting, and Other Hot Work

NFPA 70 (2011; Errata 2 2012) National Electrical Code

NFPA 70E (2004) Electrical Safety in the Workplace

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

EM 385-1-1 (2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011) 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 1910.94	Ventilation
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1919	Gear Certification
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.500	Fall Protection

1.2 SUBMITTALS

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

SD-01 Preconstruction Submittals

- Accident Prevention Plan (APP)
- Activity Hazard Analysis (AHA)
- Crane Critical Lift Plan
- Crane Work Plan
- Proof of qualifications for Crane Operators

SD-06 Test Reports

Reports

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

- Accident Reports
- Monthly Exposure Reports
- Regulatory Citations and Violations
- Crane Reports

SD-07 Certificates

- Confined Space Entry Permit
- Certificate of Compliance (Crane)
- Third Party Certification of Barge-Mounted Mobile Cranes

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

## 1.3 DEFINITIONS

- a. Associate Safety Professional (ASP). An individual who is currently certified by the Board of Certified Safety Professionals.
- b. Certified Construction Health & Safety Technician (CHST). An individual who is currently certified as a CHST by the Board of Certified Safety Professionals.
- c. Certified Industrial Hygienist (CIH). An individual who is currently certified as a CIH by the American Board of Industrial Hygiene.
- d. Certified Safety Professional (CSP). An individual who is currently certified as a CSP by the Board of Certified Safety Professionals.
- e. Certified Safety Trained Supervisor (STS). An individual who is currently certified as an STS by the Board of Certified Safety Professionals.
- f. Competent Person for Fall Protection. A person who is capable of identifying hazardous or dangerous conditions in the personal fall arrest system or any component thereof, as well as their application and use with related equipment, and has the authority to take prompt corrective measures to eliminate the hazards of falling.
- g. High Visibility Accident. Any mishap which may generate publicity and/or high visibility.
- h. Low-slope roof. A roof having a slope less than or equal to 4 in 12 (vertical to horizontal).
- i. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even though provided by a physician or registered personnel.
- j. Multi-Employer Work Site (MEWS). A multi-employer work site, as defined by OSHA, is one in which many employers occupy the same site. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors.
- k. Operating Envelope. The area surrounding any crane. Inside this "envelope" is the crane, the operator, riggers, rigging gear between the hook and the load, the load and the crane's supporting structure (ground, rail, etc.).
- l. Qualified Person for Fall Protection. A person with a recognized degree or professional certification, extensive knowledge, training and experience in the field of fall protection who is capable of performing design, analysis, and evaluation of fall protection systems and equipment.
- m. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:
  - (1) Death, regardless of the time between the injury and death, or the length of the illness;
  - (2) Days away from work;

- (3) Restricted work;
- (4) Transfer to another job;
- (5) Medical treatment beyond first aid;
- (6) Loss of consciousness; or
- (7) A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

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

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

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

q. Weight Handling Equipment (WHE) Accident. A WHE accident occurs when any one or more of the six elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; and collision, including unplanned contact between the load, crane, and/or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, roll over, etc.).

#### 1.4 CONTRACTOR SAFETY SELF-EVALUATION CHECKLIST

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

#### 1.5 REGULATORY REQUIREMENTS

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



## 1.6 DRUG PREVENTION PROGRAM

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

## 1.7 SITE QUALIFICATIONS, DUTIES AND MEETINGS

### 1.7.1 Personnel Qualifications

Work performed under this contract shall meet Level 2.

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

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

##### Level 1:

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

##### Level 2:

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

##### Level 3:

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

##### Level 4:

A minimum of 10 years safety work of a progressive nature with at least 5 years of experience on similar projects.  
30-hour OSHA construction safety class or equivalent within the last 5 years.  
An average of at least 24 hours of formal safety training each year for the past 5 years with training for competent person status for at least the following areas of competency: Excavation; Scaffolding; Fall protection; Hazardous energy; Confined space; Health hazard recognition, evaluation and control of chemical, physical and biological agents; Personal protective equipment and clothing to include selection, use and maintenance.

##### Level 5:

An Associate Safety Professional (ASP), Certified Safety Trained

Supervisor (STS) and/or Construction Health & Safety Technician (CHST).

A minimum of 10 years safety work of a progressive nature with at least 5 years of experience on similar projects.

30-hour OSHA construction safety class or equivalent within the last 5 years.

An average of at least 24 hours of formal safety training each year for the past 5 years with training for competent person status for at least the following areas of competency: Excavation; Scaffolding; Fall protection; Hazardous energy; Confined space; Health hazard recognition, evaluation and control of chemical, physical and biological agents; Personal protective equipment and clothing to include selection, use and maintenance.

Level 6: A

Certified Safety Professional (CSP) and/or Certified Industrial Hygienist (CIH).

A minimum of 10 years safety work of a progressive nature with at least 5 years of experience on similar projects.

30-hour OSHA construction safety class or equivalent within the last 5 years.

An average of at least 24 hours of formal safety training each year for the past 5 years with training for competent person status for at least the following areas of competency: Excavation; Scaffolding; Fall protection; Hazardous energy; Confined space; Health hazard recognition, evaluation and control of chemical, physical and biological agents; Personal protective equipment and clothing to include selection, use and maintenance.

1.7.1.2 Certified Safety Professional (CSP) and/or Certified Industrial hygienist (CIH)

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

1.7.1.3 Associate Safety professional (ASP), Certified Safety Trained Supervisor (STS) and/or Construction Health and Safety Technician (CHST).

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

1.7.1.4 Competent Person for Confined Space Entry

Provide a competent person meeting the requirements of EM 385-1-1 who is assigned in writing by the Designated Authority to assess confined spaces

and who possesses demonstrated knowledge, skill and ability to:

- a. Identify the structure, location, and designation of confined and permit-required confined spaces where work is done;
- b. Calibrate and use testing equipment including but not limited to, oxygen indicators, combustible gas indicators, carbon monoxide indicators, and carbon dioxide indicators, and to interpret accurately the test results of that equipment;
- c. Perform all required tests and inspections specified in 29 CFR 1910.146 and 29 CFR 1915 Subpart B;
- d. Assess hazardous conditions including atmospheric hazards in confined space and adjacent spaces and specify the necessary protection and precautions to be taken;
- e. Determine ventilation requirements for confined space entries and operations;
- f. Assess hazards associated with hot work in confined and adjacent space and determine fire watch requirements; and,
- g. Maintain records required.

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

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

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

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

#### 1.7.1.6 Crane Operators

Crane operators shall meet the requirements in USACE EM 385-1-1, Section 16 and Appendix G. In addition, for mobile cranes with Original Equipment Manufacturer (OEM) rated capacities of 50,000 pounds or greater, crane operators shall be designated as qualified by a source that qualifies crane operators (i.e., union, a government agency, or an organization that tests and qualifies crane operators). Proof of current qualifications shall be provided.

#### 1.7.2 Personnel Duties

##### 1.7.2.1 Site Safety and Health Officer (SSHO)/Superintendent

- a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and

actual dates of corrections. Safety inspection logs shall be attached to the Contractors' daily report.

- b. Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors.
- c. Maintain applicable safety reference material on the job site.
- d. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.
- e. Implement and enforce accepted APPS and AHAs.
- f. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. A list of unresolved safety and health deficiencies shall be posted on the safety bulletin board.
- g. Ensure sub-contractor compliance with safety and health requirements.
- h. Ensure an approved "Special Permission Energized Electrical Work Permit" prior to starting any activity on energized electrical systems.

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

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

- a. Perform safety and occupational health management, surveillance, inspections, and safety enforcement for the project.
- b. Perform as the safety and occupational health "competent person" as defined by USACE EM 385-1-1.
- c. Be on site whenever work or testing is being performed.
- d. Conduct and document safety inspections.
- e. Shall have no other duties other than safety and occupational health management, inspections, and enforcement on this contract.

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

### 1.7.3 Meetings

#### 1.7.3.1 Preconstruction Conference

- a. The Contractor will be informed, in writing, of the date of the preconstruction conference. The purpose of the preconstruction conference is for the Contractor and the Contracting Officer's representatives to become acquainted and explain the functions and operating procedures of their respective organizations and to reach

mutual understanding relative to the administration of the overall project's Accident Prevention Plan (APP) before the initiation of work.

b. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).

c. The Contractor shall discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, a schedule for the preparation, submittal, review, and acceptance of AHAs shall be established to preclude project delays.

d. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Work shall not begin until there is an accepted APP.

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

#### 1.7.3.2 Weekly Safety Meetings

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

#### 1.7.3.3 Work Phase Meetings

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

### 1.8 TRAINING

#### 1.8.1 New Employee Indoctrination

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

#### 1.8.2 Periodic Training

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

### 1.8.3 Training on Activity Hazard Analysis (AHA)

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

### 1.9 ACCIDENT PREVENTION PLAN (APP)

The Contractor shall use a qualified person to prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of USACE EM 385-1-1 and as supplemented herein. Cover all paragraph and subparagraph elements in USACE EM 385-1-1, Appendix A, "Minimum Basic Outline for Preparation of Accident Prevention Plan". Where a paragraph or subparagraph element is not applicable to the work to be performed indicate "Not Applicable" next to the heading. Specific requirements for some of the APP elements are described below at paragraph 1.8.1. The APP shall be job-specific and shall address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the Contractor's overall safety and health program. Any portions of the Contractor's overall safety and health program referenced in the APP shall be included in the applicable APP element and made site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP shall be signed by the person and firm (senior person) preparing the APP, the Contractor, the on-site superintendent, the designated site safety and health officer and any designated CSP and/or CIH.

Submit the APP to the Contracting Officer 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP. The Contracting Officer reviews and comments on the Contractor's submitted APP and accepts it when it meets the requirements of the contract provisions.

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

Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSSH and quality control manager. Should any unforeseen hazard become evident during the performance of work, the project superintendent shall inform the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, all necessary action shall be taken by the Contractor to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment.

Copies of the accepted plan will be maintained at the resident engineer's office and at the job site. The APP shall be continuously reviewed and amended, as necessary, throughout the life of the contract. Unusual or high-hazard activities not identified in the original APP shall be incorporated in the plan as they are discovered.

## 1.9.1 EM 385-1-1 Contents

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

- a. Names and qualifications (resumes including education, training, experience and certifications) of all site safety and health personnel designated to perform work on this project to include the designated site safety and health officer and other competent and qualified personnel to be used such as CSPs, CIHs, STSs, CHSTs. The duties of each position shall be specified.
- b. Qualifications of competent and of qualified persons. As a minimum, competent persons shall be designated and qualifications submitted for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; personal protective equipment and clothing to include selection, use and maintenance.
- c. Confined Space Entry Plan. Develop a confined space entry plan in accordance with USACE EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, and any other federal, state and local regulatory requirements identified in this contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none will be created.)
- d. Health Hazard Control Program. The Contractor shall designate a competent and qualified person to establish and oversee a Health Hazard Control Program in accordance with USACE EM 385-1-1, Section 6. The program shall ensure that employees, on-site Government representatives, and others, are not adversely exposed to chemical, physical and biological agents and that necessary controls and protective actions are instituted to ensure health.
- e. Crane Critical Lift Plan. Prepare and sign weight handling critical lift plans for lifts over 75 percent of capacity of the crane or hoist (or lifts over 50 percent of the capacity of a barge mounted mobile crane's hoists) at any radius of lift; lifts involving more than one crane or hoist; lifts of personnel; and lifts involving more than rigging or operation, sensitive equipment, or unusual safety risks. The plan shall be submitted 15 calendar days prior to on-site work and include the requirements of USACE EM 385-1-1, paragraph 16.c.18. and the following:
  - (1) For lifts of personnel, the plan shall demonstrate compliance with the requirements of 29 CFR 1926.500(g).
  - (2) For barge mounted mobile cranes, barge stability calculations identifying barge list and trim based on anticipated loading; and load charts based on calculated list and trim. The amount of list and trim shall be within the crane manufacturer's requirements.
- f. Alcohol and Drug Abuse Plan

(1) Describe plan for random checks and testing with pre-employment screening in accordance with the DFAR Clause subpart 252.223-7004, "Drug Free Work Force."

(2) Description of the on-site prevention program

g. Fall Protection and Prevention (FP&P) Plan. The plan shall be site specific and address all fall hazards in the work place and during different phases of construction. It shall address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 1.8 m (6 feet). A qualified person for fall protection shall prepare and sign the plan. The plan shall include fall protection and prevention systems, equipment and methods employed for every phase of work, responsibilities, assisted rescue self-rescue and evacuation procedures, training requirements, and monitoring methods. Fall Protection and Prevention Plan shall be revised every six months for lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. The accepted Fall Protection and Prevention Plan shall be kept and maintained at the job site for the duration of the project. The Fall Protection Plan shall be included in the Accident Prevention Plan (APP)

h. Training Records and Requirements. List of mandatory training and certifications which are applicable to this project (e.g. explosive actuated tools, confined space entry, fall protection, crane operation, vehicle operator, forklift operators, personal protective equipment); list of requirements for periodic retraining/certification; outline requirements for supervisory and employee safety meetings.

i. Occupant Protection Plan. The safety and health aspects of lead-based paint removal, prepared in accordance with Section 02 83 19.00 10 Lead Based Paint Hazard Abatement, Target Housing & Child Occupied Facilities, 02 82 33.13 20 Removal/Control and Disposal of Lead Containig Paint.

j. Lead Compliance Plan. The safety and health aspects of lead work, prepared in accordance with Section 02 83 13.00 20 Lead in Construction.

k. Asbestos Hazard Abatement Plan. The safety and health aspects of asbestos work, prepared in accordance with Section 02 2 16.00, "Engineering Control of Asbestos Containing Materials"

l. Site Safety and Health Plan. The safety and health aspects prepared in accordance with this section.

m. PCB Plan. The safety and health aspects of Polychlorinated Biphenyls work, prepared in accordance with Sections 02 84 33, "Removal and Disposal of Polychlorinated Biphenyls (PCBs) and 02 61 23, "Removal and Disposal of PCB Contaminated Soils)".

n. Site Demolition Plan. The safety and health aspects prepared in accordance with Section 02 41 00.00 40, Demolition" and referenced sources. Include engineering survey as applicable.

o. Excavation Plan. The safety and health aspects prepared in accordance with Section 3100, Earthwork.

p. [Crane Work Plan](#). The contractor shall provide a crane work plan



to the Contracting Officer for acceptance. The crane work plan shall include the specific model of each crane and a drawing identifying their locations (exact), the dimensions, wheel sizes, number of wheels, wheel spacing, tire pressure(s), number of axles, axle spacing, minimum wheel load to be exerted during operations and maximum outrigger load to be exerted during operations. The Contractor shall allow at least 10 working days for acceptance/non-acceptance of the crane work plan. No crane operations shall begin prior to written acceptance of the crane plan by the Government. ROICC shall be the government approving authority.

#### 1.10 ACTIVITY HAZARD ANALYSIS (AHA)

The Activity Hazard Analysis (AHA) format shall be in accordance with USACE EM 385-1-1. Submit the AHA for review at least 15 calendar days prior to the start of each phase. Format subsequent AHA as amendments to the APP. An AHA will be developed by the Contractor for every operation involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or subcontractor is to perform work. The analysis must identify and evaluate hazards and outline the proposed methods and techniques for the safe completion of each phase of work. At a minimum, define activity being performed, sequence of work, specific safety and health hazards anticipated, control measures (to include personal protective equipment) to eliminate or reduce each hazard to acceptable levels, equipment to be used, inspection requirements, training requirements for all involved, and the competent person in charge of that phase of work. For work with fall hazards, including fall hazards associated with scaffold erection and removal, identify the appropriate fall protection methods used. For work with materials handling equipment, address safeguarding measures related to materials handling equipment. For work requiring excavations, include requirements for safeguarding excavations. An activity requiring an AHA shall not proceed until the AHA has been accepted by the Contracting Officer's representative and a meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activity, including on-site Government representatives. The Contractor shall document meeting attendance at the preparatory, initial, and follow-up phases of quality control inspection. The AHA shall be continuously reviewed and, when appropriate, modified to address changing site conditions or operations. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

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

Activity hazard analyses shall be updated as necessary to provide an effective response to changing work conditions and activities. The on-site superintendent, site safety and health officer and competent persons used to develop the AHAs, including updates, shall sign and date the AHAs before they are implemented.

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

### 1.11 DISPLAY OF SAFETY INFORMATION

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

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

### 1.12 SITE SAFETY REFERENCE MATERIALS

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

### 1.13 EMERGENCY MEDICAL TREATMENT

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

### 1.14 [REPORTS](#)

#### 1.14.1 [Accident Reports](#)

- a. For recordable injuries and illnesses, and property damage accidents resulting in at least \$2,000 in damages, the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the Navy Contractor Significant Incident Report (CSIR) form or USACE Accident Report Form 3394 and provide the report to the Contracting Officer within 1 calendar day(s) of the accident. The Contracting Officer will provide copies of any required or special forms.
- b. For a weight handling equipment accident (including rigging gear accidents) the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the WHE Accident Report (Crane and Rigging Gear) form and provide the report to the Contracting Officer within 30 calendar days of the accident. Crane operations shall not proceed 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.

#### 1.14.2 Accident Notification

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

#### 1.14.3 Monthly Exposure Reports

Monthly exposure reporting to the Contracting Officer is required to be attached to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor. The Contracting Officer will provide copies of any special forms.

#### 1.14.4 Regulatory Citations and Violations

Contact the Contracting Officer immediately of any OSHA or other regulatory agency inspection or visit, and provide the Contracting Officer with a copy of each citation, report, and contractor response. Correct violations and citations promptly and provide written corrective actions to the Contracting Officer.

#### 1.14.5 Crane Reports

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

#### 1.14.6 Certificate of Compliance

The Contractor shall provide a Certificate of Compliance for each crane entering an activity under this contract (see Contracting Officer for a blank certificate). Certificate shall state that the crane and rigging gear meet applicable OSHA regulations (with the Contractor citing which OSHA regulations are applicable, e.g., cranes used in construction, demolition, or maintenance shall comply with 29 CFR 1926 and USACE EM 385-1-1 section 16 and Appendix H. Certify on the Certificate of Compliance that the crane operator(s) is qualified and trained in the operation of the crane to be used. For cranes at DOD activities in foreign countries, the Contractor shall certify that the crane and rigging gear conform to the appropriate host country safety standards. The Contractor shall also certify that all of its crane operators working on the DOD activity have been trained in the proper use of all safety devices (e.g., anti-two block devices). These certifications shall be posted on the crane.

#### 1.14.7 Third Party Certification of Barge-Mounted Mobile Cranes

Barge-mounted mobile cranes shall be certified in accordance with 29 CFR 1919 by an OSHA accredited person.

#### 1.15 HOT WORK

Prior to performing "Hot Work" (welding, cutting, etc.) or operating other flame-producing/spark producing devices, a written permit shall be requested from the Fire Division. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. The Contractor will provide at least two (2) twenty (20) pound 4A:20 BC rated extinguishers for normal "Hot Work". All extinguishers shall be current inspection tagged, approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch shall be trained in accordance with NFPA 51B and remain on-site for a minimum of 30 minutes after completion of the task or as specified on the hot work permit.

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

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

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

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

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

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

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

## PART 2 PRODUCTS

### 2.1 CONFINED SPACE SIGNAGE

The Contractor shall provide permanent signs integral to or securely attached to access covers for all required confined spaces. Signs

wording: "DANGER--PERMIT-REQUIRED CONFINED SPACE - DO NOT ENTER -" in bold letters a minimum of 25 mm(one inch) in height and constructed to be clearly legible with all paint removed. The signal word "DANGER" shall be red and readable from 1.52 m(5 feet).

## 2.2 FALL PROTECTION ANCHORAGE

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

## PART 3 EXECUTION

### 3.1 CONSTRUCTION AND/OR OTHER WORK

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

#### 3.1.1 Hazardous Material Use

Each hazardous material must receive approval prior to being brought onto the job site or prior to any other use in connection with this contract. Allow a minimum of 10 working days for processing of the request for use of a hazardous material. Any work or storage involving hazardous chemicals or materials must be done in a manner that will not expose Government or Contractor employees to any unsafe or unhealthful conditions. Adequate protective measures must be taken to prevent Government or Contractor employees from being exposed to any hazardous condition that could result from the work or storage. The Prime Contractor shall keep a complete inventory of hazardous materials brought onto the work-site. Approval by the Contracting Officer of protective measures and storage area is required prior to the start of the work.

#### 3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with USACE EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials.

#### 3.1.3 Unforeseen Hazardous Material

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos. If additional material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed

without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

### 3.2 PRE-OUTAGE COORDINATION MEETING

Contractors are required to apply for utility outages at least 15 days in advance. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, the Contractor shall attend a pre-outage coordination meeting with the Contracting Officer to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist.

### 3.3 FALL HAZARD PROTECTION AND PREVENTION

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

#### 3.3.1 Training

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

#### 3.3.2 Fall Protection Equipment

The Contractor shall enforce use of the fall protection equipment designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is on a surface 1.8 m (6 feet) or more above lower levels. Fall protection systems such as guardrails, personnel fall arrest system, safety nets, etc., are required when working within 1.8m (6 feet) of any leading edge. In addition to the required fall protection systems, safety skiff, personal floatation devices, life rings etc., are required when working above or next to water in accordance with USACE EM 385-1-1, paragraphs 05.I. and 05.J. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems may be required when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, or travel. Fall protection must comply with 29 CFR 1926.500, Subpart M and USACE EM 385-1-1.

##### 3.3.2.1 Personal Fall Arrest Equipment

Personal fall arrest equipment, systems, subsystems, and components shall meet ANSI Z359.1. Only a full-body harness with a shock-absorbing lanyard

or self-retracting lanyard is an acceptable personal fall arrest device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Only locking snap hooks and carabiners shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed 1.8 m (6 feet). The total fall distance and any swinging of the worker (pendulum-like motion) that can occur during a fall shall always be taken into consideration when attaching a person to a fall arrest system.

### 3.3.3 Fall Protection for Roofing Work

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

#### a. Low Sloped Roofs:

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

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

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

### 3.3.4 Safety Nets

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

### 3.3.5 Existing Anchorage

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

### 3.3.6 Horizontal Lifelines

Horizontal lifelines shall be designed, installed, certified and used under

the supervision of a qualified person for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).

### 3.3.7 Guardrail Systems

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

### 3.3.8 Rescue and Evacuation Procedures

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

## 3.4 PERSONAL PROTECTIVE EQUIPMENT

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

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

## 3.5 SCAFFOLDING

Employees shall be provided with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Access to scaffold platforms greater than 6 m (20 feet) in height shall be accessed by use of a scaffold stair system. Vertical ladders commonly provided by scaffold system manufacturers shall not be used for accessing scaffold platforms greater than 6 m (20 feet) in height. The use of an adequate gate is required. Contractor shall ensure that employees are qualified to perform scaffold erection and dismantling. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection and prevention plan. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward.



Special care shall be given to ensure scaffold systems are not overloaded. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material is prohibited. The first tie-in shall be at the height equal to 4 times the width of the smallest dimension of the scaffold base. Work platforms shall be placed on mud sills. Scaffold or work platform erectors shall have fall protection during the erection and dismantling of scaffolding or work platforms that are more than six feet. Delineate fall protection requirements when working above six feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

### 3.5.1 Stilts

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

## 3.6 EQUIPMENT

### 3.6.1 Material Handling Equipment

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

b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions.

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

### 3.6.2 Weight Handling Equipment

a. Cranes must be equipped with:

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

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

(3) Anti-two block prevention devices.

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

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

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

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

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

c. The Contractor shall comply with the crane manufacturer's

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

d. The Contractor shall comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, and ASME B30.8 for floating cranes and floating derricks.

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

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

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

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

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

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

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

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

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

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

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

p. A substantial and durable rating chart containing legible letters and figures shall be provided with each crane and securely mounted onto

the crane cab in a location allowing easy reading by the operator while seated in the control station.

q. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.

r. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.

s. The Contractor shall certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

### 3.6.3 Equipment and Mechanized Equipment

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

b. Manufacture specifications or owner's manual for the equipment shall be on site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Such additional safety precautions or requirements shall be incorporated into the AHAs.

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

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

### 3.7 EXCAVATIONS

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

#### 3.7.1 Utility Locations

All underground utilities in the work area must be positively identified by a third party, independent, private utility locating company in addition to any station locating service and coordinated with the station utility department. Any markings made during the utility investigation must be maintained throughout the contract.

#### 3.7.2 Utility Location Verification

The Contractor must physically verify underground utility locations, including utility depth, by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system. Digging within 2 feet of a known utility must not be performed by means of mechanical equipment; hand digging shall

be used. If construction is parallel to an existing utility the utility shall be exposed by hand digging every 100 feet if parallel within 5 feet of the excavation.

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

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

### 3.7.4 Shoring Systems

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

### 3.7.5 Trenching Machinery

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

## 3.8 ELECTRICAL

### 3.8.1 Conduct of Electrical Work

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Positive cable identification must be made prior to submitting any outage request for electrical systems. Arrangements are to be coordinated with the Contracting Officer and Station Utilities for identification. The Contracting Officer will not accept an outage request until the Contractor satisfactorily documents that the circuits have been clearly identified. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When working in energized substations, only qualified electrical workers shall be permitted

to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. In addition, provide electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may be required, depending on the specific job and as delineated in the Contractor's AHA.

### 3.8.2 Arc Flash Risk/Hazard Analysis

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

### 3.8.3 Arc Flash Risk/Hazard Analysis Qualifications

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

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

### 3.8.4 Special Permission Energized Electrical Work Permit

All work on energized electrical systems, including high voltage, must have an approved "Special Permission Energized Electrical Work Permit." The results of a Arc Flash Risk/Hazard Analysis, per NFPA 70E, shall be included in the "Special Permission Energized Electrical Work Permit" request. Flame-resistant (FR) clothing and personal protective equipment (PPE) shall be rated for a minimum of 8 calories per square centimeter even if the flash hazard analysis indicates a lower value. A blank copy of the permit request is attached. An editable version may be obtained from the Contracting Officer.

### 3.8.5 Portable Extension Cords

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

## 3.9 WORK IN CONFINED SPACES

The Contractor shall comply with the requirements in Section 06.I of USACE EM 385-1-1 and OSHA 29 CFR 1910.146. Any potential for a hazard in the confined space requires a permit system to be used.

- a. Entry Procedures. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. (See Section 06.I.05 of USACE EM 385-1-1 for entry procedures.) All hazards pertaining to the space shall be reviewed with each employee during review of the AHA.
- b. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its' action level.
- c. Ensure the use of rescue and retrieval devices in confined spaces greater than 1.5 m (5 feet) in depth. Conform to Sections 06.I.09, 06.I.10 and 06.I.11 of USACE EM 385-1-1.
- d. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.
- e. Include training information for employees who will be involved as entrants and attendants for the work. Conform to Section 06.I.06 of USACE EM 385-1-1.
- f. Daily Entry Permit. Post the permit in a conspicuous place close to the confined space entrance.

### 3.10 CRYSTALLINE SILICA

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

### 3.11 HOUSEKEEPING

#### 3.11.1 Clean-Up

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

#### 3.11.2 Falling Object Protection

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

-- End of Section --

# Special Permission Energized Electrical Work Permit

Permit Number: \_\_\_\_\_

## Part I: Request for Special Permission

Job Order/Contract Number: \_\_\_\_\_

(1) Description of circuit/equipment: \_\_\_\_\_

(2) Job Location: \_\_\_\_\_

(3) Description of work to be done: \_\_\_\_\_

(4) Justification of why the circuit/equipment cannot be de-energized: \_\_\_\_\_

(5) Anticipated Duration of Work Requiring Special Permission: (hours/minutes) \_\_\_\_\_ On (date) \_\_\_\_\_

(6) Means Employed to Restrict Access of Unqualified Persons: \_\_\_\_\_

(7) Shock Hazard Analysis:

Voltage \_\_\_\_\_ Approach Boundaries: (distance) Limited \_\_\_\_\_ Restricted \_\_\_\_\_ Prohibited \_\_\_\_\_ Flash \_\_\_\_\_

(8) Flash Hazard Analysis: Calorie PPE required \_\_\_\_\_ (8 minimum)

Approach Boundaries to be crossed: (Check as applicable) Limited \_\_\_\_ Restricted \_\_\_\_ Prohibited \_\_\_\_ Flash Protection \_\_\_\_

(9) PPE to be used: (in addition to required daily wear)

Leather Gloves:	Yes ___ No ___
Voltage Rated Rubber Gloves with Leather Protectors	Yes ___ No ___
Safety Glasses	Yes ___ No ___
Arc Flash Face Shield rated 10-cal/cm sq or more	Yes ___ No ___
Arc Flash Hood rated 20 cal/cm sq or more	Yes ___ No ___
Safety Helmet	Yes ___ No ___
Balaclava (Head Sock)	Yes ___ No ___
Hearing Protection (single level)	Yes ___ No ___
Voltage Rated Tools	Yes ___ No ___
Hazard Risk Category 3 Clothing	Yes ___ No ___

(10) Source of Lighting: Outside Daylight \_\_\_ Inside Existing Artificial \_\_\_ Temporary Portable Lighting: (AC) \_\_\_ Battery \_\_\_

(11) Name of Employee(s) Assigned to Job and will receive job briefing before beginning work (sign in sheet required): \_\_\_\_\_

Requested By \_\_\_\_\_

Name Typed

Organization (BL / FEAD / PWO)

Phone #

Signature

## Part II: Recommended Approval

Construction Safety Manager Concurrence: \_\_\_\_\_ Date: \_\_\_\_\_

Notification:

Operation Officer: \_\_\_\_\_ Date: \_\_\_\_\_

Executive Officer: \_\_\_\_\_ Date: \_\_\_\_\_

Approved by: \_\_\_\_\_ Date \_\_\_\_\_

Commanding Officer / Designee





## SECTION 01 42 00

## SOURCES FOR REFERENCE PUBLICATIONS

01/07

## 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 B 564 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. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number. The designations "AOK" and "LOK" are for administrative purposes and should not be used when ordering publications.

## AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

100 Barr Harbor Drive  
West Conshohocken, PA 19428-2959  
Ph: 610-832-9585  
Fax: 610-832-9555  
Internet: <http://www.astm.org>  
AOK 5/01  
LOK 3/01

## AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

30 W. University Dr.  
Arlington Heights, IL 60004-1893  
Ph: 847-394-0150  
Fax: 847-253-0088  
Internet: <http://www.amca.org>  
AOK 5/01  
LOK 2/01

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

1827 Walden Ofc. Sq.  
Suite 104  
Schaumburg, IL 60173-4268  
Ph: 847-303-5664  
Fax: 847-303-5774  
Internet: <http://www.aamanet.org>  
AOK 5/01  
LOK 2/01

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)  
444 N. Capital St., NW, Suite 249  
Washington, DC 20001  
Ph: 800-231-3475 202-624-5800  
Fax: 800-525-5562 202-624-5806  
Internet: <http://www.transportation.org>  
AOK 5/01  
LOK 2/01

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)  
1330 Kemper Meadow Dr.  
Suite 600  
Cincinnati, OH 45240  
Ph: 513-742-2020  
Fax: 513-742-3355  
Internet: <http://www.acgih.org>  
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WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)  
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-- End of Section --



SECTION 01 45 10

QUALITY CONTROL

09/01

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 A 880 (1996) Criteria for Use in Evaluation of Testing Laboratories and Organizations for Examination and Inspection of Steel, Stainless Steel, and Related Alloys
- ASTM C 1077 (1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
- ASTM D 3666 (2000) Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials
- ASTM D 3740 (1999c) Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
- ASTM E 329 (2000a) Agencies Engaged in the Testing and Inspection of Materials Used on Construction
- ASTM E 543 (1999) Evaluating Agencies that Perform Nondestructive Testing

1.2 SUBMITTALS

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

SD-11 Closeout Submittals

Quality Control Plan (QC PLAN)

Submit a QC plan within 15 calendar days after receipt of Notice of Award.

1.3 INFORMATION FOR THE CONTRACTING OFFICER

Deliver the following to the Contracting Officer:

- a. Combined Contractor Production Report/Contractor Quality Control

Report (1 sheet): Original and 1 copy, by 10:00 AM the next working day after each day that work is performed;

- b. QC Specialist Reports and Test Results: Originals and 1 copy, by 10:00 AM the next working day after each day that work is performed;
- c. Testing Plan and Log, 1 copy, at the end of each month;
- d. QC Meeting Minutes: 1 copy, within 2 calendar days of the meeting;
- e. Rework Items List: 1 copy, by the last working day of the month and;
- f. QC Certifications: As required by the paragraph entitled "QC Certifications".

#### 1.4 QC PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. The QC program consists of a QC Organization, a QC Plan, attending a QC Plan meeting, attending a Coordination and Mutual Understanding Meeting, conducting QC meetings, performing three phases of control, performing submittal review, ensuring testing is performed, and preparing QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with the requirements of this Contract. The QC program shall cover construction operations on-site and off-site and shall be keyed to the proposed construction sequence.

#### 1.5 QC ORGANIZATION

##### 1.5.1 QC Manager

##### 1.5.1.1 Duties

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

##### 1.5.1.2 Qualifications

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

##### 1.5.1.3 Construction Quality Management Training

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



sign up for the next available class:

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

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

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

Associated Builders and Contractors (ABC), Carolinas Chapter  
Contact: ABC, Carolinas Chapter  
3705 Latrobe Drive  
Charlotte, NC 28211  
Phone: 704-367-1331  
or: 877-470-4819

1.5.2 Alternate QC Manager Duties and Qualifications

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

1.6 QC PLAN

1.6.1 Requirements

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

- a. A table of contents listing the major sections identified with tabs in the following order:
  - I. QC ORGANIZATION
  - II. NAMES AND QUALIFICATIONS
  - III. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL
  - IV. OUTSIDE ORGANIZATIONS
  - V. APPOINTMENT LETTERS
  - VI. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER
  - VII. TESTING LABORATORY INFORMATION
  - VIII. TESTING PLAN AND LOG
  - IX. PROCEDURES TO COMPLETE REWORK ITEMS

- X. DOCUMENTATION PROCEDURES
  - XI. LIST OF DEFINABLE FEATURES
  - XII. PROCEDURES FOR PERFORMING THE THREE PHASES OF CONTROL
  - XIII. PERSONNEL MATRIX
  - XIV. PROCEDURES FOR COMPLETION INSPECTION
- b. A chart showing the QC organizational structure and its relationship to the production side of the organization.
  - c. Names and qualifications, in resume format, for each person in the QC organization.
  - d. Duties, responsibilities and authorities of each person in the QC organization.
  - e. A listing of outside organizations such as, architectural and consulting engineering firms that will be employed by the Contractor and a description of the services these firms will provide.
  - f. A letter signed by an officer of the firm appointing the QC Manager and stating that he/she is responsible for managing and implementing the QC program as described in this contract. Include in this letter the QC Manager's authority to direct the removal and replacement of non-conforming work.
  - g. Procedures for reviewing, approving and managing submittals. Provide the names of the persons in the QC organization authorized to review and certify submittals prior to approval.
  - h. Testing laboratory information required by the paragraphs entitled "Accredited Laboratories" or "Testing Laboratory Requirements", as applicable.
  - i. A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test.
  - j. Procedures to identify, record, track and complete rework items.
  - k. Documentation procedures, including proposed report formats.
  - l. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and requires separate control requirements. As a minimum, if approved by the Contracting Officer, consider each Section of the Specifications as a definable feature of work. However, at times, there may be more than one definable feature of work in each Section of the Specifications.
  - m. A personnel matrix showing, for each section of the specification, who will perform and document the three phases of control, and who will perform and document the testing.
  - o. Procedures for Identifying and Documenting the Completion Inspection process. Include in these procedures the responsible party for punch out inspection, prefinal inspection, and final acceptance inspection.

### 1.6.2 Preliminary Work Authorized Prior to Approval

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

### 1.6.3 Approval

Approval of the QC plan is required prior to the start of construction. The Contracting Officer reserves the right to require changes in the QC plan and operations as necessary to ensure the specified quality of work. The Contracting Officer reserves the right to interview any member of the QC organization at any time in order to verify his/her submitted qualifications.

### 1.6.4 Notification of Changes

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

### 1.7 QC PLAN MEETING

Prior to submission of the QC plan, meet with the Contracting Officer to discuss the QC plan requirements of this Contract. The purpose of this meeting is to develop a mutual understanding of the QC plan requirements prior to plan development and submission.

### 1.8 COORDINATION AND MUTUAL UNDERSTANDING MEETING

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

### 1.9 QC MEETINGS

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

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

- Rework items completed since last meeting;
- c. Review the status of submittals:
  - Submittals reviewed and approved since last meeting
  - Submittals required in the near future;
- d. Review the work to be accomplished in the next 2 weeks and documentation required. Schedule the three phases of control and testing:
  - Establish completion dates for rework items
  - Preparatory phases required
  - Initial phases required
  - Follow-up phases required
  - Testing required
  - Status of off-site work or testing
  - Documentation required;
- e. Resolve QC and production problems; and
- f. Address items that may require revising the QC plan:
  - Changes in QC organization personnel
  - Changes in procedures.

#### 1.9.1 THREE PHASES OF CONTROL

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

#### 1.9.2 Preparatory Phase

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

- a. Review each paragraph of the applicable specification sections;
- b. Review the Contract drawings;
- c. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required;
- d. Review the testing plan and ensure that provisions have been made to provide the required QC testing;
- e. Examine the work area to ensure that the required preliminary work has been completed;
- f. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop

drawings and submitted data;

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

#### 1.9.3 Initial Phase

Notify the Contracting Officer at least 48 hours in advance of each initial phase. When construction crews are ready to start work on a definable feature of work, conduct the initial phase with the QC Specialists, the super intendent, and the foreman responsible for that definable feature of work. Observe the initial segment of the definable feature of work to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily Contractor Quality Control Report. Repeat the initial phase for each new crew to work on-site, or when acceptable levels of specified quality are not being met. Perform the following for each definable feature of work:

- a. Establish the quality of workmanship required;
- b. Resolve conflicts;
- c. Review the Safety Plan and the appropriate activity hazard analysis to ensure that applicable safety requirements are met; and
- d. Ensure that testing is performed by an approved laboratory.

#### 1.9.4 Follow-Up Phase

Perform the following for on-going work daily, or more frequently as necessary until the completion of each definable feature of work and document in the daily Contractor Quality Control Report:

- a. Ensure the work is in compliance with Contract requirements;
- b. Maintain the quality of workmanship required;
- c. Ensure that testing is performed by an approved laboratory; and
- d. Ensure that rework items are being corrected.

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

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

#### 1.10 SUBMITTAL REVIEW

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

#### 1.11 TESTING

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

### 1.11.1 Testing Laboratory Requirements

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

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

### 1.11.2 Accredited Laboratories

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

### 1.11.3 Inspection of Testing Laboratories

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

### 1.11.4 Capability Check

The Contracting Officer retains the right to check laboratory equipment in

the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract.

#### 1.11.5 Test Results

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

#### 1.12 QC CERTIFICATIONS

##### 1.12.1 Contractor Quality Control Report Certification

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

##### 1.12.2 Invoice Certification

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

##### 1.12.3 Completion Certification

Upon completion of work under this Contract, the QC Manager shall furnish a certificate to the Contracting Officer attesting that "the work has been completed, inspected, tested and is in compliance with the Contract".

#### 1.13 DOCUMENTATION

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

##### 1.13.1 Contractor Production Report

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

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

- b. Weather conditions in the morning and in the afternoon including maximum and minimum temperatures.
- c. A list of Contractor and subcontractor personnel on the work site, their trades, employer, work location, description of work performed and hours worked.
- e. A list of job safety actions taken and safety inspections conducted. Indicate that safety requirements have been met including the results on the following:
  - (1) Was a job safety meeting held this date? (If YES, attach a copy of the meeting minutes.)
  - (2) Were there any lost time accidents this date? (If YES, attach a copy of the completed OSHA report.)
  - (3) Was crane/manlift/trenching/scaffold/hv electrical/high work/hazmat work done? (If YES, attach a statement or checklist showing inspection performed.)
  - (4) Was hazardous material/waste released into the environment? (If YES, attach a description of incident and proposed action.)
- f. A list of safety actions taken today and safety inspections conducted.
- g. A list of equipment/material received each day that is incorporated into the job.
- h. A list of construction and plant equipment on the work site including the number of hours used, idle and down for repair.
- i. Include a "remarks" section in this report which will contain pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site.

#### 1.13.2 Contractor Quality Control Report

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

- a. Identify the control phase and the definable feature of work.
- b. Results of the Preparatory Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work, the drawings and specifications have been reviewed, submittals have been approved, materials comply



with approved submittals, materials are stored properly, preliminary work was done correctly, the testing plan has been reviewed, and work methods and schedule have been discussed.

- c. Results of the Initial Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work the preliminary work was done correctly, samples have been prepared and approved, the workmanship is satisfactory, test results are acceptable, work is in compliance with the Contract, and the required testing has been performed and include a list of who performed the tests.
- d. Results of the Follow-up Phase inspections held including the location of the definable feature of work. Indicate in the report for this definable feature of work that the work complies with the Contract as approved in the Initial Phase, and that required testing has been performed and include a list of who performed the tests.
- e. Results of the three phases of control for off-site work, if applicable, including actions taken.
- f. List the rework items identified, but not corrected by close of business.
- g. List the rework items corrected from the rework items list along with the corrective action taken.
- h. Include a "remarks" section in this report which will contain pertinent information including directions received, quality control problem areas, deviations from the QC plan, construction deficiencies encountered, QC meetings held, acknowledgement that as-built drawings have been updated, corrective direction given by the QC Organization and corrective action taken by the Contractor.
- i. Contractor Quality Control Report certification.

#### 1.13.3 Testing Plan and Log

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

#### 1.13.4 Rework Items List

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

## 1.13.5 As-Built Drawings

The QC Manager is required to review the as-built drawings required by Section 01 78 00, "Closeout Procedures", to ensure that as-built drawings are kept current on a daily basis and marked to show deviations which have been made from the Contract drawings. The QC Manager shall initial each deviation and each revision. Upon completion of work, the QC Manager shall furnish a certificate attesting to the accuracy of the as-built drawings prior to submission to the Contracting Officer.

## 1.13.6 Report Forms

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

- a. Combined Contractor Production Report and Contractor Quality Control Report (1 sheet), with separate continuation sheet
- b. Testing Plan and Log
- c. Rework Items List

## PART 2 PRODUCTS

Not used.

## PART 3 EXECUTION

Not used.

# CONTRACTOR PRODUCTION REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE

CONTRACT NO

TITLE AND LOCATION

REPORT NO

CONTRACTOR

SUPERINTENDENT

AM WEATHER

PM WEATHER

MAX TEMP

F

MIN TEMP

F

## WORK PERFORMED TODAY

Schedule Activity No.	WORK LOCATION AND DESCRIPTION	EMPLOYER	NUMBER	TRADE	HRS

**JOB SAFETY**

WAS A JOB SAFETY MEETING HELD THIS DATE?

if YES attach copy of the meeting minutes

YES  NO

WERE THERE ANY LOST TIME ACCIDENTS THIS DATE?

if YES attach copy of completed OSHA report

YES  NO

TOTAL WORK HOURS ON JOB SITE THIS DATE

CUMULATIVE TOTAL OF WORK HOURS FROM PREVIOUS REPORT

TOTAL WORK HOURS FROM START OF CONSTRUCTION

WAS CRANE/MANLIFT/TRENCHING/SCAFFOLD/HV ELECTRICAL/HIGH WORK DONE?

if YES attach statement or checklist showing inspection performed

YES  NO

WAS HAZARDOUS MATERIAL/WASTE RELEASED INTO THE ENVIRONMENT?

if YES attach description of incident and proposed action

YES  NO

LIST SAFETY ACTIONS TAKEN TODAY/SAFETY INSPECTIONS CONDUCTED

SAFETY REQUIREMENTS HAVE BEEN MET.

EQUIPMENT/MATERIAL RECEIVED TODAY TO BE INCORPORATED IN JOB

CONSTRUCTION AND PLANT EQUIPMENT ON JOB SITE TODAY. INCLUDE NUMBER OF HOURS USED TODAY

REMARKS

CONTRACTOR/SUPERINTENDENT

DATE

# CONTRACTOR QUALITY CONTROL REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE

PHASE	@BLANK NOT APPLICABLE	YES	NO	IDENTIFY SPECIFICATION SECTION, DEFINABLE FEATURE OF WORK, LOCATION AND LIST PERSONNEL PRESENT
<b>PREPARATORY</b>	PLANS AND SPECS HAVE BEEN REVIEWED.	<input type="checkbox"/>	<input type="checkbox"/>	
	THE SUBMITTALS HAVE BEEN APPROVED.	<input type="checkbox"/>	<input type="checkbox"/>	
	MATERIALS COMPLY WITH APPROVED SUBMITTALS	<input type="checkbox"/>	<input type="checkbox"/>	
	MATERIALS STORED PROPERLY.	<input type="checkbox"/>	<input type="checkbox"/>	
	PRELIMINARY WORK WAS DONE CORRECTLY.	<input type="checkbox"/>	<input type="checkbox"/>	
	TESTING PLAN HAS BEEN REVIEWED.	<input type="checkbox"/>	<input type="checkbox"/>	
	WORK METHOD AND SCHEDULE DISCUSSED.	<input type="checkbox"/>	<input type="checkbox"/>	
	JOB SAFETY / HAZARD ANALYSIS ADDRESSED	<input type="checkbox"/>	<input type="checkbox"/>	
	<b>INITIAL</b>	PRELIMINARY WORK WAS DONE CORRECTLY	<input type="checkbox"/>	
SAMPLE HAS BEEN PREPARED/APPROVED		<input type="checkbox"/>	<input type="checkbox"/>	
WORKMANSHIP IS SATISFACTORY		<input type="checkbox"/>	<input type="checkbox"/>	
TEST RESULTS ARE ACCEPTABLE.		<input type="checkbox"/>	<input type="checkbox"/>	
WORK IS IN COMPLIANCE WITH THE CONTRACT.		<input type="checkbox"/>	<input type="checkbox"/>	
WORK COMPIES WITH SAFETY REQUIREMENTS		<input type="checkbox"/>	<input type="checkbox"/>	
TESTING PERFORMED & WHO PERFORMED TEST				
<b>FOLLOW-UP</b>	WORK COMPIES WITH CONTRACT AS APPROVED INITIAL PHASE	<input type="checkbox"/>	<input type="checkbox"/>	
	WORK COMPIES WITH SAFETY REQUIREMENTS	<input type="checkbox"/>	<input type="checkbox"/>	
	TESTING PERFORMED & WHO PERFORMED TEST			

REWORK ITEMS IDENTIFIED TODAY (NOT CORRECTED BY CLOSE OF BUSINESS)

REWORK ITEMS CORRECTED TODAY (FROM REWORK ITEMS LIST)

REMARKS

On behalf of the contractor, I certify that this report is completed 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.

\_\_\_\_\_  
AUTHORIZED QC MANAGER AT SITE

DATE

## GOVERNMENT QUALITY ASSURANCE REPORT

DATE

QUALITY ASSURANCE REPRESENTATIVE'S REMARKS AND/OR EXCEPTIONS TO THE REPORT

\_\_\_\_\_  
GOVERNMENT QUALITY ASSURANCE MANAGER

DATE

**CONTRACTOR QUALITY CONTROL REPORT CONTINUATION SHEET**  
 (ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE \_\_\_\_\_

PHASE	BLANK NOT APPLICABLE	YES	NO
<b>PREPARATORY</b>	PLANS AND SPECS HAVE BEEN REVIEWED	<input type="checkbox"/>	<input type="checkbox"/>
	THE SUBMITTALS HAVE BEEN APPROVED.	<input type="checkbox"/>	<input type="checkbox"/>
	MATERIALS COMPLY WITH APPROVED SUBMITTALS	<input type="checkbox"/>	<input type="checkbox"/>
	MATERIALS STORED PROPERLY.	<input type="checkbox"/>	<input type="checkbox"/>
	PRELIMINARY WORK WAS DONE CORRECTLY.	<input type="checkbox"/>	<input type="checkbox"/>
	TESTING PLAN HAS BEEN REVIEWED.	<input type="checkbox"/>	<input type="checkbox"/>
	WORK METHOD AND SCHEDULE DISCUSSED.	<input type="checkbox"/>	<input type="checkbox"/>
	JOB SAFETY / HAZARD ANALYSIS ADDRESSED	<input type="checkbox"/>	<input type="checkbox"/>

IDENTIFY SPECIFICATION SECTION, DEFINABLE FEATURE OF WORK, LOCATION AND LIST PERSONNEL PRESENT

**PREPARATORY**

PRELIMINARY WORK WAS DONE CORRECTLY	<input type="checkbox"/>	<input type="checkbox"/>
SAMPLE HAS BEEN PREPARED/APPROVED	<input type="checkbox"/>	<input type="checkbox"/>
WORKMANSHIP IS SATISFACTORY	<input type="checkbox"/>	<input type="checkbox"/>
TEST RESULTS ARE ACCEPTABLE.	<input type="checkbox"/>	<input type="checkbox"/>
WORK IS IN COMPLIANCE WITH THE CONTRACT.	<input type="checkbox"/>	<input type="checkbox"/>
WORK COMPLIES WITH SAFETY REQUIREMENTS	<input type="checkbox"/>	<input type="checkbox"/>

TESTING PERFORMED & WHO PERFORMED TEST

**INITIAL**

**CONTRACTOR QUALITY CONTROL REPORT CONTINUATION SHEET**  
 (ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE

**PHASE**

(BLANK NOT APPLICABLE)

**YES**

**NO**

IDENTIFY SPECIFICATION SECTION, DEFINABLE FEATURE OF WORK, LOCATION AND LIST PERSONNEL PRESENT

WORK COMPLIES WITH CONTRACT AS APPROVED INITIAL PHASE	<input type="checkbox"/>	<input type="checkbox"/>
WORK COMPLIES WITH SAFETY REQUIREMENTS	<input type="checkbox"/>	<input type="checkbox"/>

**FOLLOW-UP**







## SECTION 01 50 00

## TEMPORARY FACILITIES AND CONTROLS

01/07

## PART 1 GENERAL

## 1.1 TEMPORARY UTILITIES

## 1.1.1 Availability of Utility Services

- a. The Contract clause related to utilities applies. Reasonable amounts of water and electricity from the nearest outlet will be provided free of charge for pursuance of work within a facility under this contract. If the nearest available outlet cannot be utilized by the Contractor because of improper voltage, insufficient current, improper pressure, incompatible connectors, etc., it shall be the responsibility of the Contractor to provide temporary utilities as required.
- b. Reasonable amounts of utilities for contractor trailers and storage buildings will be made available to the Contractor, when available. The Contractor shall be responsible for providing transformers, electrical service poles and drops for electrical services, and backflow preventer devices on connections to domestic water lines. Final taps and tie-ins to the Government utility grid will be made by the Contractor after approval by the Contracting Officer. Tap-in cost, if any, shall be the responsibility of the Contractor. Under no circumstances will taps to base fire hydrants be allowed for obtaining domestic water.

## 1.1.2 Trailers

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

## 1.1.3 Energy and Utilities Conservation

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

## 1.1.4 Location of Underground Utilities

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

- a. In addition, the Contractor will be responsible for obtaining the services of a professional utility locator prior to digging.

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

- b. It is mandatory that the Contractor also contact the Base Telephone Office (451-2531) prior to accomplishing any digging at Camp Lejeune. A telephone office representative will assist in locating telephone lines.
- c. It is mandatory that the Contractor also contact Charter Communications, cable TV service prior to accomplishing any digging at Camp Lejeune, to ensure that all buried cable lines are identified. Contact Mr. Olin Criswell at 353-8677 for assistance.

#### 1.1.4.1 The Locations of Underground Utilities

shown at only approximate and the information provided may be incomplete. Contractor shall attempt to ascertain locations of existing underground utilities prior to and during digging operations.

#### 1.1.4.2 Damage to Underground Utilities

Immediate notice shall be delivered to the Contracting Officer of any damage. The Contractor shall make temporary repairs immediately, and shall provide permanent repairs as soon as practicable. For any additional work required by reason of conflict between the new and existing work, an adjustment in contract price will be made in accordance with Contract clause entitled "Differing Site Conditions", if appropriate.

### 1.2 WEATHER PROTECTION

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

#### 1.2.1 Building and Site Storm Protection

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

##### 1.2.1.1 Hurricane Conditions of Readiness

Unless directed otherwise, comply with:

- a. Condition FIVE: Normal weather conditions are expected for the foreseeable future. No action is required.
- b. Condition FOUR (Sustained winds of 74 mph or greater expected within 72 hours): Contractors shall continue normal daily clean

up and good house keeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Stack lumber in neat piles less than 4 feet high. Prepare to remove or secure all debris, trash, or stored materials that could become missile hazards during high wind conditions. Meetings should be held on-site with all subcontractors to review the measures that are going to be taken should the base go to a higher readiness condition. Contact the ROICC for any additional updates and upon completion of all required actions.

- c. Condition THREE (Sustained winds of 74 mph or greater expected within 48 hours): Once Condition 3 is set, contractors shall shift their focus from their normal activities to taking the actions that are required to prepare the job site for the potential of destructive weather. All debris and rubbish shall be removed from the site at the end of the workday. All stored materials shall either be removed from the job site or secured (metal straps or heavy lines/ropes). All tools, equipment and gear shall be secured at the end of the workday. Begin preparations to adequately secure the facility (windows boarded up, etc.). Meetings should be held on-site with all subcontractors to review the measures that are going to be taken should base go to a higher readiness condition. Contact the ROICC for any additional updates and upon completion of all required actions.
- d. Condition TWO (Sustained winds of 74 mph or greater expected within 24 hours): Cease all normal activities until the job-site is completely prepared for the onslaught of destructive weather. The job site should be completely free of debris, rubbish and scrap materials. The facility being worked on should be made weather-tight. All scaffolding planking shall be removed. All formwork and free standing structural steel shall be braced. All machinery, tools, equipment and materials shall be properly secured or removed from the job-site. Expend every effort to clear all missile hazards and loose equipment from the job site. When the contractor secures for the day the job site should be left in a condition that is ready for the storm and the contractor should assume that they will not be allowed to return to their job site until after the storm passes and the base is reopened. Contact ROICC for additional updates and upon completion of required actions.
- e. Condition ONE (Sustained winds of 74 mph or greater expected within 12 hours): If still on the job site, the contractor will be required to immediately leave the base until the storm passes and the base is reopened.

### 1.3 STORAGE AREAS

The Contract Clause entitled "FAR 52.236-10, Operations and Storage Areas" and the following apply:

#### 1.3.1 Storage Size and Location

The open site available for storage shall be confined to the indicated operations area.

#### 1.4 TEMPORARY SANITARY FACILITIES

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

#### 1.5 TEMPORARY BUILDINGS

Locate these where directed and within the indicated operations area.

##### 1.5.1 Maintenance of Temporary Facilities

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

##### 1.5.2 Trailers or Storage Buildings

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

#### PART 2 PRODUCTS

Not used.

#### PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 57 19

TEMPORARY ENVIRONMENTAL CONTROLS

12/10

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.

U.S. DEPARTMENT OF DEFENSE (DOD)

- MIL-S-16165 (Rev E) Shielding Harnesses, Shielding Items and Shielding Enclosures for Use in the Reduction of Interference from Engine Electrical Systems
- MIL-STD-461 (2007; Rev F) Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
- MIL-STD-462 (Rev D; Notice 4) Electromagnetic Interference Characteristics

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

- 40 CFR 261 Identification and Listing of Hazardous Waste
- 40 CFR 262 Generators of Hazardous Waste
- 40 CFR 263 Transporters of Hazardous Waste
- 40 CFR 264 Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
- 40 CFR 265 Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
- 40 CFR 300 National Oil and Hazardous Substances Pollution Contingency Plan
- 49 CFR 171 General Information, Regulations, and Definitions
- 49 CFR 172 Hazardous Materials Tables and Hazardous Materials Communications Regulations
- 49 CFR 178 Shipping Container Specification

1.2 Contractor Liabilities for Environmental Protection

Contractors shall complete and provide [environmental training documentation](#)

for training required by Federal, State, and local regulations.

### 1.3 DEFINITIONS

#### 1.3.1 Sediment

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

#### 1.3.2 Solid Waste

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

#### 1.3.3 Sanitary Wastes

Wastes characterized as domestic sanitary sewage.

#### 1.3.4 Rubbish

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

Recyclables includes: clean paper, cardboard, glass, plastics (No. 1 & 2), metal, cans, untreated wood/lumber, and concrete.

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

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

#### 1.3.5 Debris

Combustible and noncombustible wastes such as ashes and waste materials resulting from construction or maintenance and repair work, (excluding recyclables) leaves, and tree trimmings.

#### 1.3.6 Chemical Wastes

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

#### 1.3.7 Garbage

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

#### 1.3.8 Hazardous Waste

Hazardous substances as defined in [40 CFR 261](#) or as defined by applicable State and local regulations.

#### 1.3.9 Hazardous Materials

Hazardous materials as defined in [49 CFR 171](#) and listed in [49 CFR 172](#).

1.3.10 Landscape Features

Trees, plants, shrubs, and ground cover.

1.3.11 Lead Acid Battery Electrolyte

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

1.3.12 Oily Waste

Petroleum products and bituminous materials.

1.3.13 Class I Ozone Depleting Substance (ODS)

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

1.4 SUBMITTALS

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

SD-11 Closeout Submittals

Solid waste disposal permit

Disposal permit for hazardous waste

Environmental training documentation

Permit to transport hazardous waste

Hazardous waste certification

Annual Report of Products Containing Recovered Materials

1.4.1 Solid Waste Disposal Permit

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

1.4.2 Disposal Permit for Hazardous Waste

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

1.4.3 Permit to Transport Hazardous Waste

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

#### 1.4.4 Hazardous Waste Certification

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

#### 1.5 ENVIRONMENTAL PROTECTION REGULATORY REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined in this Section. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, State, and local regulations pertaining to the environment, including but not limited to water, air, solid waste, and noise pollution.

#### 1.6 GENERAL ENVIRONMENTAL MANAGEMENT SYSTEM AND ENVIRONMENTAL AWARENESS

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

#### 1.7 CAMP LEJEUNE SANITARY LANDFILL INFORMATION SHEET

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

### PART 2 PRODUCTS

#### 2.1 ANNUAL REPORT OF PRODUCTS CONTAINING RECOVERED MATERIALS

The Contractor shall submit data annually (by December 1) products used during the previous fiscal year (October 1 - September 30) as required by 6002 of the Solid Waste Disposal Act as amended by Resource Conservation and Recovery Act (RCRA). Report forms is attached to end of this section as "Appendix A."

### PART 3 EXECUTION

#### 3.1 PROTECTION OF NATURAL RESOURCES

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified. Conform to the state permitting requirements of the Clean Water Act.

##### 3.1.1 Land Resources

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without Contracting Officer's permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by Contracting Officer. Where such use of attach ropes, cables, or guys is authorized, the Contractor shall be responsible for any resultant damage.



#### 3.1.1.1 Protection of Trees

Protect existing trees which are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. By approved excavation, remove trees with 30 percent or more of their root systems destroyed. Removal of trees and the procedure for removal requires approval of the Contracting Officer.

#### 3.1.1.2 Landscape Replacement

Remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features. Obtain Contracting Officer's approval before removal or replacement.

#### 3.1.1.3 Temporary Construction

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 signs of construction. Grade temporary roads, parking areas, and similar temporarily used areas to conform with surrounding contours.

#### 3.1.2 Water Resources

##### 3.1.2.1 Oily Wastes

Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water. Surround all temporary fuel oil or petroleum storage tanks with a temporary earth berm of sufficient size and strength to contain the contents of the tanks in the event of leakage or spillage.

#### 3.2 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Carefully protect in-place and report immediately to the Contracting Officer historical and archaeological items or human skeletal remains discovered in the course of work. Stop work in the immediate area of the discovery until directed by the Contracting Officer to resume work. The Government retains ownership and control over historical and archaeological resources.

#### 3.3 NOISE

Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives will not be permitted without written permission from the Contracting Officer, and then only during designated times.

#### 3.4 RESTRICTIONS ON EQUIPMENT

##### 3.4.1 Electromagnetic Interference Suppression

- a. Electric motors must comply with MIL-STD-461 relative to radiated and conducted electromagnetic interference. A test for electromagnetic interference will not be required for motors that are identical physically and electrically to those that have previously met the requirements of MIL-STD-461. An electromagnetic interference suppression test will not be required

for electric motors without commutation or sliprings having no more than one starting contact and operated at 3,600 revolutions per minute or less.

- b. Equipment used by the Contractor shall comply with MIL-S-16165 for internal combustion engines and MIL-STD-461 for other devices capable of producing radiated or conducted interference.
- c. Conduct tests for electromagnetic interference on electric motors and Contractor's construction equipment in accordance with MIL-STD-461 and MIL-STD-462. Test location shall be reasonably free from radiated and conducted interference. Furnish testing equipment, instruments, and personnel for making the tests; a test location; and other necessary facilities.

#### 3.4.2 Radio Transmitter Restrictions

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

#### 3.5 CONTROL AND DISPOSAL OF SOLID WASTES

Pick up and separate solid wastes, and place in covered containers which are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean.

##### 3.5.1 Disposal of Metal Paint Cans

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

##### 3.5.2 Disposal of Rubbish and Debris

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

Metals shall be taken to the DRMO disposal area at Lot 203, as specified.

<u>CATEGORY</u>	<u>CONSTRUCTION DEBRIS DISPOSAL - BASE SANITARY LANDFILL EXAMPLE/GENERAL INFORMATION FOR DEPOSIT IN THE LANDFILL</u>
Recyclable Cardboard	Breakdown corrugated cardboard boxes and deliver to the Base Recycling Center located at Building 982. If base personnel rejects the cardboard, take cardboard for off-base disposal.
Recyclable Wood Pallets	Deliver usable pallets to the Base Recycling Center located at Building 982. If base personnel rejects the pellets, take pallets for off-base disposal.
Untreated Wood	Deliver lumber, trees, stumps, limbs, tops, tops, and shrubs to the landfill properly separated and separate from any other items, and place in locations as designated by the landfill operator.
Organic Matter	Deliver leaves, pine straw, grass clippings, and shrub clippings to the landfill separated from any other items, and place in locations as designated by the landfill operator. No bags or containers are allowed.
Asphalt Pavement	Remove pavement from Government property and deliver to an asphalt recycling establishment. Provide a record of the total tons of asphalt recycled and the corporate name and location of the recycling establishment receiving the removed asphalt.
*****	Weigh each and every vehicle delivering debris upon entrance and exit. Cover debris.
<hr/>	
Metals	Metals will not be accepted at the landfill. Remove metals from each and every category before delivery to landfill. (Example: Remove hardware from doors and windows.)  Dispose of metal construction debris at Defense Reutilization Maintenance Office (DRMO).  Aluminum, brass, copper, lead, other metal, electrical wiring, cable (cut in 3 foot or less sections)
Construction Material	Construction material should be managed and placed in a designated area. Area shall be kept clean of debris and all material removed at the end of the project.

<u>CATEGORY</u>	<u>CONSTRUCTION DEBRIS DISPOSAL - BASE SANITARY LANDFILL EXAMPLE/GENERAL INFORMATION FOR DEPOSIT IN THE LANDFILL</u>
Solid Waste	Separate each category of solid waste to enhance recycling.
Hazardous Material	This project involves demolition, renovation/repair and/or construction activities; therefore, hazardous material (such as paints, solvents, thinners, adhesives, etc) may be used during the execution of this project. The contractor will be required to appropriately manage the hazardous material and provide secondary containment.
Solid Waste Report	All solid waste generated and recycled will be weighed. Contractor will report the amount of solid waste disposed and recycled at the end of the project to EMD's Solid Waste Manager or the Pollution Prevention Manager via the OICC.  Tonnage information for all materials delivered to the Base Landfill is available at the Landfill Office. Submit a written request to the Landfill Manager, specifying the desired information.
Recycling of Construction Debris	Recyclable material (ex. Scrap metal/aluminum/brass/copper/lead, and other metal) may be recycled through Defense Utilization Maintenance Office) DRMO using a 1348-1a with the following information (Proceeds for the sale of recyclable material are to go to the Qualified Recycling financial account - 17F3875 27RM 00767001 0 000027 3c 000000 06700198004). For additional information contact the Base Recycling Coordinator 910-451-4214.
Electrical Equipment	Before demolition or removal of electrical equipment from the Base - Contractor shall contact Base High Voltage Shop Supervisor at (910) 451-2790, to allow for first right of refusal of electrical equipment such as: ATS, transformers, and generators. Electrical equipment will not be accepted at landfill.

### 3.5.3 Disposal Off-Base

- a. Provide 24-hour advance written notice to the Contracting Office of Contractor's intention to dispose of off base.
- b. Disposal at sites or landfills not holding a valid State of North Carolina permit is specifically prohibited. The prohibition also

applies to sites where a permit may have been applied for but not yet obtained.

- c. Off-base disposal of construction debris outside the parameters of this paragraph at site without State permits and/or not in accordance with regulatory requirements shall require the Contractor at his own expense to remove, transport and relocate the debris to a State approved site. The Contractor shall also be required to pay any fines, penalties, or fees related to the illegal disposal of construction debris

### 3.6 CONTROL AND DISPOSAL OF HAZARDOUS WASTE

#### 3.6.1 Hazardous Waste Generation

Handle generated hazardous waste in accordance with 40 CFR 262.

#### 3.6.2 Hazardous Waste Disposal

Dispose of hazardous waste in accordance with Federal, State, and local regulations, especially 40 CFR 263, 40 CFR 264, and 40 CFR 265. Removal of hazardous waste from Government property shall not occur without prior notification and coordination with the Contracting officer. Transport hazardous waste by a permitted, licensed, or registered hazardous waste transported to a TSD facility. Hazardous waste shall be properly identified, packaged, and labeled in accordance with 49 CFR 172. Provide completed manifest for hazardous waste disposed of off-site to the Contracting Officer within 7 days of disposal. Hazardous waste shall not be brought onto the station.

#### 3.6.3 Hazardous Waste Storage

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

#### 3.6.4 Spills of Oil and Hazardous Materials

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

#### 3.6.5 Lead-Acid Batteries

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

- a. An industrial waste water treatment plant, if available and approved by the Contracting Officer for disposing of lead-acid battery electrolyte.
- b. Dispose of the lead-acid battery electrolyte at a permitted or interim status hazardous waste TSD facility.

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

#### 3.6.6 Mercury Control

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

#### 3.6.7 Petroleum Products

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

#### 3.6.8 Ozone Depleting Substances (ODS)

Remove ODS as specified in Section 02 41 00, "Demolition."

### 3.7 DUST CONTROL

Keep dust down at all times, including nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not shake bags of cement, concrete mortar, or plaster unnecessarily.

ANNUAL REPORT OF PRODUCTS CONTAINING RECOVERED MATERIALS

Contractor shall submit data annually (By 1 December) for the following products used during the previous fiscal year (1 October - 30 September) as required by 6002 of the Solid Waste Disposal Act as ammended by Resource Conservation and Recovery Act (RCRA):

Contract Number: \_\_\_\_\_ Fiscal Year: \_\_\_\_\_

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

APPENDIX A

<u>MATERIAL</u>	<u>DEFINITION</u>
1. Quantity (CRM)	Quantity used containing recovered materials.
2. Total Quantity	Quantity used containing recovered materials plus quantity used not containing recovered materials.
3. Unit	Ft3 (cubic feet), Ft2 (square feet), m3 (cubic meters), yd3 (cubic yards), box (number of boxes used), \$ Amt (dollar value of material used)
4. Loose-Fill Insulation	Includes, but is not limited to..."cellulose fiber, mineral fibers (fiberglass and rock wool), vermiculite, and perlite.
5. Blanket or Batt Insulation	Includes, but is not limited to... "mineral fibers (fiberglass and rock wool)."
6. Board Insulation	This category refers to sheathing, roof decking, and wood panel insulation. It includes, but is not limited to... "cellulose fiber fiberboard, perlite composite board, polyurethane, polyisocyanurate, polystyrene, phenolics, and composites."
7. Spray-in-place Insulation	Includes, but is not limited to... "foam-in-place polyurethane and polyisocyanurate, and spray-on cellulose."
8. Cement or Concrete Containing Recovered Materials, Cement, or Concrete Containing Fly Ash	
9. Copy Paper	This item refers to... "any grade of paper suitable for copying by the xerographic method."
10. Printing & Writing Paper	This item refers to... "paper designed for printing, other than newsprint, such as offset or book paper," and... "paper suitable for pen and ink, pencil, typewriter or printing."

## APPENDIX A



<u>MATERIAL</u>	<u>DEFINITION</u>
11. Corrugated & Fiberboard Boxes	Corrugated boxes refer to... "boxes made of corrugated paperboard, which, in turn, is made from a fluted corrugating medium pasted to two flat sheets of paperboard (linerboard)." Fiber or fiberboard boxes refer to... "boxes made from containerboard, either solid fiber or corrugated paperboard (general term); or boxes made from solid paperboard of the same material throughout."
12. Folding Boxes and Cartons	This item refers to... "a paperboard suitable for the manufacture of folding cartons."
13. Stationery, Office Papers, Envelopes, and Manifold Business Forms	This item is considered self-explanatory, however, if questions arise refer to 40 CFR 250.4 for definitions of any of these items.
14. Toilet Tissue, Paper Towels, Facial Tissue, Paper Napkins, Doilies, and Industrial Wipes	This item is considered self-explanatory, however, if questions arise refer to 40 CFR 250.4 for definitions of any of these items.
15. Brown Papers, and Coarse Papers	Brown papers refer to... "papers usually made from unbleached kraft pulp and used for bags, sacks, wrapping paper, and so forth." Coarse papers refer to... "papers used for industrial purposes, as distinguished from those used for cultural or sanitary purposes."
16. Other	Any other type of paper not included in any of the above categories.

APPENDIX A

-- End of Section --



**CAMP LEJEUNE SANITARY LANDFILL  
CONTRACTOR'S INFORMATION SHEET  
No Personal Property/Off Base Trash Accepted  
(Revised May 2012)**

**General Trash**

**The following items may be mixed together and brought to the landfill in the same load:**

Non-recyclable Paper, Plastics, and Basic Garbage  
Roofing Shingles (Non-Asbestos)  
Insulation (Non-Asbestos)  
Glass (other than bottles)  
Sheet Rock (Wall Board)  
Particle Board/Composition Board/OSB (re-manufactured wood products used in construction and furniture in lieu of plywood)  
Laminated/Formica covered wood products (counter tops, etc)  
Hollow core interior doors  
Floor tile (Non-Asbestos)  
Porcelain & Ceramic products (toilets, sinks etc)  
Fiber glass  
PVC pipe (cut in 10' or less lengths)  
Ceiling tile

**Wood Products:**

**The following wood products must be removed from the Base:**

Scrap lumber (painted and unpainted)  
Embark and packing boxes, pallets, ammunition crates, trees, limbs and shrubs. Salt treated wood, creosote treated wood.

**Other Products:**

Leaves, pine straw, grass and shrub clippings.

**Wood Furniture units** (must have a 1348 with Base Property and DRMO Stamps downgrading it to SCAP or be specified in the Contract)

ALL material shall be weighed through the Base Landfill scales before being removed from the Base and net tonnage & material type must be reported to the Landfill Office.

**Lead Base Painted Wood Products** must be delivered to the landfill cut in less than eight foot lengths, wrapped in 6 mil plastic and sealed. Not accepted after 1400 Mon-Thur.

**Asbestos (all types)**

Accepted by Appointment Only Asbestos must be double wrapped in 6 mil plastic, sealed with duct tape and labeled prior to delivery. Must be delivered before 1000 Mon-Thur.

Call Landfill Manager for appointment @ 451-5011 or 451-2946.

Please provide manifest at time of delivery.

**Soil**

NON-CONTAMINATED soil accepted

**Concrete Products**

Concrete, block, brick, concrete culverts, and mortar products must be removed from the Base.

Small loads of broken up brick & block may be accepted at the discretion of the Landfill Manager.

**Recyclable Products**

**The following Recyclable Products Must be separated and dropped off at a recycling drop-off point or the Recycling Center:** Plastic Containers, Cardboard, Glass bottles, Aluminum cans & foil, White paper, Shredded paper, Vinyl siding, Steel cans (clean), Newspaper, Toner/ink cartridges.

**Landfill Hours of Operation:**

Mon – Thur: 0730 - 1530

Fri: 0730 - 1200

**CAMP LEJEUNE SANITARY LANDFILL  
CONTRACTOR'S INFORMATION SHEET  
No Personal Property/Off Base Trash Accepted  
(Revised May 2012)**

**The following items CANNOT be accepted at the landfill:**

Hazardous waste	(Contact EMD)
Liquid waste	(Contact EMD)
Metal any type	(Contact DRMO) (see Base Order 5090.17)
Paint & Paint cans	(Contact EMD)
Appliances (white gear)	(Contact EMD)
Electronics	(Contact Recycling Ctr)
Computer equipment	(Contact DRMO)
Batteries any type	(Contact EMD)
Comm wire	(Contact EMD)
Barbed wire	(Contact EMD)
Concertina wire	(Contact EMD)
Contaminated soil	(Contact EMD)
Tires	(Contact EMD)
55 Gal Drums	(Contact EMD) Oil
Filters	(Contact EMD)
Petroleum containers	(Contact EMD)
Regulated Medical waste	(Contact Navel Hospital)
PCBs or PCB containers	(Contact EMD)
Oyster Shells	(Take to Off Base collection point) (Outside T.O.P. Gate)
Items Requiring Demilitarization	(Return to generating unit for demil)
Construction and Demolition debris	(unless specifically stated in the contract)

**Other Info**

**All furniture** must be accompanied by a 1348 REJECTED by Base Property Office  
**AND** downgraded to Scrap by DRMO.

**All other Base or USMC property** must be accompanied by a 1348 downgraded to  
Scrap by DRMO.

Anything related to Ordinance, Ammunition or Dangerous items, including containers,  
tubes, and packing, must be accompanied by the ADEA Certifications and copies of the  
Certifier and Verifier's Appointment letters.

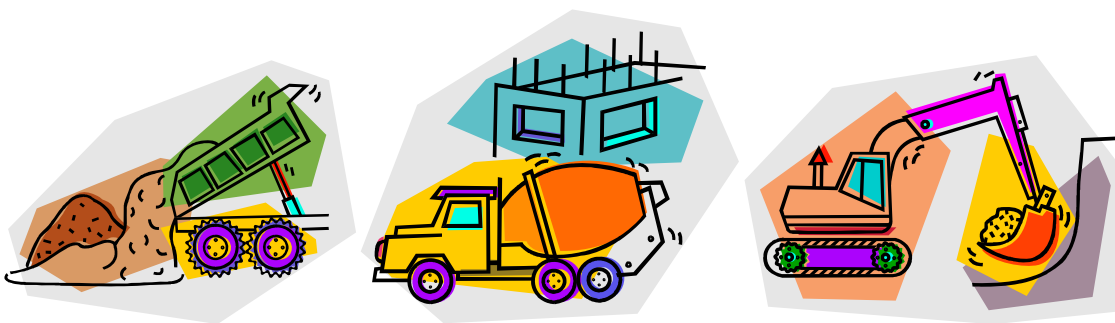
**Phone Numbers:**

Landfill Clerk	451-2946
Landfill Manager	451-4998
Landfill Fax	451-9935
EMD	451-5837
EOD	451-0558
DRMO	451-8598

# Marine Corps Base (MCB) Camp Lejeune Contractor Environmental Guide



August 2008





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**Attachment 3-1** Spill Reporting Form

**Attachment 4-1** Weekly Hazardous Waste (HW) Site Inspection Form, MCB  
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**Attachment 4-2** Weekly Hazardous Waste (HW) Site Inspection Form, MCAS  
New River

**Attachment A** MCB Camp Lejeune, NC/MCAS New River General EMS and  
Environmental Awareness Training for Contractors and Vendors





## 1.0 CONTRACTOR ENVIRONMENTAL GUIDE OVERVIEW

The purpose of this Contractor Environmental Guide is to assist contractors working aboard Marine Corps Base (MCB) Camp Lejeune (MCBCL) and Marine Corps Air Station (MCAS) New River (MCASNR) in complying with Federal and state environmental laws and regulations, as well as Marine Corps and local Installation environmental policies. This guide is designed to answer many of the environmental questions that arise as well as provide pertinent information on environmental topics and training requirements.

**NOTE** This document should be used only as a *guide* to environmental issues contractors may face while working aboard MCBCL and MCASNR. It is expected that contractors will work closely with their Resident Officer in Charge of Construction (ROICC) or Contract Representatives who will consult with the Environmental Management Division (EMD) at MCBCL and the Environmental Affairs Department (EAD) at MCASNR regarding environmental management issues, concerns, and/or questions.

**NOTE** This guide is designed to provide the Federal and state requirements and Marine Corps and Installation policies that pertain to MCBCL and MCASNR. It is the contractor's responsibility to know and comply with requirements and policies. Environmental personnel will assist contractors with compliance issues; however, the primary burden of regulatory identification, familiarity, and compliance lies with the contractor. This training *does not* replace any required regulatory environmental training as per contract requirements. Required environmental training should be completed *prior* to working at MCBCL or MCASNR, if required by your contract.

**NOTE** It is the contractor's responsibility to review the project-specific contract and specifications. Additional environmental requirements, submissions, and/or meetings not documented in this guide may be necessary.

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**This document should be used only as a *guide* to environmental issues contractors may face while working aboard MCBCL and MCASNR.**

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**If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative, who will contact EMD or EAD if additional clarification is necessary.**

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## **1.1 KEY DEFINITIONS AND CONCEPTS**

The following are key definitions and concepts used throughout this guide. If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

### **1.1.1 Key Definitions**

- **Environment.** Surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation.
- **Environmental Management Division (EMD).** MCBCL's environmental division responsible for environmental issues and compliance at MCBCL and MCASNR (with the exception of hazardous waste and hazardous materials at MCASNR).
- **Environmental Affairs Department (EAD).** MCASNR's environmental department responsible for hazardous waste/hazardous material issues at MCASNR.

### 1.1.2 Key Concepts

- **Comprehensive Environmental Training and Education Program (CETEP).** The Marine Corps training program designed to ensure that high-quality, efficient, and effective environmental training, education, and information are provided at all levels of the Marine Corps.
- **Environmental Management System (EMS).** The part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing, and maintaining the Environmental Policy.
- **EMS Training.** Instruction that is designed to ensure that military and civilian personnel, including contractors and vendors, become familiar with the Installation's EMS and how it functions.
- **General Environmental Awareness Training.** Instruction that is designed to ensure that military and civilian personnel, including contractors and vendors, become familiar with the local environmental policies and programs for regulatory compliance, natural resource conservation, pollution prevention, and environmental protection.
- **Installation.** Throughout this document, Installation refers to all MCBCL property, including MCASNR and all outlying fields associated with MCBCL.

## 1.2 INSTALLATION BACKGROUND

MCB Camp Lejeune was established in 1941 in Onslow County along the southern coast of North Carolina. MCBCL is located just north of MCAS New River. MCBCL encompasses more than 153,000 acres, consisting of 26,000 acres of water and 127,000 acres of land.

The primary function of MCBCL is national defense, providing a home base for the II Marine Expeditionary Force (MEF), 2d Marine Division, 2d Marine Logistics Group, and other combat units and support commands. MCBCL's mission is to maintain combat ready units for expeditionary deployment. MCBCL maintains and utilizes supply warehouses;

maintenance shops; hazardous material and hazardous waste storage; bulk fuel storage and transfer facilities; fleet parking; housing areas; recreational areas; two golf courses; and a marina. Additionally, MCBCL is a self-sufficient Base, with its own steam-generating station, wastewater treatment plant, drinking water wells, drinking water treatment plants, and landfill.

MCASNR is the principal U.S. Marine Corps (USMC) helicopter operating location on the East Coast. The Air Station supports aircrew training in the H-53 helicopter. It is also the evaluation and prospective beddown site for the V-22 Osprey. The mission of MCASNR is to provide the necessary support for its tenant units, Marine Aircraft Group 26 (MAG-26) and MAG-29.

### **1.2.1 Environmental Management Division (EMD) and Environmental Affairs Department (EAD)**

MCBCL's EMD, located within the Installation and Environment Department, is responsible for all natural resource and environmental matters aboard the Installation (with the exception of hazardous waste/hazardous material issues at MCASNR). EMD works closely with activities at MCBCL, educating and training personnel to comply with environmental laws while accomplishing the military mission.

The Environmental Affairs Department (EAD) is located at MCASNR. EAD and EMD work closely together. MCBCL and MCASNR participate together in one Environmental Management System (EMS).

### **1.2.2 Expectations**

As contractors aboard the Installation, your commitment to strict compliance with environmental laws and regulations will assist the Installation in providing the best possible training facilities for today's Marines and Sailors while honoring our environmental responsibilities and objectives. Violation of environmental laws can result in severe civil or criminal penalties and fines.

## **1.3 OVERVIEW OF REQUIREMENTS**

### **1.3.1 Contractor Environmental Guide**

The following information is contained in the guide:

- MCBCL Contractor Environmental Guide
  - EMS overview and requirements
  - Environmental program specific requirements
- Attachment A: MCB Camp Lejeune/MCAS New River General EMS and Environmental Awareness Training for Contractors and Vendors

This guide and associated EMS and General Environmental Awareness training module is provided for review to contractors and their employees performing work aboard the Installation. Included is a summary of the EMS and environmental programs, as well as a summary of key requirements associated with the various environmental issues contractors may encounter while performing work aboard the Installation. Contractors are expected to work with their ROICC or Contract Representatives and the EMD/EAD when environmental concerns or issues arise.

### 1.3.2 Environmental and EMS Training

In accordance with Department of Defense (DoD) instructions and Marine Corps Orders (MCO), MCBCL and MCASNR have implemented Comprehensive Environmental Training and Education Programs (CETEP). The goal of CETEP is to ensure that appropriate environmental instruction and related information are provided to all levels of the Marine Corps in the most effective and efficient manner to achieve full compliance with all applicable environmental training requirements. A major component of the CETEP is to provide general environmental awareness training to all individuals associated with the Installation, including contractors.

In addition to CETEP requirements, the Installation has implemented an Installation-wide Environmental Management System. The EMS highlights the fact that the authority and principal responsibility for controlling environmental impacts belong to those commands, units, offices, and personnel (including contractors) whose activities have the potential to impact the environment.

All contractors should provide both EMS and General Environmental Awareness training to their employees. This guide, along with the training materials in Attachment A, satisfy these training requirements. The

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**This guide and associated EMS and General Environmental Awareness training module is provided for review to contractors and their employees performing work aboard MCB Camp Lejeune.**

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**All contractors are provided both EMS and General Environmental Awareness training materials in this handbook to utilize in training their employees.**

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training module can also be accessed at the MCBCL EMD website at: <http://www.lejeune.usmc.mil/emd/> under “General EMS and Environmental Awareness Training for Contractors and Vendors.”

As such, contractors working aboard the Installation will do the following:

- Fulfill job responsibilities in compliance with environmental regulations and in conformance with EMS requirements.
- Complete all applicable environmental training and maintain associated records as per contract requirements.
- Review EMS and General Environmental Awareness training, and be aware of and understand the Environmental Policy.
- Contact their ROICC or Contract Representative immediately regarding environmental and/or EMS issues.

### 1.4 POINTS OF CONTACT

Table 1-1 lists the EMD Branches and their respective phone numbers. Contact your ROICC or Contract Representative, who may refer you to an EMD POC for environmental and EMS-related questions and/or concerns.

**Table 1-1.** EMD Points of Contact, 0730 to 1630 M–F

<b>Branch/Program Area</b>	<b>Phone Number</b>
<b>MARINE CORPS BASE, CAMP LEJEUNE</b>	
Environmental Management Division (EMD), I&E Dept	(910) 451-5003
Environmental Compliance Branch, EMD	(910) 451-5837
Hazardous Waste/Hazardous Material (HW/HM) Program	(910) 451-1482
Base HazMart	(910) 451-1482
Pollution Abatement System Program	(910) 451-1482
Environmental Quality Branch (Air Quality, Water Quality, Solid Waste, Permitting)	(910) 451-5068
Environmental Conservation Branch (Natural Resources, Cultural Resources)	(910) 451-5063
Conservation Law Enforcement	(910) 451-5226
<b>MARINE CORPS AIR STATION, NEW RIVER</b>	
Environmental Affairs Division (HW/HM issues aboard MCASNR)	(910) 449-5997

In the case of an environmental emergency, contact the appropriate party, as well as your ROICC or Contract Representative, as outlined in Table 1-2. Additional emergency response procedures are provided in Section 3.0 of this guide.

**Table 1-2.** Environmental Emergency Contacts

<b>If you spill:</b>	<b>Call:</b>
Hazardous waste	<b>911</b>
Unknown materials	<b>911</b>
Hazardous materials	<b>911</b>
Petroleum, oil, and lubricants (POL) and/or nonpetroleum oils (cooking oils and greases)	<b>911</b>





## 2.0 ENVIRONMENTAL MANAGEMENT SYSTEM

The Installation jointly operates an Environmental Management System (EMS). An EMS is a systematic way of continually implementing environmental requirements and evaluating performance. The EMS is founded on the principles of MCB Camp Lejeune and MCAS New River's Environmental Policy, which is endorsed by their respective Commanding Officers (COs). Three key principles of the Environmental Policy are to comply with relevant environmental laws and regulations, prevent pollution, and continually improve our EMS.

The purpose of the EMS is to sustain and enhance mission readiness and access to training areas through effective and efficient environmental management. The EMS highlights the fact that the authority and principal responsibility for controlling environmental impacts belong to those commands, units, offices, and personnel (including contractors and vendors) whose activities have the potential to impact the environment.

### 2.1 KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with environmental management systems. If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

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**Three key principles of the Environmental Policy are to comply with relevant environmental laws and regulations, prevent pollution, and continually improve our EMS.**

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**If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative, who will contact EMD if additional clarification is necessary.**

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### 2.1.1 Key Definitions

- **Environment.** Surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation.
- **Environmental Aspect.** A characteristic of a practice that can cause, in normal operation or upset mode, an impact to an environmental or other resource. Each practice may have several aspects.
- **Environmental Impact.** An effect of a practice's aspect on an environmental or other resource. Each practice may have several impacts.
- **Environmental Resources.** Sensitive environmental receptors (e.g., air, water, natural resources) or cultural or historic assets at the Installation, in the surrounding community, within the ecosystem or beyond, that can be impacted by the operation of practices.
- **Practice.** A unit process that supports a military mission and can impact environmental resources. (It is the ability to impact an environmental resource that is key to defining a practice. However, practices may also impact other resources.)
- **Practice Owner.** Person(s) responsible for control of practices. EMS procedures use the term *practice owner* when assignment of more specific responsibilities is left to the owning organizations.

### 2.1.2 Key Concepts

- **Environmental Management System (EMS).** The part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing, and maintaining the Environmental Policy.
- **Environmental Policy.** Statement by the organization of its intentions and principles in relation to the overall environmental performance, which provides a framework for action and for the setting of environmental objectives and targets.

## 2.2 OVERVIEW OF REQUIREMENTS

Contractors must be aware of, and adhere to, all regulations and requirements concerning EMS, including the following:

- **Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management.** Requires implementation of an EMS at all appropriate organizational levels.

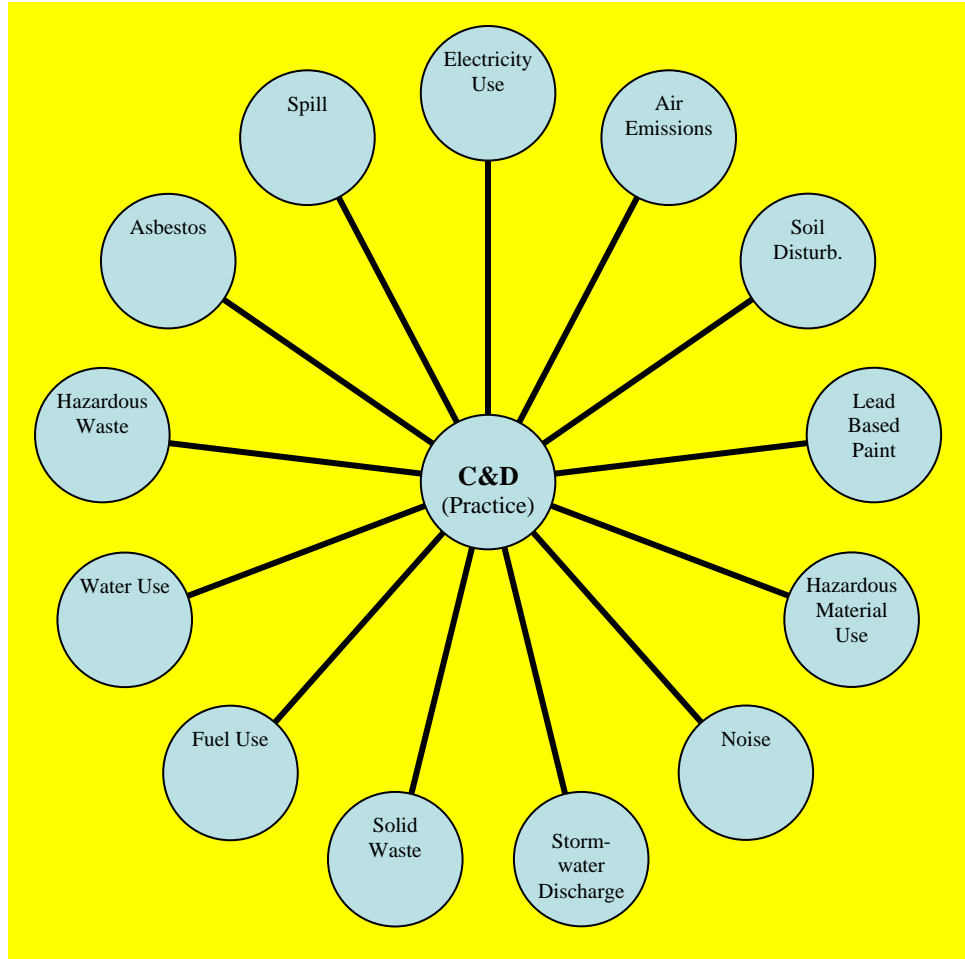
## 2.3 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

An EMS is a systematic way of continually implementing environmental requirements and evaluating performance. The foundation of the Installation's EMS is based on the activities, or practices, conducted at the installation. One "systematic" component of the EMS is identifying all practices, or actions, executed aboard the Installation that have potential environmental aspects and impacts. Each practice at the installation, such as construction/demolition, wastewater treatment, or groundskeeping, has one or many environmental aspects. An aspect of a practice is a characteristic that can cause an impact to an environmental or other resource, such as water use. These environmental aspects can then result in an impact (e.g., depletion of natural resources) on an environmental or other resource. This relationship between practices and aspects for the practice of construction and demolition (C&D) activities is illustrated in the following simplified figure:

---

**It is expected that contractors understand that the activities performed on base can interact with the environment and have the potential to impact the environment.**

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## 2.4 EMS RESPONSIBILITIES

It is expected that contractors understand that the activities (e.g., practices) performed on Installation can interact with the environment (e.g., environmental aspects) and have the potential to impact the environment. Therefore, it is expected that contractors will do the following:

- Review the Contractor Environmental Guide.
- Be aware of the Environmental Policy.
- Conduct activities in a manner to avoid and/or minimize impacts to the environment by complying with all applicable Federal, state, and local environmental regulations and Base Orders.
- Be familiar with spill procedures.
- Report all environmental emergencies and spills.

- Report any environmental problems or concerns promptly and notify the ROICC or Contract Representative.
- Respond to data collection efforts upon request.

## **2.5 CONTRACTOR ENVIRONMENTAL GUIDE AND EMS**

The Contractor Environmental Guide comprises sections that are categorized based on the type of environmental requirements routinely encountered by contractors at the Installation. The following matrix relates the practices that contractors generally execute aboard the Installation to the contents of this guide. The matrix is provided to assist contractors in narrowing down specific requirements that may apply to on-site activities.

<b>MCB CAMP LEJEUNE PRACTICES</b>	<b>Env. Emergency Response/ Spill Response, Section 3.0</b>	<b>HM/HW, Section 4.0</b>	<b>Unforeseen Site Conditions, Section 5.0</b>	<b>Asbestos, Section 6.0</b>	<b>Lead Based Paint, Section 7.0</b>	<b>Stormwater, Section 8.0</b>	<b>Solid Waste, Recycling, and P2, Section 9.0</b>	<b>Training, Section 10.0</b>	<b>Cultural Resources, Section 11.0</b>	<b>Permitting, Section 12.0</b>	<b>Air Quality, Section 13.0</b>	<b>Natural Resources, Section 14.0</b>
Battery Replacement							●					
Building Maintenance–General		●		●			●					
Building Operation–General		●					●					
Catch Basin Cleaning						●						
Construction/Demolition				●	●	●	●		●	●		●
Controlled Burn Operations												
Degreasing		●										
Engine Operation and Maintenance		●									●	
Equipment Calibration		●										
Equipment Disposal							●					
Equipment Operation and Maintenance		●		●								
Erosion Control						●				●		●
Fuel Storage–Containers		●				●						
Fueling		●										
Grinding												
HM Storage		●			●	●						
HM Transportation		●			●							
HW Generation		●					●			●		
HW Satellite Accumulation Area		●					●			●		
Land Clearing						●	●		●	●		●
Landscaping						●						
Material Storage Handling		●					●					
Mowing						●						
Outfall Cleaning						●						
Packaging/Unpackaging							●					
Paint Removal					●						●	
Painting		●									●	
Painting Preparation		●										
Parts Replacement				●								
PCB Disposal		●										
Pesticide/Herbicide Application		●								●		
Range Residue Clearance						●				●		

<b>MCB Camp Lejeune Practices</b>	<b>Emergency Response/ Spill Response, Chapter 3.0</b>	<b>HM/HW, Chapter 4.0</b>	<b>Unforeseen Site Conditions, Chapter 5.0</b>	<b>Asbestos, Chapter 6.0</b>	<b>Lead Based Paint, Chapter 7.0</b>	<b>Stormwater, Chapter 8.0</b>	<b>Recycling and Pollution Prevention, Chapter 9.0</b>	<b>Training, Chapter 10.0</b>	<b>Cultural Resources, Chapter 11.0</b>	<b>Permitting, Chapter 12.0</b>	<b>Air Quality, Chapter 13.0</b>	<b>Natural Resources, Chapter 14.0</b>		
Refrigerant Replacement	<b>Applicable To All Practices Conducted Aboard MCB Camp Lejeune</b>	●	<b>Applicable To All Practices Conducted Aboard MCB Camp Lejeune</b>								●			
Riparian Buffer Maintenance							●						●	
Rock Crushing Operations								●	●					
Runoff Sedimentation Basins								●						
Sediment Traps								●						
Soil Excavation/Grading								●			●			
Solid Waste Recycling Collection/Transportation									●					
Storage Tank Cleaning and Maintenance		●										●		
Stormwater Collection/Conveyance System								●				●		
Stormwater Engineering Controls Operation and Maintenance								●				●		
Stump/Brush Removal								●	●					●
Vehicle Operation									●					
Vehicle Parking								●						
Vehicle/Equipment Fluid Change	●													
	<b>Applicable To All Practices Conducted Aboard MCB Camp Lejeune</b>													





## 3.0 ENVIRONMENTAL EMERGENCY RESPONSE/SPILL RESPONSE

The purpose of emergency planning is to control, contain, and remove releases of materials while minimizing impacts to human health and the environment. Contractors operating aboard the Installation must be aware of, and adhere to, environmental emergency response procedures and notification requirements to minimize detrimental effects from inadvertent releases.

For procedures relating to emergencies caused by unforeseen site conditions, please refer to Section 5.0 in this guide. For other types of non-environmental emergencies, always call 911.

### 3.1 KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with environmental emergency response and spill response requirements. If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

#### 3.1.1 Key Definitions

- **Berm.** A mound used to prevent the spread of a contaminated area.
- **Non-Petroleum Oil.** Oil products that may include, but are not limited to, synthetic oils such as silicone fluids and tung oils, wood-derivative oils such as resin/rosin oils, animal fats and oil, and edible and inedible seed oils from plants.
- **POL.** Petroleum, Oil, and Lubricant products that may include, but are not limited to, any petroleum-based products such as gasoline, diesel fuel, jet fuel, engine oil, gear oil, lube oil, and lubricant products such as hydraulic brake fluid, automatic transmission fluid (ATF), and grease.
- **Release.** The uncontrolled loss of a hazardous material from its storage vessel, to include POLs. All releases are required to be reported to the Fire and Emergency Services Division. Releases of POLs that occur within an enclosed and contained maintenance facility are not subject to this reporting requirement provided they do not have the potential to impact the environment.

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**If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative, who will contact EMD if additional clarification is necessary.**

---

### 3.1.2 Key Concepts

- **Environmental Emergency Response Contacts:**

<b>If you spill:</b>	<b>Call:</b>	<b>Follow-up:</b>
Hazardous waste	<b>911</b>	Spill Report
Unknown materials	<b>911</b>	Spill Report
Hazardous materials	<b>911</b>	Spill Report

- **Spill Follow-Up.** Contractors have containment and cleanup responsibilities following a spill.

### 3.1.3 Environmental Management System

All practices associated with Emergency Response/Spill Response are listed in Section 2 of this Handbook. The following is a list of potential impacts associated with these practices.

- Air Quality Degradation
- Community Relations/Public Perception Impact
- Depletion of Landfill Space
- Depletion of Resources
- Electricity Consumption
- Fuel Consumption
- Groundwater Quality Degradation
- Historic/Cultural Resource Disturbance
- Other Natural Resource Disturbance
- Personnel Exposure
- Potable Water Quality Degradation
- Real Property/Private Property Damage
- Soil Compaction
- Soil Erosion
- Soil Quality Degradation
- Surface Water Quality Degradation
- Water Consumption
- Wetlands Disturbance
- Wildlife Species/Habitat Disturbance

## 3.2 OVERVIEW OF REQUIREMENTS

Contractors operating aboard the Installation must be aware of, and adhere to, all applicable regulations and requirements regarding emergency response and spill procedures, including the following:

- **Clean Air Act (CAA) of 1970, Section 112r.** Specifies emergency planning where potential exists for catastrophic release of hazardous air pollutants.
- **Clean Water Act (CWA) of 1972.** Establishes the basic structure for regulating discharges of pollutants into the Waters of the United States.
- **Comprehensive Environmental Response, Compensation, and Liability (CERCLA) Act of 1980.** Authorizes federal response to any release or threatened release of hazardous substance into the environment. This act defines hazardous substances (HS) by reference to substances that are listed or designated under other environmental statutes.
- **Emergency Planning and Community Right-to-Know Act of 1986, Section 304.** Establishes requirements for the reporting of a release to ensure a quick response by local emergency responders. Notification requirements apply to two chemical lists: the Extremely Hazardous Substances (EHS) list and CERCLA HS list. The “List of Lists” provides comprehensive identification of EHSs and HSs.
- **NC General Statute Chapter 143, Article 21A – Oil Pollution and Hazardous Substances Control.** Prohibits pollution by oil, oil products, oil by-products, and other hazardous substances into the land and the waters over which the State has jurisdiction. The statute establishes specific requirements for reporting a release to the State and supports and complements applicable provisions of the Federal Water Pollution Control Act.
- **Oil Pollution Act (OPA) of 1990.** Addresses oil storage at facilities and emphasizes preparedness and response activities. This act prohibits the harmful discharge of oil and hazardous substances into Waters of the United States.
- **Resource Conservation and Recovery Act of 1976 Subtitle C.** Establishes a system for controlling hazardous waste from the time it is generated, transported, treated, stored, and/or disposed of, or from “cradle to grave.”

### 3.3 Spill Notification

The Installation Integrated Contingency Plan (ICP) provides general information for any type of response actions needed for spills aboard the Installation. Contractors must develop a Unit Level Contingency Plan that addresses spill response for their specific sites and potential spill types (e.g., chemical; sewer; POL; and non-petroleum oils). This plan must be maintained onsite and be available for review upon request.

In the event of a spill, contact your ROICC or Contract Representative after contacting emergency response. They will contact EMD to obtain a spill report form. Return the completed form to EMD (Fax # (910) 451-3471) and to your ROICC or Contract Representative. A copy of the spill reporting form is included as Attachment 3-1. The following information must be provided when reporting a spill to 911:

- Your name and phone number
- Location of spill (building, number, street)
- Number and type of injuries, if any
- Type and amount of spilled material
- Source of the spill (container, vehicle, etc.)
- Action being taken, if any, to control the spill
- Estimated time of spill

Do not wait to report a spill if all of the required information is not immediately available.

### 3.4 Follow-Up

Should surface runoff be contaminated, the contractor will, under the advisement of the Fire and Emergency Services Division or EMD, construct a temporary berm or containment area. Contaminated surface water will be removed in accordance with all safety and environmental requirements for the Installation. The Resource Conservation and Recovery Section (RCRS) within EMD ((910) 451-1482) will be notified and will provide concurrence for temporary containment areas and removal of contaminated runoff.

If solid or hazardous waste was generated as the result of a spill, refer to Sections 4.0 and 9.0 of this guide for disposal requirements.

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**Contractors must develop a Unit Level Contingency Plan that addresses spill response for their specific sites and potential spill types.**

---

**Attachment 3-1**

**Spill Reporting Form**



\*\* For EMD Personnel Only.  
Fill out all the blanks except for #18.

### SPILL REPORTING FORM

CALL RECEIVED BY: \_\_\_\_\_ RESPONDED BY: \_\_\_\_\_

SUBJ: \_\_\_\_\_

1. DATE: \_\_\_\_\_ TIME: \_\_\_\_\_

2. SOURCE: \_\_\_\_\_

(Include Serial Number of equipment if available).

3. LOCATION BUILDING: \_\_\_\_\_

4. Did Fire Dept. Respond? \_\_\_\_\_ Name of Responder: \_\_\_\_\_

5. UNIT/AGENCY: \_\_\_\_\_ POC: \_\_\_\_\_

6. ESTIMATED AMOUNT: \_\_\_\_\_ GALLONS -- QUARTS -- PINTS (Circle One)

7. TYPE OF SUBSTANCE: \_\_\_\_\_

8. SAMPLES TAKEN: \_\_\_\_\_

9. SLICK DESCRIPTION: (NONE) OR \_\_\_\_\_

10. ACTION TAKEN: \_\_\_\_\_

\_\_\_\_\_

11. ON SCENE WEATHER: \_\_\_\_\_

12. OIL SPILL MOVEMENT: (NONE) OR \_\_\_\_\_

13. DAMAGE: (NONE) OR \_\_\_\_\_

14. POTENTIAL DANGER: (NONE) OR \_\_\_\_\_

15. CAUSE OF SPILL: \_\_\_\_\_

\_\_\_\_\_

16. PARTIES PERFORMING SPILL REMOVAL: \_\_\_\_\_

17. ASSISTANCE REQUIRED: NO ADDITIONAL OR \_\_\_\_\_

\*\* 18. TELEPHONE REPORT WAS MADE TO NRC—TIME \_\_\_\_\_ DATE \_\_\_\_\_  
CONFIRMATION NUMBER IS \_\_\_\_\_. TELEPHONE REPORT WAS MADE TO  
NC DIVISION OF EMERGENCY—TIME \_\_\_\_\_ DATE \_\_\_\_\_, POC IS

POINT OF CONTACT IS MR JOHN HAMILTON, ENVIRONMENTAL COMPLIANCE  
BRANCH, ENVIRONMENTAL MANAGEMENT DIVISION, INSTALLATION AND  
ENVIRONMENT DEPARTMENT, AT (910) 451-1482.





## 4.0 HAZARDOUS MATERIALS/HAZARDOUS WASTE MANAGEMENT

All persons on a Marine Corps installation are subject to compliance with Federal and state regulations and permit conditions addressing the proper management of both hazardous materials and hazardous waste.

Mishandling these wastes and materials may result in violation notices, fines, and/or penalties. The U.S. Environmental Protection Agency (USEPA) regulates hazardous wastes through the Resource Conservation and Recovery Act (RCRA), which provides specific regulatory definitions for hazardous waste and its management. RCRA governs all hazardous waste from the point of generation to the point of final disposal. This includes hazardous waste generated by contractors aboard the Installation. Hazardous materials, including those used by contractors aboard the Installation, are regulated by the Emergency Planning and Community Right-to-Know Act (EPCRA). Additionally, the North Carolina Department of Environment and Natural Resources (NCDENR) has issued more stringent rules and regulations governing hazardous materials and hazardous waste management that also apply to contractors.

### 4.1 KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with hazardous materials, hazardous wastes, and their management. If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

#### 4.1.1 Key Definitions

- **Hazardous Material (HM).** A chemical compound, or combination of compounds, posing or capable of posing a significant risk to public health, safety, or the environment as a result of its quantity, concentration, or physical/chemical/infectious properties.
- **Hazardous Waste (HW).** A solid waste, or combination of solid wastes, which because of quantity, concentration, or physical, chemical, or infectious characteristics may:

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**If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative.**

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- Cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness, or
  - Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.
- **Manifest.** A document that allows all parties involved in hazardous waste management (e.g., generators, transporters, disposal facilities, USEPA, state agencies) to track the movement of hazardous waste from the point of generation to the point of ultimate treatment, storage, or disposal.
  - **Material Safety Data Sheet (MSDS).** A document that provides information about (1) the potential health effects of exposure to chemicals or other potentially dangerous substances and (2) safe working procedures for users to adhere to when handling that chemical or substance.
  - **Non-RCRA-Regulated Waste.** A waste that is not regulated or is exempt from regulation under RCRA hazardous waste requirements but has other regulatory requirements for proper management.
  - **Satellite Accumulation Area (SAA).** A HW generation point at which waste may be accumulated until the HW storage container is full. A filled container must be transferred within 72 hours to an approved 90-day site or long-term HW storage facility. An EMD authorization for an SAA must be obtained and posted at the site. EMD authorization will establish individual limits for each SAA. No SAA authorizations will exceed 55 gallons of HW or 1 quart of acutely HW. Per Installation policy, storage of HW in a SAA should not exceed 365 days even if the container is not full.
  - **Universal Waste (UW).** Universal waste regulations streamline hazardous waste management standards for batteries, pesticides, mercury-containing equipment, and fluorescent lamps. The regulations govern the collection and management of these widely generated wastes, thus facilitating environmentally sound collection and proper recycling or treatment. In North Carolina, batteries,

thermostats, obsolete agricultural pesticides, and fluorescent lamps may be managed under the UW Rule. UW must be transferred off-site within one (1) year of the date when the material was first identified as waste.

- **Used Oil.** Any oil that has been refined from crude oil or synthetic oil and, as a result of use, storage, or handling, has become unsuitable for its original purpose due to the presence of impurities or loss of original properties. Used oil may be suitable for further use and is economically recyclable, therefore is managed as a separate category of material.

#### 4.1.2 Key Concepts

None.

#### 4.1.3 Environmental Management System

Practices, or activities, associated with hazardous materials and hazardous waste management includes the following:

- Building maintenance—general
- Building operation—general
- Degreasing
- Engine operation and maintenance
- Equipment calibration
- Equipment operation and maintenance
- Fuel storage—containers
- Fueling
- HM storage
- HM transportation
- HW satellite accumulation area
- Painting
- Painting preparation
- Polychlorinated biphenyl (PCB) disposal
- Pesticide/herbicide application
- Refrigerant replacement
- Storage tank cleaning and maintenance
- Vehicle/equipment fluid change

The potential impacts of these activities on the environment include depletion of the hazardous waste landfill; depletion of non-renewable resources; and degradation of soil quality.

## 4.2 OVERVIEW OF REQUIREMENTS

Contractors operating aboard MCB Lejeune and MCAS New River must be aware of, and adhere to, all applicable regulations and requirements regarding hazardous materials and hazardous waste, including the following:

- **Base Order (BO) 5090.9, Hazardous Material/Waste Management/Air Station Order (ASO) 5090.2, Environmental Compliance and Protection Program for MCAS New River.** Establishes procedures and general responsibilities for the disposal of hazardous material and hazardous waste under environmental permits and authorizations.
- **Emergency Planning and Community Right-to-Know Act (EPCRA).** Establishes requirements regarding emergency planning and the reporting of hazardous chemical storage and usage.
- **Resource Conservation and Recovery Act (RCRA) of 1976.** Establishes standards for generators and transporters of hazardous waste that will ensure the following: proper recordkeeping and reporting; use of manifest system; use of appropriate labels and containers; and proper management of hazardous waste transfer, storage, and disposal facilities.
- **40 CFR Subchapter I (Parts 260–299), Solid Wastes.** Federal regulations promulgated under the 1976 RCRA that regulate hazardous waste management, generators, transporters, and owners or operators of treatment, storage, or disposal facilities. North Carolina has adopted the Federal hazardous waste rules by reference.

The Installation is a large quantity generator of hazardous waste. Therefore, all hazardous waste generated aboard MCB Camp Lejeune must meet the regulatory requirements of this generator designation.

Both MCB Camp Lejeune and MCAS New River maintain Hazardous Waste Management Plans that outline the specific requirements for

managing hazardous materials and hazardous wastes each Base. This section presents key points from these documents.

The contractor is responsible for ensuring that any used hazardous materials generated during work aboard MCB Camp Lejeune are properly managed and turned in weekly on Wednesday from 1300 - 1500 hours to the EMD Consolidation Center, Bldg. S-962 on Michael Road. For work aboard MCAS New River, hazardous materials can be turned at the Environmental Affairs Department (EAD) Hazardous Waste warehouse, Bldg AS-4225, located on Canal Street. This includes universal waste, used oil, petroleum-contaminated materials, regulated hazardous waste, and non-RCRA-regulated waste. Environmental personnel will provide oversight to verify compliance with applicable Federal and state laws governing the generation and handling of these materials.

Depending on the type of project, contractors may be required to submit a Hazardous Waste Management Plan to the ROICC or the Contract Representative prior to beginning work. Additionally, a Contractor Hazardous Material Inventory Log and corresponding MSDSs for all materials to be used aboard either Base during the execution of the contract may be required by the Contracting Officer. EMD/EAD will use the MSDSs to help contractors establish their Hazardous Material Storage and Satellite Accumulation Areas.

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**Contractors may be required to submit a Hazardous Waste Management Plan to the ROICC or the Contract Representative prior to beginning work.**

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### 4.3 HAZARDOUS MATERIALS REQUIREMENTS

If a project uses hazardous materials:

- Reduce/reuse/recycle when possible; meet contract requirements for recycling.
- Segregate incompatible materials. Consult your MSDS or EMD if you are unsure of a material's compatibility. Some **examples of incompatible materials** likely to be used by contractors at the Installation are:
  - **Corrosives** (e.g., batteries, stripping and cleaning compounds containing acids or bases) **and Flammables** (e.g., fuels, oils, paints, and adhesives);

- **Corrosives** (e.g., batteries, stripping and cleaning compounds containing acids or bases) **and Oxidizers** (e.g., bleach); and
- **Oxidizers** (e.g., bleach) **and Flammables** (e.g., fuels, oils).

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**Do not store large quantities of materials. Keep on hand only what can be used.**

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**Stop work immediately if a project unearths a hazardous material (such as munitions or ordnance) and report the situation to the ROICC or Contract Representative.**

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- Keep flammable materials in flammable storage lockers.
- Do not store large quantities of materials. Keep on hand only what can be used.
- Do not dump any hazardous material into floor drains, sinks, oil-water separators, or storm drains, or onto the ground
- Store containers that hold 55 gallons or more (including in-use electrical generators and portable equipment) in proper secondary containment. Containment must be inspected on a weekly basis; all inspections and drainage events must be documented.
- Maintain MSDSs and appropriate spill control/cleanup materials on-site at all times.
- Provide HAZMAT storage and usage information for regulatory reporting to the appropriate environmental office upon request.
- Stop work immediately if a project unearths a hazardous material (such as munitions or ordnance) and report the situation to the ROICC or Contract Representative.
- Do not leave hazardous materials on-site once the contract is completed. Remove from Installation property or turn in all full, partially full, and empty hazardous material containers to the Resource Conservation and Recovery Section (RCRS) at Bldg. S-962 on Michael Road (MCBCL) or EAD at Bldg AS-4225 on Canal Street (MCASNR) upon completion of the contract.

#### **4.4 UNIVERSAL WASTE REQUIREMENTS**

NCDENR allows thermostats, obsolete agricultural pesticides, lamps, and certain types of batteries to be managed as universal waste (UW). UW has less stringent requirements for storage, transport, and collection, but must

still comply with full hazardous waste requirements for final recycling, treatment, or disposal. UW requirements are outlined in 40 CFR 273.

All UW must be properly containerized, stored, and labeled at the time the waste is first generated. Containers/areas accumulating UW must be labeled as follows:

- Words: *UNIVERSAL WASTE*.
- Content: Noun name found on the specific Hazardous Waste Profile Sheet (DRMS Form 1930) available from EMD (e.g., *batteries, fluorescent lamps, pesticides, mercury-containing equipment*).
- Accumulation Start Date (ASD): The ASD must be marked on the subject container the moment a UW item is placed into the container. Storage of UW cannot exceed 365 days.
- Number of Containers: The number of containers marked reflects the total number of containers disposed of within the current document (i.e., 1 of 1, etc.).

RCRS or EAD personnel will assist contractors in establishing each UW accumulation area. Key points to follow:

- The containers must be under the control of the contractor generating the waste and must be closed at all times except when adding waste.
- Per Installation policy, UW containers/areas must be inspected weekly using the Weekly Hazardous Waste (HW) Site Inspection Form included as Attachment 4-1 or 4-2. Written records noting discrepancies as well as corrective actions must be maintained onsite for a period of three years. Copies of inspection reports should be provided to the ROICC or Contract Representative.
- When the ASD reaches one year or when the container is full, the waste generator has 72 hours (3 days) to move the UW into the permitted storage area at Bldg. S-962 on Michael Road (MCBCL) or to Bldg AS-4225 on Canal Street (MCASNR). Coordinate with the appropriate environmental office for pickup (MCBCL – (910) 451-1482; MCASNR – (910) 449-5997/6143) when the drum is full or the contract is finished.

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**The appropriate environmental office must be notified before any hazardous waste is generated on projects managed by the ROICC or the FSC.**

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## 4.5 HAZARDOUS WASTE REQUIREMENTS

The appropriate environmental office must be notified before any hazardous waste is generated on projects managed by the ROICC or the Facilities Support Contracts (FSC). If you are uncertain about whether a waste meets the definition of a hazardous waste, have your ROICC or Contract Representative contact RCRS or EAD. Installation personnel must approve all regulated waste and hazardous waste storage locations.

If a project generates hazardous waste:

- Minimize generation through waste minimization and pollution prevention techniques.
- Have your ROICC or Contract Representative contact RCRS or EAD if you are unsure about how to manage a waste. Do not mix waste types (e.g., used oil rags and solvent rags).
- Have your ROICC or Contract Representative contact RCRS or EAD for turn-in procedures as wastes are generated.
- Do not dump any hazardous waste into floor drains, sinks, oil-water separators, or storm drains, or onto the ground. Do not place hazardous waste into general trash dumpsters.
- Ensure that hazardous waste drums are properly labeled and lids are secured (wrench tight).
- Ensure that SAAs are managed properly and storage limits are not exceeded; have your ROICC or Contract Representative consult with RCRS or EAD prior to creating a new SAA.

### 4.5.1 Storage

All hazardous waste must be properly containerized, stored, and labeled at the time the waste is first generated. Hazardous waste must be stored in containers that meet applicable specifications of the U.S. Department of Transportation (DOT). Hazardous waste labels, as required by the USEPA and the NCDENR, must contain the following information:

- Words: *HAZARDOUS WASTE*.



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- Content: Noun name found on the specific Hazardous Waste Profile Sheet (DRMS Form 1930) provided by RCRS or EAD.
  - Accumulation Start Date (ASD): For HW accumulated in an SAA, the ASD will be affixed once the container is filled or at the one-year anniversary, whichever comes first.
  - Number of Containers: Reflects the total number of containers (i.e., 1 of 1, etc.).

Any HW generated by contractors must be stored in a SAA. RCRS or EAD will assist contractors in establishing each SAA. A summary of procedures follows:

- The generator of hazardous waste may accumulate as much as 55 gallons of a hazardous waste stream (or less than one quart of acutely hazardous waste) in a container at or near the point of generation.
- The containers must be under the control of the contractor generating the waste and must be kept closed (wrench tight) at all times except when adding waste.
- Hazardous waste containers must be inspected weekly using the Weekly Hazardous Waste (HW) Site Inspection Form included as Attachment 4-1 or 4-2. Written records noting discrepancies as well as corrective actions must be maintained for a period of three years. Copies of inspection reports should be provided to the ROICC or Contract Representative.
- The generating contractor should monitor the level of waste in the SAA container and shall coordinate turn-in to RCRS or EAD prior to it becoming full. If the SAA container should become full, the generating contractor has 72 hours (3 days) to move the hazardous waste to the permitted storage area at Bldg. S-962 on Michael Road (MCBCL) or Bldg AS-4225 on Canal Street (MCASNR). Storage of HW in a SAA should not exceed 365 days even if the container is not full.

#### 4.5.2 Manifesting and Disposal

Disposal of hazardous waste generated by contractors must be coordinated with the Installation. Hazardous and universal waste generated aboard MCB Camp Lejeune and MCAS New River must be transported off-base by a permitted hazardous waste transporter and must include a hazardous waste manifest. These procedures must be followed:

- The MCB Camp Lejeune or MCAS New River USEPA ID number is used for disposal of all contractor-generated hazardous waste.
- Only personnel from the Installation who have been designated in writing by the Commanding Officer can sign the hazardous waste manifest. Your ROICC or Contract Representative should contact RCRS at (910) 451-1482 (MCBCL) or EAD at (910) 449-5997 (MCASNR) regarding manifesting regulated and non-regulated wastes off-site.
- Under NO circumstances can a contractor or ROICC or Contract Representative sign a hazardous waste manifest or use another USEPA ID number for wastes generated at Installation.

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**Only personnel from EMD who have been designated in writing by the MCB Camp Lejeune Commanding Officer can sign the hazardous waste manifest.**

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#### 4.6 NON-RCRA-REGULATED WASTE REQUIREMENTS

Non-RCRA-regulated wastes include used oil and oil filters, used antifreeze, contaminated wipes, discarded electronic equipment, and batteries not managed as universal waste.

##### 4.6.1 Used Oil and Oil Filters

Used motor oil itself is *not* regulated as a hazardous waste in North Carolina if it is recycled or burned for energy recovery. If used oil is not recycled, the generator must determine prior to disposal whether it is a hazardous waste. Used oil must be collected in drums marked “Used Oil.” If the Used Oil storage container has a volume of 55 gallons or more, it must be stored in secondary containment. Coordinate with RCRS at (910) 451-1482 (MCBCL) or EAD at (910) 449-5997 (MCASNR) for pickup when the drum is full or the contract is finished.

- Do not dump used oil into drains, sinks, or trash containers, or onto the ground.
- Do not store used oil in open buckets or drip pans, damaged or rusted containers, or containers that cannot be fully closed.
- Do not mix used oil with other waste materials.

Used oil filters are not regulated as hazardous waste in North Carolina as long as they are not mixed with listed hazardous wastes. To qualify for this exclusion, the following conditions must be met:

- Used oil filters must be gravity hot-drained by puncturing the filter anti-drain back valve or filter dome and hot draining into a “Used Oil” storage drum. “Hot-drained” means that the oil filter is drained at a temperature that approximates the temperature at which the engine operates. All used oil filters will be hot-drained for a minimum of 24 hours before turn-in to RCRS at Bldg. S-962 on Michael Road (MCBCL) or EAD at Bldg AS-4225 on Canal Street (MCASNR).
- Any incidental spillage that occurs must be cleaned up with Dry Sweep, rags, or “oil socks.”
- Drained used oil filters must be collected in a container that is in good condition and is labeled with the words “Drained Used Oil Filters.”
- No other waste streams should be deposited in containers collecting used oil filters for disposal.
- Drained used oil filters will be turned into RCRS at Bldg. S-962 on Michael Road on a weekly basis on Wednesday from 1300 to 1500 (MCBCL) or to EAD at Bldg AS-4225 on Canal Street (MCASNR).

#### **4.6.2 Used Antifreeze**

Used antifreeze is considered a hazardous waste because of its toxicity unless it is recycled or placed in an approved storage area. Used antifreeze will be containerized in spill proof containers and turned in at RCRS on a weekly basis at Bldg. S-962 on Michael Road, for recycling. For used

antifreeze generated aboard MCAS New River, contact EAD at (910) 449-5997 for turn-in instructions.

#### **4.6.3 Petroleum-Contaminated Wipes/Oily Rags**

Petroleum-contaminated wipes and oily rags are to be managed as non-regulated waste. Follow these procedures:

- Store oil-contaminated wipes and oily rags in metal containers because of their flammability/combustibility to protect them from the weather.
- Do not throw these non-regulated waste items into solid waste dumpsters or garbage cans.
- Turn petroleum-contaminated wipes and oily rags that are not on a red rag contract into RCRS at Bldg. S-962 on Michael Road on a weekly basis on Wednesday from 1300 to 1500 (MCBCL) hour or to EAD at Bldg AS-4225 on Canal Street (MCASNR).

#### **4.6.4 Used Electronic Equipment**

Used electronic equipment usually contains lead solder or polychlorinated biphenyl (PCB) oils (i.e., light ballast). These items will be turned in as they are generated. Have your ROICC or Contract Representative contact RCRS (MCBL) at (910) 451-1482 or EAD (MCASNR) at (910) 449-5997 for proper handling and turn-in procedures.

#### **4.6.5 New and Used Batteries (Not Regulated as Universal Waste)**

- Store compatible batteries together (i.e., lithium batteries should be stored with other lithium batteries).
- Store batteries off the ground to prevent them from coming into contact with water.
- Store lead-acid batteries away from an open flame.
- Place rechargeable batteries in plastic bags before storing them with other rechargeable batteries.
- Do not dispose of batteries unless authorized.

- Have your ROICC or Contract Representative contact RCRS at (910) 451-1482 or EAD at (910) 449-5997 for proper handling and turn-in procedures.



**Attachment 4-1**

**Weekly Hazardous Waste (HW) Site Inspection Form  
MCB Camp Lejeune**





MCB Camp Lejeune Weekly Hazardous Waste (HW) Site Inspection  
 Universal Waste (UW)/Satellite Accumulation Area (SAA)

Bldg Number/location of HW Site: \_\_\_\_\_

Unit Evaluated: \_\_\_\_\_ Evaluation Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

Evaluation By (Site Manager): \_\_\_\_\_ Evaluation Time: \_\_\_\_\_

QUESTION	YES	NO	Location of Discrepancy <i>and</i> Proposed Corrective Action
1. Is housekeeping maintained in acceptable manner?			
2. Is any HW present at site?			
3. Are HW containers properly marked?			
4. Are HW containers in serviceable condition			
5. Are container bungs, caps, openings properly secured?			
6. Is unit spill plan/activation prominently posted?			
7. Is 911 spill response sign posted?			
8. Are " <b>Danger-Unauthorized Personnel Keep Out</b> " signs posted so they may be seen from any approach?			
9. Are " <b>No Smoking</b> " signs posted?			
10. Does the site have emergency communication system or two man rule in effect? If the two man rule is implemented is there a sign with the legend " <b>Two Man Rule in Effect</b> " posted?			
11. Are properly charged fire extinguishers as well as eye wash stations present and are they inspected at least monthly?			
12. Is the post indicator valve in good operating condition and secured in the closed position, are there any structural defects such as cracked concrete?			
13. Is the proper spill response equipment readily available?			
14. Is the site designated, recognizable, and is the EMD Authorization posted within the site as to be visible to personnel placing waste into the container? (SAA site only)			
15. Are all hazardous wastes properly segregated and stored in the designated site?			
16. Are there any hazardous materials being stored in the Satellite Accumulation Area or < 90 day storage site?			



**Attachment 4-2**

**Weekly Hazardous Waste (HW) Site Inspection Form  
MCAS New River**



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Weekly Hazardous Waste Storage  
Area Inspection Form

Squadron: \_\_\_\_\_ Inspector: \_\_\_\_\_

Date: \_\_\_\_\_ Signature: \_\_\_\_\_

Question                                                 Yes    No                                                 Corrective Actions or N/A

1. Is the HW container located at or near the point of generation?			
2. Is the HW container DOT approved?			
3. Is the HW container marked correctly with the words Hazardous Waste, correct noun name of contents, NSN'S and unit designator?			
4. Is the HW container closed and wrench tight when not adding to the container?			
5. If a funnel is left in place, does that funnel have a plug or ball valve to be considered closed or secured?			
6. Is the HW container in good condition? (no excessive rust or dents in critical areas, seals are in place, no bulging or collapsing and no signs of spillage or leakage)			
7. Is the Spill Contingency Plan posted and in plain view?			
8. Is the SAA Site approval letter from EAD posted at the SAA site?			
9. Is the SAA Site limited to Authorized Personnel only?			
10. Is the HW container below the proper ullage for a liquid to expand? (4 inches from the top)			
11. Are SAA HW containers moved to the 90-Day Site within 72 hours when filled to the proper ullage or weight capacity of the container?			
12. (90 Day-Site only) Are all palletized waste streams correctly marked with Hazardous Waste or Universal Waste, noun name of the waste, NSN and unit designator on the pallet or wall of the waste structure?			
13. (90 Day-Site only) Are all HW containers turned into DRMO prior to the 90 <sup>th</sup> day since the ASD?			
14. Are there adequate spill response supplies readily available for use in case of spill or leakage?			
15. Is there a means of emergency communications between storage facilities and working spaces?			
16. Is the SAA site or 90 Day-Site in a good state of police?			

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## 5.0 UNFORESEEN SITE CONDITIONS

Marine Corps Base (MCB) Camp Lejeune was placed on the U.S. Environmental Protection Agency's (USEPA's) National Priorities List (NPL) effective November 4, 1989. To ensure the protection of human health and the environment, a proactive Installation Restoration Program has been established and is in the process of assessing and remediating various sites on the Installation. Numerous investigations have been performed on the Installation to ensure that all contaminated sites have been found, but additional contaminated areas may still exist. As a contractor, it is your responsibility to notify the ROICC or Contract Representative of any unforeseen site conditions you encounter while on the Installation. It is recommended that any contractors performing intrusive activities on the Installation be properly trained in accordance with the Occupational Safety and Health Act (OSHA) standards as written in 29 CFR 1910.120(e). If intrusive activities are planned in known contaminated areas, all required environmental training should be completed *prior* to working at MCB Camp Lejeune. Copies of training records should be available upon request by federal or state regulators.

### 5.1 KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with unforeseen site conditions. If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

#### 5.1.1 Key Definitions

- **National Priorities List (NPL).** Lists the sites of national priority among the known releases or threatened releases of hazardous substances, pollutants, or contaminants.
- **Unforeseen Site Condition.** A potentially hazardous, unanticipated site condition encountered on a job site.

#### 5.1.2 Key Concepts

- **Notification.** Contractors must notify the ROICC or Contract Representative of any unforeseen site conditions.

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**If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative.**

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- **Response.** Contractors must stop working and evacuate work areas in the event unforeseen site contaminants are suspected.

## 5.2 OVERVIEW OF REQUIREMENTS

Contractors operating aboard the Installation must be aware of, and adhere to, all applicable regulations and requirements regarding unforeseen site conditions.

- **Comprehensive Environmental Response, Compensation, and Liability (CERCLA) Act of 1980 and Superfund Amendments & Reauthorization Act (SARA) of 1986.** Establishes the nation's hazardous waste site cleanup program.

## 5.3 UNFORESEEN SITE CONDITION PROCEDURES

### 5.3.1 Petroleum, Oil, and Lubricants (POL)

The most frequent condition encountered that requires EMD assistance is the presence of a petroleum, oil, or lubricant odor while excavating. If you notice an odor, take the following action:

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**If you notice an odor, stop work and immediately clear the area of all personnel to a safe distance upwind of the suspected area.**

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- Stop work.
- Immediately clear the area of all personnel to a safe distance upwind of the suspected area.
- Call the Fire and Emergency Services Division (911) immediately if personnel are affected or injured by the suspected contaminant.
- Call the Fire and Emergency Services Division to properly secure the area.
- Notify the ROICC or Contract Representative so that the EMD Spill Response Team will be contacted to determine the appropriate course of action.

Please note that while staged and awaiting sampling results and proper disposal, the contaminated soil is to be placed on and covered with plastic. [Note: Per the Resource Conservation and Recovery Act, the North Carolina Department of Environment and Natural Resources does not allow contaminated soils to be reintroduced into excavations].



### 5.3.2 Munitions and Ordnance

Stop work immediately if a project unearths a hazardous material (such as munitions or an ordnance item) and report the situation to the ROICC or Contract Representative.

For other emergency response procedures, please refer to Section 3.0 of this guide.

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**Stop work immediately if a project unearths a hazardous material (such as munitions or an ordnance item) and report the situation to the ROICC or Contract Representative.**

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## 6.0 ASBESTOS

Contractors working aboard the Installation must follow Federal and state regulations for the proper notifications and management of asbestos associated with demolition and renovation projects, as well as Installation requirements.

### 6.1 KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with asbestos and its management. If you have any questions or concerns about the information in this section, please consult with the ROICC or your Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

#### 6.1.1 Key Definitions

- **Asbestos.** A group of natural minerals that separate into strong, very fine fibers that are heat resistant and extremely durable.
- **Asbestos-Containing Material (ACM).** Any material containing more than one (1) percent asbestos, per 29 CFR 1101.
- **Category I Nonfriable ACM.** Asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than one percent asbestos, per 40 CFR 61.
- **Category II Nonfriable ACM.** Any material, excluding Category I nonfriable ACM, containing more than one (1) percent asbestos that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure, per 40 CFR 61.
- **Demolition.** The removal of any load-bearing walls or structure.
- **Friable.** Any ACM that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure (may include damaged ACM that was previously identified as nonfriable), per 40 CFR 763.
- **Glove Bag.** A sealed compartment with attached inner gloves that is used for the handling of ACM.

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**If you have any questions or concerns about the information in this section, please consult with the ROICC or your Contract Representative.**

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- **Presumed Asbestos-Containing Material (PACM).** Thermal system insulation and surfacing material found in buildings constructed no later than 1980, per 29 CFR 1926.
- **Regulated Asbestos-Containing Material (RACM).** Includes friable ACM, Category I nonfriable ACM that has become friable, Category I nonfriable ACM that has been sanded, ground, cut, etc., and Category II nonfriable ACM that has a high probability of becoming crumbled, pulverized, or reduced to powder during demolition or renovation, per 40 CFR 61.
- **Renovation.** Altering a facility or its components in any way, including the stripping or removal of RACM, per 40 CFR 61.

### 6.1.2 Key Concepts

- **Demolition Notification.** North Carolina law requires notification for all demolitions, regardless of whether asbestos is present, 10 working days prior to starting demolition.
- **Disposal.** ACM waste can be accepted at the MCB Camp Lejeune Sanitary Landfill. Work with the ROICC or your Contract Representative to coordinate the disposal through the MCBCL Landfill office at (910) 451-2946.
- **Removal Requirements.** Permits for asbestos removal or demolition must be obtained when RACM present exceeds 160 linear feet, 260 square feet, or 35 cubic feet. Additionally, proper work practice procedures must be followed during demolition or renovation operations.
- **Renovation Notification.** If RACM is present within a structure, North Carolina law requires notification of renovation 10 working days prior to starting renovation.

### 6.1.3 Environmental Management System

Practices, or activities, associated with asbestos management include the following:

- Building maintenance—general
- Construction/demolition

- Equipment operation and maintenance
- Parts replacement

The potential impacts of these activities on the environment include soil contamination and degradation of water quality, air quality, and quality of life.

## 6.2 OVERVIEW OF REQUIREMENTS

Contractors operating aboard the Installation must be aware of, and adhere to, all applicable regulations and requirements regarding ACM, including the following:

- **Asbestos Hazard and Emergency Response Act (AHERA), 1986.** AHERA was written primarily to provide officials in schools, grades K-12, with rules and guidance for the management of asbestos-containing materials.
- **Asbestos School Hazard Abatement Reauthorization Act (ASHERA), 1992.** This act extended AHERA regulations to cover public and commercial buildings
- **National Emission Standards for Hazardous Air Pollutants (NESHAP), Subpart A, General Provisions, and Subpart M, Asbestos, 40 CFR 61.** Includes standards for asbestos demolition and renovation, disposal, and administrative requirements.
- **Naval Facilities Guide Specifications and Engineering Control of Asbestos Materials.** Covers the requirements for safety procedures and requirements for the demolition, removal, encapsulation, and disposal of asbestos-containing materials.
- **North Carolina Asbestos Hazard Management Program, NC General Statutes Chapter 130A, Article 19; 10A NCAC 41C .0601–.0608 and .0611.** Incorporates 40 CFR Part 763 and 29 CFR 1926.1101 by reference and outlines criteria for asbestos exposures in public areas, accreditation of persons conducting asbestos management activities, and asbestos permitting and fee requirements.

- **Safety and Health Regulations for Construction, Asbestos, 29 CFR 1926.1101.** Regulates asbestos exposure in construction activities.

### 6.3 RESPONSIBILITIES BEFORE A DEMOLITION OR RENOVATION PROJECT

Prior to starting a demolition or renovation project, contractors must:

- Know whether ACM or PACM is present in the buildings involved in the project,
- Complete the necessary notifications,
- Understand what actions to take if ACM or PACM is unexpectedly encountered during project execution, and
- Know how to properly dispose of ACM.

#### 6.3.1 Identification of ACM and PACM

Contract documents will identify the presence of ACM and PACM. Contact your ROICC or Contract Representative with questions regarding the presence of ACM or PACM as identified in these documents.

#### 6.3.2 Notification

To maintain accurate files and records, the ROICC or Contract Representative is required to notify the EMD Asbestos Program Manager, who is part of the Installations and Environment Department, of all work involving asbestos removals, including glove bag projects.

A demolition/renovation notification form DHHS 3768 must be submitted to the NC Health Hazards Control Unit (NCHHCU) 10 working days in advance of demolition activities, regardless of whether asbestos is present. This form must be posted on-site during the entire duration of the project. Have your ROICC or Contract Representative contact the Asbestos Program Manager with questions or concerns about requirements for notification of demolition or renovation.

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**The ROICC or Contract Representative is required to notify Camp Lejeune’s Asbestos Program Manager of all work involving asbestos removals, including glove bag projects.**

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**A demolition/renovation notification form DHHS 3768 must be submitted to the NCHHCU 10 working days in advance of demolition activities, regardless of whether asbestos is present.**

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### 6.3.3 Removal

If ACM is present, it must be removed before the area is disturbed during renovation or demolition activities (except in certain rare instances).

Certification and handling requirements for asbestos removal are provided in 10A NCAC 41C and the Asbestos NESHAP. Refer to these regulations for detailed requirements.

### 6.3.4 Training

North Carolina regulations require that all persons who perform asbestos management activities in the State of North Carolina must be accredited by the NCHHCU under the appropriate accreditation category (i.e. Building Inspector, Project Supervisor, Abatement Worker). Training documentation should be available upon request.

## 6.4 RESPONSIBILITIES DURING A DEMOLITION OR RENOVATION PROJECT

North Carolina regulations require that Form DHHS 3768, *Asbestos Permit Application and Notification for Demolition and Renovation*, be posted on-site during all permitted projects. Contractors must post this form when the project will remove the following: 35 cubic feet, 160 square feet, or 260 linear feet of RACM or asbestos that might become regulated as a result of handling. The form must also be posted for nonscheduled asbestos removal that will exceed these numbers in a calendar year.

During a renovation or demolition project, if the contractor suspects the presence of additional ACM other than those materials identified in contract documents, the contractor must immediately report the suspected area to the ROICC or Contract Representative. Before proceeding, the facility must be inspected by a person who has been trained and accredited in North Carolina as an asbestos building inspector by the NCHHCU. The individual performing the asbestos survey will coordinate with the ROICC or Contract Representative throughout the process. A legible copy of the building inspection report must be provided to the NCHHCU prior to each demolition and upon request for renovations; a building inspection report will be acceptable only if the inspection was performed during the three

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**Form DHHS 3768  
*must* be posted  
on-site during all  
permitted  
projects.**

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**During a renovation  
or demolition  
project, if the  
contractor suspects  
additional ACM, the  
contractor must  
immediately report  
the suspected area  
to the ROICC or  
Contract  
Representative.**

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years before the demolition. A copy of the report should also be forwarded to the Asbestos Program Manager.

For glove bag project requirements, please refer to 29 CFR 1926.1101 for specific work procedures.

## **6.5 DISPOSAL OF ACM WASTE**

Contractors can dispose of ACM waste at the MCB Camp Lejeune Sanitary Landfill after first coordinating with the MCBCL Landfill office, through their ROICC or Contract Representative. The contractor must provide the MCBCL Landfill with Form DHHS 3787, *North Carolina Health Hazards Control Unit's Asbestos Waste Shipment Record*. The form must be submitted to NCHHCU for all permitted asbestos removal projects by the contractor.



## 7.0 LEAD-BASED PAINT

The improper removal of lead-based paint (LBP) may result in the production of paint chips and dust, which may contaminate a structure inside and out. The North Carolina Department of Health and Human Services (NCDHHS) regulations require any person who performs an inspection, risk assessment, or abatement to be certified. NCDHHS also requires a person who conducts an abatement of a child-occupied facility or target housing to obtain a permit for the abatement.

### 7.1 KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with LBP activities. If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

#### 7.1.1 Key Definitions

- **Abatement.** The permanent elimination of lead-based paint hazards.
- **Demolition.** The removal of any load-bearing walls or structure.
- **Inspection.** A surface-by-surface investigation to determine the presence of lead-based paint and a report explaining the results of the investigation.
- **Lead-Based Paint (LBP).** Surface coatings that contain lead in amounts equal to or in excess of 1.0 milligram per square centimeter, or more than 0.5 percent by weight, per 40 CFR 745.
- **Lead-Containing Paint.** Surface coatings that contain lead in any amount greater than the laboratory reporting limit but less than 1.0 milligram per square centimeter, or less than 0.5 percent by weight, per 29 CFR 1926.62 and 29 CFR 1910.1025; also contained in 40 CFR Part 745 Subpart L, and have been adopted by the State of North Carolina under NC General Statute Chapter 130A, Article 19A.

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**If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative.**

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- **Renovation.** Alteration of a facility or its components in any way.

### 7.1.2 Key Concepts

- **Disposal.** Analysis is required to determine proper disposal of waste (nonhazardous or hazardous). A Toxic Characteristic and Leaching Process analysis must be conducted to determine whether lead levels have exceeded 5 parts per million, which is the RCRA level for hazardous waste determination.
- **Lead-Based Paint Survey.** A lead-based paint survey is required prior to the disturbance of painted surfaces to determine whether the paint meets the criteria of a lead-based paint.
- **Training.** Lead-based paint training requirements set forth by the Occupational Safety and Health Administration (OSHA) are to be followed by personnel involved in all lead-based paint removal activities. MCBCL Base Safety tracks this training for contract staff, as the Safety Office houses the Lead Program Manager.

### 7.1.3 Environmental Management System

Practices, or activities, associated with LBP include the following:

- Construction/demolition
- Hazardous material storage
- Hazardous material transportation
- Paint removal

The potential impacts of these activities on the environment include the potential degradation of soil, water, and air environments, and the potential exposure of Installation occupants. Camp Lejeune still contains living quarters that have lead-based paint on the inside of the structures.

## 7.2 OVERVIEW OF REQUIREMENTS

Contractors operating aboard the Installation must be aware of, and adhere to, all applicable regulations and requirements regarding LBP activities, including the following:

- **Naval Facilities Engineering Service Center, Facilities Management Guide for Asbestos and Lead.** Ensures the protection of workers, building occupants, and the environment.

- **10A NCAC 41C .0800, Lead-Based Paint Hazard Management Program.** Requires (1) all individuals and firms involved in LBP activities to be certified and (2) all LBP activities to be carried out in accordance with 40 CFR 745.
- **29 CFR 1926, Safety and Health Regulations for Construction.** Contains OSHA requirements for construction activities where workers may have contact with lead.
- **40 CFR Part 745, Lead-Based Paint Poisoning Prevention in Certain Residential Structures.** Ensures that (1) lead-based paint abatement professionals, including workers, supervisors, inspectors, risk assessors, and project designers, are well trained in conducting LBP activities and (2) inspections for the identification of LBP, risk assessments for the evaluation of LBP hazards, and abatements for the permanent elimination of LBP hazards are conducted safely, effectively, and reliably by requiring certification of professionals.

### 7.3 RESPONSIBILITIES BEFORE RENOVATION OR DEMOLITION

Prior to any renovation or demolition aboard the Installation that involves the disturbance of painted surfaces, a LBP survey must be completed by a certified inspector, retained through the ROICC or Public Works (PW) offices. Certain projects will use PW staff to conduct the sampling and other projects will use contracted personnel. Buildings constructed prior to 1978 are assumed to contain LBP; therefore, no LBP survey is necessary. The LBP survey (through sampling and analysis) will determine whether painted surfaces meet the criteria of LBP (lead content equal to or greater than 1.0 milligram per square centimeter as measured by X-ray fluorescence (XRF) or lab analysis, or 0.5 percent by weight). For contracts where LBP is to be removed prior to demolition or renovation, the associated Naval Facilities Guide Specifications and contract documents must be implemented.

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**Buildings constructed prior to 1978 are assumed to contain LBP.**

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### 7.4 PERMITS

Contractors must obtain Lead Removal permits from NCDHHS when lead paint is removed from targeted housing (child-occupied facilities and housing built prior to 1978).

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**If the LBP survey determines that LBP will be abated as part of a renovation or demolition project, analytical samples must be taken to determine whether the material is hazardous.**

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## 7.5 DISPOSAL

If the LBP survey determines that LBP will be abated as part of a renovation or demolition project, analytical samples must be taken by the contractor to determine whether the material is hazardous. Usually a Toxic Characteristic Leaching Process (TCLP) sample is collected from a “representative” sample of the material removed. The laboratory conducting the sample analysis must be accredited by the Environmental Lead Laboratory Accreditation Program (ELLAP). A list of these accredited labs is available by contacting (703) 849-8888.

If the LBP is removed from the underlying building material, then the paint is the waste stream. If the LBP is removed with the building material, then both materials are considered the waste stream.

If the lead content is below hazardous waste (HW) regulatory disposal levels, consult with your ROICC or Contract Representative to determine whether your contract allows for the disposal material in the MCB Camp Lejeune Sanitary Landfill.

If the abated LBP is above HW regulatory levels, refer to Section 4.0 of this guide for information on HW management and disposal requirements.

## 7.6 TRAINING

Before the project begins, workers who are subject to exposure of lead during abatement or removal activities must be trained according to the OSHA regulation in 29 CFR 1926.62 concerning lead exposure in construction. The contractor is responsible for providing this training.

## 8.0 STORMWATER

There are three types of stormwater discharge that contractors for the Installation must address if they plan on disturbing land: industrial, construction, and post-construction stormwater runoff. The general requirements for each area as they apply to contractors are discussed in the following subsections.

### 8.1 KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with stormwater. If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

#### 8.1.1 Key Definitions

- **Best Management Practices (BMPs).** Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of Waters of the United States. BMPs can include treatment requirements, operational procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. BMPs may also denote structural and nonstructural stormwater treatment devices and measures.
- **Erosion and Sedimentation Control Plan.** Any plan, amended plan, or revision to an approved plan submitted to the North Carolina Division of Land Resources or delegated authority in accordance with North Carolina General Statute 113A-57. Erosion and Sedimentation Control Plans show the devices and practices that will retain sediment generated by the land-disturbing activity within the boundaries of the tract during construction and upon development of the tract.
  - **Land Disturbance.** Areas that are subject to clearing, excavating, grading, stockpiling earth materials, and placement/removal of earth material.
- **Nonpoint Source Discharge.** All discharges from stormwater runoff that cannot be attributed to a discernible, confined, and discrete conveyance.

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**If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative.**

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- **Point Source Discharge.** Any discernible, confined, and discrete conveyance, including but specifically not limited to, any pipe, ditch, channel, tunnel conduit, well, discrete fissure, container, rolling stock, or concentrated animal feeding operation from which pollutants are or may be discharged to Waters of the State.
- **Stormwater.** Stormwater runoff, snow melt runoff, and surface runoff and drainage, per 40 CFR 122.
- **Stormwater Associated with Construction Activities.** The discharge of stormwater from construction activities including clearing, grading, and excavating that result in a land disturbance of equal to or greater than 1 acre, per 40 CFR 122.
- **Stormwater Associated with Industrial Activities.** The discharge from any conveyance that is used for collecting and conveying stormwater and that is directly related to manufacturing, processing, or raw materials storage areas from an applicable industrial plant or activity, per 40 CFR 122.

### 8.1.2 Key Concepts

- **Operational Requirements.** Equipment, discharge, and material use requirements that apply to all construction and industrial activities.
- **Permit Requirements.** Land-disturbing projects may be subject to a variety of permit requirements to protect surface water quality from both construction and post-construction stormwater runoff. In the applicable areas of the Installation, a State Stormwater Management Permit and coverage under the Construction General Permit may be required.
- **Post-Construction.** The management of stormwater generated on a stable, established site after the construction process is complete. The State Stormwater Management Program sets forth requirements for post-construction stormwater runoff control.

### 8.1.3 Environmental Management System

Practices, or activities, associated with stormwater include the following:

- Catch basin cleaning
- Construction/demolition

- Erosion control
- Fuel storage–containers
- Hazardous material storage
- Land clearing
- Landscaping
- Mowing
- Outfall cleaning
- Range residue clearance
- Riparian buffer maintenance
- Runoff sedimentation basins
- Sediment traps
- Soil excavation/grading/grubbing
- Stormwater collection/conveyance system
- Stormwater engineering controls operation and maintenance
- Stump/brush removal
- Vehicle parking

The potential impacts of these activities on the environment include degradation of water quality and damage to public & private property due to flooding.

## 8.2 OVERVIEW OF REQUIREMENTS

Contractors operating aboard the Installation must be aware of, and adhere to, all applicable regulations and requirements regarding potential stormwater contamination, including the following.

- **40 CFR 122, National Pollutant Discharge Elimination System.** Requires permits for the discharge of pollutants from any point source into Waters of the United States.
- **15 NCAC 02H. 0100, Point Source Discharges to the Surface Waters.** Requires permits for control of sources of water pollution by providing the requirements and procedures for application and issuance of state NPDES permits for discharge from an outlet, point source, disposal system discharging to the surface waters of the state, and for the construction and operations of treatment works with such a discharge.
- **15A NCAC Chapter 4.** Requires all persons conducting land-disturbing activity to take all reasonable measures to protect

all public and private property from damage caused by the release of sediments from the activity. The primary tool used to accomplish the objective is the development of an Erosion and Sedimentation Control Plan. The plan must

- Identify critical areas,
  - Limit exposure areas,
  - Limit time of exposure,
  - Control surface water,
  - Control sedimentation, and
  - Manage stormwater runoff.
- **15A NCAC 02H. 1000 Stormwater Management.** The State Stormwater Management Program requires all persons conducting land-disturbing activities that (1) require a Coastal Area Management Act (CAMA) Major Development Permit or an Erosion and Sedimentation Control Plan, and (2) are located within coastal counties or drain to specific classifications of water bodies, to protect surface waters and highly productive aquatic resources from the adverse impacts of uncontrolled high-density development or the potential failure of stormwater control measures. To receive permit approval, projects must limit the density of development, reduce the use of conventional collection systems in favor of vegetative systems, and incorporate post-construction, structural BMPs.

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**Any project involving land-disturbing activities aboard the Installation has been reviewed by the Installation’s NEPA Review Board prior to the onset of work.**

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### **8.3 Prior to Site Work**

#### **8.3.1 Notifications**

Any project involving land-disturbing activities aboard the Installation has been reviewed by the Installation’s National Environmental Policy Act (NEPA) Review Board prior to the onset of work. Documentation of this review should have been provided to your ROICC or Contract Representative and may include mandatory conditions affecting the construction/implementation of the project. Consult with your ROICC or Contract Representative to obtain or review any NEPA documentation associated with the project in your contract.

#### **8.3.2 Stormwater Phase I Permit**

Discharges of industrial stormwater have the potential to contain contaminants from industrial activity. This type of discharge is defined



and regulated in 40 CFR 122, the USEPA final rule regarding National Pollutant Discharge Elimination System (NPDES) stormwater permitting.

Daily industrial operations discharging stormwater aboard MCB Camp Lejeune and MCAS New River are covered under NPDES Permit NCS000290.

### 8.3.3 Project-Specific Permits

Contractors are responsible for preparing all project-specific stormwater permit applications and related plans and for coordinating the permit review schedule with the ROICC or Contract Representative. For projects located outside of Public-Private Venture (PPV) housing, MCB Camp Lejeune is the responsible party for all project-specific stormwater permits. (All permit-required plans and applications must go through internal approval before being submitted to the appropriate state agency.) The permit review schedule should allow adequate time for internal review prior to state submission deadlines. For housing-related projects located outside of the jurisdiction of MCB Camp Lejeune, stormwater compliance should be coordinated with the appropriate PPV contractor.

For construction activities that disturb one acre or more of land, permit coverage is required under the North Carolina General Permit No. NCG010000 (General Permit). To obtain coverage under the General Permit, three copies of a proposed Erosion and Sedimentation Control Plan must be prepared and submitted to the NCDENR Sedimentation Control Commission (or to an approved local program) at least 30 days prior to beginning construction activity. Another copy of the plan will be kept on file at the job site. **Coverage under the permit becomes effective upon issuance of a plan approval. No land-disturbing activities may take place prior to receiving plan approval.** The approved plan is considered a requirement or condition of the General Permit; deviation from the approved plan will constitute a violation of the terms and conditions of the permit unless prior approval for the deviations has been obtained.

A State Stormwater Management Permit, issued in accordance with 15A NCAC 02H. 1000, is required for all development activities that require a CAMA Major Development Permit or an Erosion and Sedimentation Control Plan and that meet any of the following criteria:

- Development within the 20 coastal counties

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**Contractors are responsible for preparing all project-specific stormwater permit applications and related plans and for coordinating the permit review schedule with the ROICC or Contract Representative.**

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**All permit-required plans and applications must go through internal approval before being submitted to the appropriate state agency.**

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**A State Stormwater Management Permit is required for all activities that will disturb one acre or more of land.**

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- Development that drains to an Outstanding Resource Water (ORW)
- Development within one mile of and draining to a High Quality Water (HQW)

Because the Installation is located in a coastal county, any project that disturbs greater than one acre of land (hence requiring coverage under the General Permit for construction activity) will also require a State Stormwater Management Permit. A State Stormwater Management Permit Application must be submitted and filed with the NCDENR, Division of Water Quality, following completion of the construction plans and specifications and prior to commencement of construction activities. Copies of this form are available at the NCDENR website: <[http://h2o.enr.state.nc.us/su/Forms\\_Documents.htm#sswmp](http://h2o.enr.state.nc.us/su/Forms_Documents.htm#sswmp)>. The State Stormwater Management Permits typically specify design standards for conveyance systems and structural BMPs, a schedule of compliance, and general conditions to which the permittee must adhere.

#### **8.4 Responsibilities During Site Work**

The contractor is responsible for maintaining the quality of the stormwater runoff and preventing pollution of stormwater at the construction/job site. The job site may be inspected by Installation environmental personnel to ensure compliance with the Installation Stormwater Pollution Prevention Plan and applicable permits. The following requirements apply to all projects occurring at the Installation that have the potential to impact water quality:

- Any changes to the project area that do not comply with the approved Erosion and Sedimentation Control Plan, alter the approved post-construction stormwater conveyance system, or could otherwise significantly change the nature or increase the quantity of pollutants discharged should be immediately communicated to the ROICC or Contract Representative.
- Equipment utilized during the project activity must be operated and maintained in such a manner as to prevent the potential or actual pollution of the surface or ground waters of the state.
- All permitted erosion and sedimentation control projects will be inspected by the contractor at least once every seven calendar days

(unless discharges to a 303(d)-Listed water body are occurring) and within 24 hours after any storm event greater than 0.5 inch of rain per 24-hour period, as required by the North Carolina General Permit No. NCG010000 (General Permit). Inspection results shall be maintained by the designated contractor throughout the duration of the active construction project.

- Fuels, lubricants, coolants, hydraulic fluids, or any other petroleum products shall not be discharged onto the ground, into surface waters, or down storm drains (to include leaking vehicles, heavy equipment, pumps and/or structurally deficient containers of hazardous materials).
- Spent fluids shall be disposed of in a manner so as not to enter surface, ground waters of the state, or storm drains. Disposal of spent fluids is outlined in Section 4.0.
- Implement spill prevention measures, clean up all spills immediately, and follow spill reporting requirements presented in Section 3.0. Any spilled fluids shall be cleaned up to the extent practicable and disposed of in a manner so as not to allow their entry into the water, surface or ground, of the state. Please refer to Section 3.0 for emergency and spill response procedures.
- Herbicide, pesticide, and fertilizer usage during construction activity shall be consistent with the Federal Insecticide, Fungicide, and Rodenticide Act and shall be in accordance with label restrictions. Please refer to Section 4.0 for additional information on Hazardous Material/Hazardous Waste Management.
- Particular care must be used when storing materials outside. Materials and equipment stored outside that could potentially affect the quality of stormwater runoff include, but are not limited to, garbage dumpsters, vehicles, miscellaneous metals, wood products, and empty storage drums. If there is any question about whether an outdoor storage practice is acceptable, contact the ROICC or Contract Representative.
- Use good-housekeeping practices to maintain work areas in a clean and orderly manner, paying particular attention to those areas that may contribute pollutants to stormwater.



## 9.0 SOLID WASTE, RECYCLING, AND POLLUTION PREVENTION

The Installation has a proactive pollution prevention (P2) and recycling program. Contractors should minimize the amount of solid waste requiring disposal in a landfill. This section addresses solid waste, including both municipal solid waste (MSW) and construction and demolition (C&D) waste. Hazardous materials and hazardous waste are discussed in Section 4.0 of this guide. Contractors are required to comply with all Federal, state, and local laws and regulations for proper disposal and recycling of all solid wastes.

### 9.1 KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with solid waste, recycling, and pollution prevention. If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

#### 9.1.1 Key Definitions

- **Construction and Demolition (C&D) Debris.** Materials generated during the construction, renovation, and demolition of buildings, roads, and bridges. C&D debris often contains bulky, heavy materials that include concrete, wood (from buildings), asphalt (from roads and roofing shingles), gypsum (the main component of drywall), etc.
- **Green Procurement (GP).** The purchase of environmentally preferable products and services in accordance with Federally mandated “green” procurement preference programs. GP is intended to protect the environment and reduce energy consumption.
- **Pollution Prevention (P2).** Reducing the amount of a hazardous substance or pollutant entering waste streams or otherwise released to the environment prior to recycling, treatment, or disposal.
- **Recycling.** A series of activities that includes collecting, sorting and processing recyclables into raw materials, and manufacturing raw

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**Contractors should minimize the amount of solid waste requiring disposal in a landfill.**

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**If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative.**

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materials into new products per the US Environmental Protection Agency (USEPA).

- **Solid Waste.** Any solid, semisolid, liquid, or contained gaseous materials discarded, including garbage, construction debris, commercial refuse, sludge from water supply or waste treatment plants or from air pollution control facilities, and other discarded materials, per the Resource Conservation and Recovery Act (RCRA) of 1976.

### 9.1.2 Key Concepts

- **Pollution Prevention/Green Procurement.** Pollution prevention and green procurement practices are strongly encouraged for Installation contractors.
- **Recycling.** Recycling is required on the Installation. The MCBCL Recycling Center accepts specified recyclables.
- **Solid Waste.** The location for disposal of solid waste will be in accordance with contract specifications (off-base or MCBCL Landfill). Data related to off-base disposal (to include C&D waste) must be provided to the ROICC or Contract Representative on a monthly basis.

### 9.1.3 Environmental Management System

Practices, or activities, associated with solid waste, recycling, and pollution prevention, include the following:

- Battery replacement
- Building maintenance—general
- Building operation—general
- Construction/demolition
- Equipment disposal
- Hazardous waste recycling
- Land clearing
- Material storage handling
- Packaging/unpackaging
- Rock crushing operations
- Solid waste recycling collection/transportation
- Stump/brush removal

- Vehicle operation

The potential impacts of these activities on the environment include soil degradation, surface water quality degradation, depletion of landfill space, and depletion of nonrenewable resources.

## 9.2 OVERVIEW OF REQUIREMENTS

Contractors operating aboard the Installation must be aware of, and adhere to, all applicable regulations and requirements regarding solid waste disposal, recycling, and pollution prevention, including the following:

- **Base Order (BO) 5090.4, Solid Waste Reduction – Qualified Recycling Program (QRP).** Provides guidance for solid waste reduction, pollution prevention, and management of recyclable materials.
- **BO 11350.2D, Refuse Disposal Procedures.** Establishes procedures for the separation, collection, and disposal of refuse and the disposal of waste wood products.
- **Pollution Prevention Act (PPA) of 1990 (42 U.S.C. 13101 *et seq.*).** Establishes the national policy that "pollution should be prevented or reduced at the source whenever feasible," and establishes the following hierarchy: source reduction, recycling, treatment, and disposal.
- **Resource Conservation and Recovery Act (RCRA) of 1976.** Governs the disposal of solid waste and establishes Federal waste disposal standards and requirements for state and regional authorities. The objectives of Subtitle D are to assist in developing and encouraging methods for the disposal of solid waste that are environmentally sound and that maximize the utilization of valuable resources recoverable from solid waste.
- **Solid Waste Disposal Act (SWDA) of 1965.** Requires Federal facilities to comply with all Federal, state, interstate, and local requirements concerning the disposal and management of solid wastes.

At a minimum, the following actions are required by all contractors:

1. Prior to performing work that will or may generate solid waste at the Installation, all contractors must provide their ROICC or Contract

Representative with a copy of their Solid Waste Disposal Permit unless MCBCL's landfill is being utilized for disposal. Recycling is encouraged and can be coordinated with the ROICC or Contract Representative and the Landfill Manager.

2. Provide the weights of ALL wastes, both solid and C&D that are either disposed of or recycled to the ROICC or Contract Representative with a copy to the Landfill Manager. This requirement does not apply in instances where the Landfill/Recycling facility picks up or accepts materials directly from the contractor. If contractors are transporting waste off-site for disposal, it is mandatory that they track the material weight and provide that information to their ROICC or Contract Representative.

### **9.3 SOLID WASTE REQUIREMENTS**

Contractors producing solid waste on the Installation are required to take these steps:

- Pick up solid waste and place it in covered containers that are regularly emptied.
- Prevent contamination of the site and the surrounding areas when handling and disposing of waste.
- Leave the project site clean upon completion of a project.

#### **9.3.1 MCBCL Landfill Acceptable Waste Streams**

The MCBCL Landfill accepts certain types of solid waste under the conditions specified in Table 9-1. MCBCL Landfill hours of operation are 0800 to 1530, Monday through Friday. Contractors must have a construction pass and a copy of the face of the related contract to enter the MCBCL Landfill and dispose of waste. Contractors must also contact the Landfill Operator prior to unloading refuse. Each material must be separated into different loads.



**Table 9-1. MCBCL Landfill Requirements**

<b>Waste Category <sup>a</sup></b>	<b>Example</b>	<b>Requirements</b>
Mixed Debris	Sheetrock, plaster, ceramic tiles	<ul style="list-style-type: none"> <li>• Items may be mixed together</li> </ul>
Painted Masonry and Concrete	Concrete, block, brick	<ul style="list-style-type: none"> <li>• Separate from other items</li> <li>• Lead-painted or mastic-contaminated masonry or concrete must be separated from unpainted concrete products</li> <li>• Remove reinforcement wire and rebar flushed with exposed surfaces</li> </ul>
Unpainted Masonry and Concrete	Concrete, block, brick	<ul style="list-style-type: none"> <li>• Separate from other items</li> <li>• Remove reinforcement wire and rebar flushed with exposed surfaces</li> </ul>
Nonrecyclable Cardboard	N/A	<ul style="list-style-type: none"> <li>• Dispose of cardboard only if the MCBCL Recycling Center has rejected the cardboard</li> </ul>
Nonrecyclable Wood Pallets	N/A	<ul style="list-style-type: none"> <li>• Dispose of pallets only if the MCBCL Recycling Center has rejected the pallets</li> </ul>
Treated Wood	Piling, power poles	<ul style="list-style-type: none"> <li>• Separate from other items</li> </ul>
Untreated/Unpainted Wood	Lumber, stumps, limbs	<ul style="list-style-type: none"> <li>• Separate from other items</li> </ul>
Organic Matter	Leaves, grass clippings	<ul style="list-style-type: none"> <li>• Separate from other items</li> <li>• No bags or containers are allowed</li> </ul>
Fiberglass Tanks	N/A	<ul style="list-style-type: none"> <li>• Clean tanks before delivering to the landfill</li> </ul>

<sup>a</sup> Metals are not accepted at the landfill and must be removed from each waste category prior to disposal. Metal construction debris should be disposed of at the DRMO. Disposal requirements set forth in BO 11350.2D should be followed.

## 9.4 RECYCLING REQUIREMENTS

The Installation Recycling program is managed by the MCBCL Landfill, with assistance from the EMD. The MCBCL Landfill plays a vital role in the Installation's effort to reduce the amount of solid waste requiring disposal. Reducing solid waste saves money and helps to protect the environment by conserving natural resources. Additionally, Marine Corps facilities are mandated to recycle.

### 9.4.1 MCBCL Recycling Center

The MCBCL Recycling Center, Bldg. 982, is co-located with the landfill on Piney Green Road. Normal working hours are Monday through Friday, 0730–1530. All materials can be brought to the Recycling Center. For details, have your ROICC or Contract Representative contact the Recycling Center for details at (910) 451-2946. The following types and categories of materials are accepted for recycling at the Recycling Center:

- Wood pallets
- White Paper (mixed flat or shredded)
- Newspaper
- Magazines
- Military publications (binders removed)
- Phone books
- Plastic and glass (containers or bottles)
- Toner cartridges

The following types and categories of materials are accepted for recycling but must be delivered to the Defense Reutilization and Marketing Office (DRMO) at Lot 203:

- Scrap metal
- Steel (high temperature, corrosion resistant)
- Brass (includes spent/fired munitions)
- Copper and copper wire
- Aluminum (plate, sheet, scrap) and aluminum cans

Special arrangements can be made for other materials (C&D debris) or larger volumes of commonly recycled materials from events such as

construction and deconstruction. Regulations set forth in BO 11350.2D must be followed.

#### 9.4.2 Other Recyclables

- **Asphalt Pavement.** Asphalt must be removed and delivered to an asphalt recycling facility. Contractors must provide a record of the total tons of asphalt recycled and the corporate name and location of the recycling facility to their ROICC or Contract Representative, with a copy to the Landfill Manager.
- **Empty Metal Paint Cans.** Empty metal paint cans shall be taken to Bldg. S-962 for recycling. All HM cans or HM containers that are generated from MCBCL or Marine Expeditionary Force contracts will be turned into Bldg. S-962 on Michael Rd. on the scheduled contractor turn-in day. Have your ROICC or Contract Representative contact EMD at (910) 451-1482 for more information. Any waste generated from this process must be managed appropriately.
- **Other Metals.** Other metals must be taken to the DRMO disposal area in Lot 201.
- **Red Rags Recycling.** A basewide program is in place to supply and launder shop rags through an off-site contractor, Aramark, in Savannah, Georgia. Almost all work centers on the Installation use this “Red-Rags” service wherein clean rags are supplied by the contractor and picked up after use. The rags are then laundered off-site and returned. This has reduced rag/POL-contaminated non-regulated waste by over 85 percent.
- **Universal Waste.** See Section 4.0 of this guide for management procedures.
- **Unused Hazardous Materials.** These materials can be turned into Bldg. 908 HM Free Issue point on Michael Rd. Have your ROICC or Contract Representative contact the Free Issue Point at (910) 451-1718.
- **White Rags Recycling.** Analogous to the red rags program, white rags have recently been introduced into painting operations at MCB Camp Lejeune. An off-site contractor, Aramark, in Savannah, Georgia, launders used rags. The white rags have no dye in the cloth

that can interfere with painting operations. Laundering the white rags reduces disposal of paint-related waste.

## **9.5 POLLUTION PREVENTION AND GREEN PROCUREMENT**

MCB Camp Lejeune is subject to green procurement (GP) requirements. GP implements environmentally protective principles in the procurement arena and includes preferential use of the following:

- Recovered materials products
- Biobased products
- Water and energy efficient products
- Alternatives to ozone depleting substances
- Electronics meeting Electronic Produce Environmental Assessment Tool standards
- Products that do not contain toxic chemicals, hazardous substances, and other pollutants targeted for reduction and elimination by the Department of Defense
- Alternative fuel use/increased fuel efficiency
- Environmentally preferable purchasing practices

Contractors are encouraged to employ GP practices whenever feasible.

## 10.0 TRAINING

It is the contractor's responsibility to ensure that every employee has the required training to perform his or her duties in compliance with Federal, state, and local regulatory requirements.

To minimize the environmental impact of operations occurring on the Installation, all civilian and military personnel, including contractors, are required to receive both Environmental Management System (EMS) and general environmental awareness training at the level necessary for their job function. The training presentation provided as Attachment A satisfies these training requirements.

**NOTE** It is the contractor's responsibility to know and comply with Federal, state, and local regulations. Installation environmental personnel, upon request from the ROICC or Contract Representative, will assist contractors with compliance issues; however, the primary burden of regulatory identification, familiarity, and compliance lies with the contractor. This training *does not* replace any required regulatory environmental training (i.e., asbestos abatement worker training) as per contract requirements. Any required environmental training should be completed *prior* to working at MCB Camp Lejeune. Copies of training records should be available upon request by federal or state regulators.

### 10.1 KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with contractor training requirements. If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

#### 10.1.1 Key Definitions

None.

#### 10.1.2 Key Concepts

- **Comprehensive Environmental Training and Education Program (CETEP).** The Marine Corps training program designed to ensure that high-quality, efficient, and effective environmental

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**To minimize the environmental impact of operations aboard the Installation, all contractors are required to receive both EMS and general environmental awareness training at the level necessary for their job function.**

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**If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative.**

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training, education, and information are provided at all levels of the Marine Corps.

- **Environmental Management System (EMS).** The part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing, and maintaining the Environmental Policy.
- **EMS Training.** Instruction that is designed to ensure that military and civilian personnel, including contractors and vendors, become familiar with the Installation's EMS and how it functions
- **General Environmental Awareness Training.** Instruction that is designed to ensure that Installation personnel, including contractors and vendors, become familiar with the MCB Camp Lejeune and MCAS New River environmental policies and programs for regulatory compliance, natural resource conservation, pollution prevention, and environmental protection. General EMS and Environmental Awareness Training for Contractors and Vendors is required for all contractors working aboard the Installation. The training presentation is included as Attachment A. Documentation of receipt of this training should be maintained by the contractor and be available upon request.

## 10.2 OVERVIEW OF REQUIREMENTS

Contractors operating aboard the Installation must be aware of, and adhere to, all applicable regulations and requirements concerning training, including the following:

- **Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management.** Requires implementation of an EMS at all appropriate organizational levels.

## 10.3 REQUIRED TRAINING

### 10.3.1 General Environmental Awareness

In accordance with Department of Defense (DoD) instructions and Marine Corps Orders (MCO), the Installation has implemented a Comprehensive Environmental Training and Education Program (CETEP). A major

component of the CETEP is to provide general environmental awareness training to all individuals associated with the installation, including contractors and vendors. Attachment A is provided to contractors and their employees performing work aboard the Installation to utilize for general environmental awareness training.

### **10.3.2 Environmental Management System (EMS)**

In addition to CETEP requirements, the Installation has implemented a basewide EMS per Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, and DoD and Marine Corps EMS policy. The EMS highlights the fact that the authority and principal responsibility for controlling environmental impacts belong to those commands, units, offices, and personnel (including contractors and vendors) whose activities have the potential to impact the environment. Attachment A is provided to contractors and their employees performing work aboard the Installation to utilize for EMS Training.

### **10.3.3 Recordkeeping**

All training records, including other applicable environmental training, should be maintained on-site by the contractor for review upon request.

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**Attachment A is provided to contractors and their employees performing work aboard the Installation to utilize for EMS and general environmental awareness training.**

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## 11.0 CULTURAL RESOURCES

The Installation enjoys a rich history, and remnants of our past can be found throughout the installation. As contractors, it is your responsibility to notify the Resident Officer in Charge of Construction (ROICC) or your Contract Representative immediately if you encounter suspected archaeological sites, artifacts, or human remains during your activities.

### 11.1 KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with cultural resource management. If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

#### 11.1.1 Key Definitions

- **Archaeological Resource.** Any material remains of human life or activities that are at least 100 years old and are capable of providing scientific or human understanding of past human behavior and cultural adaptation, including the site on which the remains are located. Examples include structures, tools, debris, organic waste, human remains, artistic representations, and shipwrecks.
- **Cultural Resource.** A generic term commonly used to include buildings, structures, districts, sites, and objects of significance in history, architecture, archaeology, engineering, or culture per MCO P5090.2A.
- **Historic Resource.** Any prehistoric or historic district, site, building, structure, or object significant in United States history, architecture, archaeology, engineering, or culture and included, or eligible for listing, the National Register of Historic Places (NRHP) per the National Historic Preservation Act (NHPA) of 1966 and MCO P5090.2A.

#### 11.1.2 Key Concepts

- **Notification.** Contractors must notify the ROICC or Contract Representative if any cultural resources are encountered.

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**If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative.**

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- **Policy.** It is DoD policy to preserve significant historic and archaeological resources.

### 11.1.3 Environmental Management System

Practices, or activities, associated with cultural resources include the following:

- Construction/demolition
- Land clearing
- Soil excavation/grading
- Stump/brush removal

The potential impacts of these activities on the environment include damage to cultural resources and degradation of soil quality.

## 11.2 OVERVIEW OF REQUIREMENTS

It is DoD policy to integrate the archeological and historic preservation requirements of applicable laws with the planning and management of activities under DoD control; to minimize expenditures through judicious application of options available in complying with applicable laws; and to encourage practical, economically feasible rehabilitation and adaptive use of significant historical resources.

Contractors operating aboard the Installation must be aware of, and adhere to, all applicable regulations and requirements regarding cultural resources, including the following:

- **Archaeological and Historic Preservation Act of 1974 (16 U.S.C. 469 *et seq.*).** Amends the Reservoir Salvage Act to extend its provisions beyond the construction of dams to any terrain alteration resulting from any Federal construction project or Federally licensed project, activity, or program.
- **ARPA of 1979 (16 U.S.C. 470 (aa) *et seq.*** Requires Federal land managers to issue permits for the excavation or removal of artifacts from lands under their jurisdiction. The Act requires that relevant Native American tribes be notified of permit issuance if significant religious or cultural sites will be affected. It prohibits the excavation, damage, alteration, or defacement of an archaeological site unless permitted by the Federal land manager.

- **DoD Directive 4710.1, Archaeological and Historic Resources Management.** Provides policy for the management of archaeological and historic resources on land and in water under DoD control.
- **Executive Order (EO) 11593, May 13, 1971.** Requires all Federal agencies to administer cultural properties under their control. Agencies are required to direct their policies, plans, and programs so that significant sites and structures are preserved.
- **Historic Sites, Buildings, and Antiquities Act of 1935 (Public Law 74-292, 16 U.S.C. 461 *et seq.*).** States that it is Federal policy to preserve historic and prehistoric properties of national significance.
- **National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 *et seq.*).** States that it is Federal policy to preserve important historic, cultural, and natural aspects of our national heritage and that it is a requirement to consider environmental concerns during project planning and execution.
- **National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. 470 *et seq.*).** Establishes historic preservation as a national policy and requires Federal agencies undertaking actions that may affect NRHP-eligible historic properties to consult with state historic preservation offices and the Advisory Council on Historic Preservation. Section 110 of the Act requires Federal agencies to inventory, evaluate, identify, and protect cultural resources that are determined eligible for listing in the NRHP.
- **Public Buildings Cooperative Use Act of 1976 (Public Law 94-541).** Encourages adaptive reuse of historic buildings as administrative facilities for Federal agencies.

### 11.3 PROCEDURES

All contractors are expected to follow these procedures:

- Notify the ROICC or Contract Representative immediately if suspected archaeological sites, artifacts, or human remains are encountered during your activities.

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**Notify the ROICC or Contract Representative immediately if suspected archaeological sites, artifacts, or human remains are encountered during your activities.**

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- Stop work in the immediate area of the discovery until directed by the ROICC or Contract Representative to resume work.
- Be particularly aware of your surroundings when working in a designated historic area. A summary of key cultural, archaeological, and historic areas/sites is available at the following website:  
<http://www.lejeune.usmc.mil/EMD/CULTURAL/HOME.htm>

Remember, the Government retains ownership and control over historical and archaeological resources.

## 12.0 PERMITTING

Contractors operating aboard the Installation must ensure that all relevant environmental permits are obtained before work commences on-site. Contractors must work with their ROICC or Contract Representative to determine permitting responsibilities prior to beginning work. Contractors must adhere to all permit conditions. Examples of environmentally related permits are provided in Section 12.3.

### 12.1 KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with contractor permitting requirements. If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

#### 12.1.1 Key Definitions

- **SA Waters.** Surface water that is suitable for recreation and for commercial shellfish harvesting.

#### 12.1.2 Key Concepts

- **Permits.** Prior to beginning work aboard the Installation, consult applicable permit requirements and ensure that they are met before work begins. Copies of all applicable permits/authorizations should be retained onsite for the life of the project.

### 12.2 OVERVIEW OF REQUIREMENTS

Please refer to the individual sections of this Guide for applicable permitting regulations and requirements that relate to each environmental medium. Many permits have specific timetables for submittal prior to project initiation. Contractors must consult the permit requirements and ensure that the permits are obtained in the required time frame.

### 12.3 PROJECT PERMITS AND APPROVALS

Prior to work being awarded, the Installation-associated action proponent should have had an environmental review by the Installation's National

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**If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative.**

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**The NCDENR website (<http://www.enr.state.nc.us>) is a useful reference for determining required permits and obtaining necessary forms.**

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Environmental Policy Act (NEPA) Section to comply with the NEPA of 1969. The outcome of this review would have been in the form of a Decision Memorandum (DM) or an Environmental Assessment (EA). Contractors must refer to their contract and the requirements outlined in the NEPA documentation for specific permitting requirements. EMD Program Managers are available for guidance; however, if the contractor is tasked with preparing permit applications, the contractor is expected to have the necessary capability and expertise required to complete the submittals in accordance with the guidance provided by the regulatory agency that issues the permit. In addition, EMD must be provided with copies of all permits submitted to the North Carolina Department of Environment and Natural Resources (NCDENR). In some cases, EMD must submit the permit application. Please direct questions to your ROICC or Contract Representative.

Examples of permits that may be required are discussed in applicable sections of this Guide. The following list of permits is not meant to be all inclusive. Please be aware that other permits not listed in this section may be required. The NCDENR website (<http://www.enr.state.nc.us>) is a useful reference for determining required permits and obtaining necessary forms. In addition, any inspection and/or data collection required by the permits must be retained on site for review upon request.

### **12.3.1 Stormwater (Section 8.0)**

- **National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permit for Construction Activities (also referred to as General Permit No. NCG010000).** Required for all land-disturbing activities (LDA) that exceed one (1) acre; also requires an accompanying Erosion and Sedimentation Control Plan.
- **High-Density Stormwater Permit.** Required when the (1) LDA exceeds one (1) acre and impervious surfaces are greater than or equal to 25 percent of the total project area adjacent to non-SA waters or greater than or equal to 12 percent of the total project area adjacent to SA water; OR (2) total development exceeds 10,000 square feet of impervious surface.

- **Low-Density Stormwater Permit.** Required when the LDA exceeds one (1) acre and impervious surfaces are less than 25 percent when adjacent to non-SA waters or less than 12% when adjacent to SA waters.

### 12.3.2 Asbestos (Section 6.0)

- **Asbestos Permit Application and Notification for Demolition/Renovation.** DHHS Form 3768, available at the following website:  
<http://www.epi.state.nc.us/epi/asbestos/ahmp.html>

### 12.3.3 Air Quality (Section 13.0)

- **Clean Air Act Title V Construction and Operation Permit.** Required for the construction of the following types of emission sources:
  - Boilers
  - Generators
  - Engine Test Stands
  - Surface Coating/Painting Operations
  - Refrigerant Operations (e.g., Chillers)
  - Chemical or Mechanical Depainting, Abrasive Blasting, Grinding, or Other Surface Preparation Activities
  - Fuel Storage and Fuel Dispensing
  - Woodworking Shops
  - Welding Shops
  - Bulk Chemical or Flammables Storage
  - Open Burning
  - Fire Training
  - Rock Crushing or other dust-causing activities

EMD must submit all permit applications directly to the North Carolina Division of Air Quality.

### 12.3.4 Wetlands (Section 14.0)

- Contractors working aboard the Installation will not perform any work in Waters of the United States or wetlands without an approved permit (even if the work is temporary). Unavoidable impacts to wetlands or waters of the U.S. will require coordination and written approval from the US Army Corps of Engineers for a Section 404 Clean Water Act Permit (Individual or applicable Nationwide Permit), the NC Division of Water Quality for a Section 401 Clean Water Act, Water Quality certification, and the NC Division of Coastal Management for a Federal Consistency Determination. Failure to acquire written authorization for impacts to wetlands and/or waters of the U.S. may result in significant project delays or design modifications. The action proponent must coordinate with Land and Conservation Resources Section, ECON at (910) 451-5063/7235 during project design to ensure Clean Water Act permitting issues are addressed at the earliest opportunity.

### 12.3.5 Drinking Water/Wastewater

- **Approval of Engineering Plans and Specifications for Water Supply Systems.** Applicant submits engineering plans and specifications at least 30 days prior to the date upon which the Authorization to Construct is desired. Must have Authorization to Construct prior to onset of work.
- **Wastewater Extension Permit.** NCDENR Form FTA 02/03 – Rev. 3 04/05. Applicant submitting Form FTA 02/03 should plan accordingly and allow the State approximately 90 days to issue the permit. Permit must be in hand prior to onset of work.



## 13.0 AIR QUALITY

The Air Quality Program is responsible for ensuring that the Installation complies with all applicable Federal and state air quality regulations. Your ROICC or Contract Representative can provide a copy of Base Order 5090.6, Air Quality Management, which has additional information.

### 13.1 KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with air quality. If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

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**If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative.**

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#### 13.1.1 Key Definitions

- **Ozone-Depleting Substance (ODS).** Chemicals, such as certain refrigerants, that cause depletion of the stratospheric ozone layer.
- **Title V Permit.** Permit issued under the Clean Air Act Amendments (CAAA) for all major sources of air pollution. All emission sources at the Installation must be listed on the permit.

#### 13.1.2 Key Concepts

- **Emission Sources.** Please have your ROICC or Contract Representative check with the EMD before beginning any emitting activity to determine whether any recordkeeping requirements apply.
- **Permitted Sources.** Ensure that construction permits are in place prior to beginning construction.

#### 13.1.3 Environmental Management System

Practices, or activities, associated with air quality include the following:

- Controlled burn operations
- Degreasing
- Engine operation and maintenance
- Paint removal
- Painting

- Refrigerant replacement

The potential impacts of these activities on the environment include degradation of air quality, degradation of quality of life, and depletion of nonrenewable resources.

## 13.2 OVERVIEW OF REQUIREMENTS

Contractors operating aboard the Installation must be aware of, and adhere to, all applicable regulations and requirements regarding air quality, including the following:

- **Clean Air Act Amendments of 1990.** Protect human health and clean air resources by establishing standards and regulations for the control of air pollutants.
- **Title V Permit.** Outlines the requirements that the Installation must follow to ensure air quality compliance.
- **Base Order (BO) 5090.6, Air Quality Management.** Implements policies and procedures at the Installation level that all personnel must follow in order to demonstrate compliance with the Title V Permit and USMC requirements.
- **Base Bulletin (BBul) 6280, Open Burning of Vegetative Debris.** Outlines procedures for conducting open burning in accordance with state regulations and Installation procedures.

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**A permit is required prior to the construction of any emission source. Timely submittal of the permit application is required to obtain the permit prior to commencing construction.**

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## 13.3 PERMIT REQUIREMENTS

The Installation has a single permit, the Clean Air Act Title V Construction and Operating Permit, that includes all stationary air emission sources located at the facility; therefore, all permit application submittals to the North Carolina Division of Air Quality (NCDAQ) must be coordinated through the EMD. NCDAQ will review and process the application then issue a permit to construct and operate or to modify the emission source(s). A permit is required prior to the construction of any emission source. Timely submittal of the permit application is required to obtain the final permit prior to commencing construction. The most common types of emission sources at the Installation are as follows:

- Boilers
- Generators
- Engine Test Stands
- Surface Coating/Painting Operations
- Depainting (Chemical or Mechanical), Abrasive Blasting, or Other Surface Preparation Activities
- Fuel Storage and Fuel Dispensing
- Grinding
- Woodworking
- Welding
- Refrigerant Recovery and Recycling Operations or other Ozone-Depleting Substances (e.g., Halon fire extinguishing, cleaning agents)
- Bulk Chemical and Flammable Materials Storage

### 13.4 ADDITIONAL ACTIVITIES OF CONCERN

Other activities that do not necessarily require modification to the Title V Permit, but that must be coordinated with or tracked by EMD or the State Division of Air Quality, include:

- **Use of Refrigerants and other ODS.** Includes installation, removal, replacement, conversion, or service of chillers and other refrigerant-containing equipment.
- **Open Burning (e.g., right-of-way clearing, storm debris burning).** Only vegetative debris may be burned (i.e., NO paper products, trash, treated lumber, shingles, or other synthetic materials). Any plans to conduct open burning activities at the facility must be communicated to EMD and the Fire and Emergency Services Division. Your ROICC or Contract Representative can provide a copy of Base Bulletin 6280, which contains a summary of the Installation's open burning requirements. Any open burning activities that will take place within 1,000 feet of an occupied dwelling require a waiver and approval from occupants and NCDAQ. A waiver form can be downloaded at this site: [http://daq.state.nc.us/enf/openburn/openburn\\_1000ft.pdf](http://daq.state.nc.us/enf/openburn/openburn_1000ft.pdf)  
Five designated sites have been permitted for storing and/or burning storm debris. They are located in the following areas: Mainside on

Sawmill Road, Courthouse Bay, Camp Johnson, Camp Geiger, and MCAS New River. Only storm debris can be accumulated at these sites. EMD must notify the Division of Air Quality if the Installation intends to burn the storm debris at one of these sites. Contact your ROICC or Contract Representative for more information.

- **Fire training outside of designated fire training pits.** State approval is required to conduct fire training outside of the designated fire training pits. First, complete the Notification of Open Burning for the Training of Firefighting Personnel form. The form is available at the following site:  
[http://daq.state.nc.us/enf/openburn/ob\\_firetrain.pdf](http://daq.state.nc.us/enf/openburn/ob_firetrain.pdf)

An accredited North Carolina Asbestos Inspector must inspect any structure to be burned to ensure that it is free from asbestos before the training exercise. Turn in the completed form to EMD for submittal to NCDAQ and the Division of Public Health, Health Hazards Control Unit.

- **Dust-causing activities (e.g., rock crushing).** Wet suppression is required during the entire dust-causing operation. Ensure that an adequate water supply is available, and coordinate with the Fire and Emergency Services Division if access to a fire hydrant is necessary.

## 14.0 NATURAL RESOURCES

The Installation has stewardship and recovery responsibilities over the natural resources located on the installation. These responsibilities are regulated under numerous laws described in this section. The Installation ensures compliance with these laws through an interdisciplinary process of review and coordination of all activities occurring on the installation. Contractors performing work on the Installation are responsible for complying with conditions and measures imposed on their work as a result of this process; these responsibilities include preserving the natural resources within the project boundaries and outside the limits of permanent work, restoring work sites to an equivalent or improved condition on completion of work, and confining construction activities to within the limits of the work indicated or specified. The contractor is advised that the Installation is subject to strict compliance with Federal, State, and Local wildlife laws and regulations. The contractor must not disturb wildlife (birds, nesting birds, mammals, reptiles, amphibians, and fish) or the native habitat adjacent to the project area except when indicated or specified.

### 14.1 KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with natural resources management. If you have any questions or concerns about the information in this section or require assistance regarding any wildlife matters (snakes, nesting birds, nuisance wildlife) on the site or within the project area, please consult with your ROICC or Contract Representative, who will contact Environmental Conservation Branch (ECON) at 910-451-7235 (during working hours) or 910-451-7235 (after working hours).

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**If you have any questions or concerns about the information in this section, please consult with your ROICC or Contract Representative.**

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#### 14.1.1 Key Definitions

- **Natural Resource.** Soil, water, air, plants, and animals, according to the Natural Resources Conservation Service.

- **Threatened or Endangered Species.** Federally listed plants and animals that are likely to become either endangered or extinct in the foreseeable future.
- **Wetland.** An area that is regularly saturated by surface water or groundwater and contains vegetation that is adapted for life in saturated soil conditions per the United States Environmental Protection Agency (USEPA).

#### 14.1.2 Key Concepts

- **National Environmental Policy Act (NEPA) of 1969.** Contractors must obtain and review any NEPA documentation associated with their projects.
- **Threatened and Endangered Species.** Specific requirements regarding protected areas on the Installation apply to contractor activities.
- **Timber.** Contractors must ensure that the ROICC or Contract Representative notify the Forest Management Program prior to conducting site work. Timber will not be released to contractors without the approval of the Forest Management Program.
- **Wetlands.** Any work in Installation waters or wetlands requires a permit prior to the start of an activity.

#### 14.1.3 Environmental Management System

Practices, or activities, associated with natural resources include the following:

- Construction/demolition
- Controlled burn operations
- Erosion control
- Land clearing
- Riparian buffer maintenance
- Soil excavation/grading
- Stump/brush removal

The potential impacts of these activities on the environment include air emissions, sedimentation, eutrophication of surface waters, degradation of

habitat, impacts to marine mammals, damage to commercial and noncommercial timber, impacts to endangered species and cultural resources, and degradation of soil quality.

## 14.2 OVERVIEW OF REQUIREMENTS

Contractors operating aboard the Installation must be aware of, and adhere to, all applicable regulations and requirements regarding natural resources, including the following:

- **BO 5090.11, Protected Species Program.** Sets forth regulations and establishes responsibilities to ensure conservation of threatened and endangered species and species at risk aboard MCB Camp Lejeune.
- **Clean Water Act (CWA) of 1972.** Establishes the basic structure for regulating discharges of pollutants into the Waters of the United States.
- **Marine Corps Order (MCO) P5090.2A, Environmental Compliance and Protection Manual.** Provides guidance and instruction to installations to ensure the protection, conservation, and management of watersheds, wetlands, natural landscapes, soils, forests, fish and wildlife, and other natural resources as vital Marine Corps assets.
- **NEPA of 1969 (42 U.S.C. 4321 *et seq.*).** Requires Federal agencies, including the Marine Corps, to consider the environmental impacts of projects before the decision maker proceeds with the implementation. All projects that support military training, major and minor military construction, maintenance, and natural resources management actions are reviewed for potential environmental impacts.
- **BO 11000.1D, Environmental Impact Review Procedures.** Implements the NEPA of 1969 and NEPA policy and guidance in Chapter 12 of MCO P5090.2A.
- **Rivers and Harbors Act of 1899.** Prohibits the excavation, filling, or alteration of the course, condition, or capacity of any port, harbor, or channel without prior approval from the Chief of Engineers.

### 14.3 National Environmental Policy Act (NEPA)

Staff specialists from various Installation departments participate in the NEPA process, which coordinates the review of projects and documents environmental impacts (or lack thereof) for projects before implementation.

The documentation of this review process occasionally includes mandatory conditions affecting design and construction/implementation of the project. The documentation, when completed, is provided to the action proponent, who is expected to provide it to his or her ROICC or Contract Representative.

Consult with your ROICC or Contract Representative to obtain or review any NEPA documentation associated with the project in your contract.

The documentation marks the end of the NEPA review process; it does not constitute approval for the proponent of the action to implement the action. Some contracts may include stipulations from the NEPA document that must be implemented prior to the onset of work to prevent environmental impacts and violations of Federal or state rules and regulations. Stipulations could include: replacing monitoring wells if damages occur from contractor operations; stopping work if contamination is encountered; notification that a wetlands permit is required; seasonal restrictions, etc.

### 14.4 Timber

Potential timber resources are identified during the NEPA process. The contractor is responsible for advising the ROICC or Contract Representative to notify the Forest Management Program at (910) 451-7223 prior to beginning site work. Additionally, the ROICC or Contract Representative and/or contractor is required to notify the Forest Management Program in the event the contract has been amended with modifications to the site location.

The Forest Management Program maintains first right of refusal for all timber products on construction projects and will determine whether the government will harvest the timber or release it to the contractor. The government retains exclusive rights for all forest products on construction projects. If the government elects to harvest the timber, only merchantable

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**Consult with your ROICC or Contract Representative to obtain or review any NEPA documentation associated with the project in your contract.**

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**The contractor is responsible for advising the ROICC or Contract Representative to notify the Forest Management Program at (910) 451-7223 prior to beginning site work.**

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timber will be removed. Per MCO P5090.2A, Chapter 11, “Forest products will not be given away, abandoned, carelessly destroyed, used to offset costs of contracts, or traded for products, supplies, or services.”

Contractors must adhere to the following requirements when performing site work that may impact timber resources:

- Do not remove, cut, deface, injure, or destroy trees or shrubs, without authorization from the ROICC or Contract Representative.
- Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages without authorization from the ROICC or Contract Representative. (In such cases that these actions are authorized, the contractor shall be responsible for any resultant damage.)
- Protect existing trees that are to remain in place and that may be injured, bruised, defaced, or otherwise damaged by construction operations.
- With the ROICC or Contract Representative’s approval, use approved methods of excavation to remove trees with 30 percent or more of their root systems destroyed.
- With the ROICC or Contract Representative’s approval, remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features.

Please refer to Section 9.0 for disposal information for land-clearing debris.

## 14.5 Threatened and Endangered Species

With the exception of improved roadways, entry into a threatened or endangered species site or shorebird nesting area marked with signs and/or white paint is prohibited without written permission from Installation personnel. BO 5090.11 lists threatened and endangered species residing on Installation. The following restrictions apply on the Installation unless written permission is received from Installation personnel:

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**Protect existing trees that are to remain in place and that may be injured, bruised, defaced, or otherwise damaged by construction operations.**

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**Entry into a threatened or endangered species site or shorebird nesting area marked with signs and/or white paint is prohibited without written permission from Installation personnel.**

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- Work on Onslow Beach or Brown's Island is not permitted between 1 April and 31 October. Traffic on the beaches should be limited to below the high tide line.
- Vehicles and lighting are prohibited on the beaches overnight between 1 May and 31 October.
- Construction activities are prohibited within 1500 feet of a bald eagle's nest (JD Training area).
- Cutting or damaging of pine trees is not permitted.
- Alteration of hydrology through excavation, ditching, etc., is prohibited.
- Fish and wildlife must not be disturbed.
- Water flows may not be altered; the native habitat adjacent to the project and critical to the survival of fish and wildlife may not be significantly disturbed, except as indicated or specified.

## 14.6 Wetlands

### 14.6.1 Avoidance

In accordance with MCO P5090.2A, all facilities and operational actions must avoid, to the maximum degree feasible, wetlands destruction or degradation regardless of wetland size or legal necessity for a permit. Prior to the onset of construction, coordination with the Land and Conservation Resources Section of EMD should have taken place during project design to ensure Clean Water Act permitting issues are addressed by the contractor at the earliest opportunity. Contractors must incorporate avoidance and minimization measures in order to comply with the national policy to permit no overall net loss of wetlands.<sup>1</sup> Any proposed action significantly affecting wetlands must be coordinated with the Commanding Officer of MCB Camp Lejeune.

The contractor must ensure that construction of all buildings, facilities and related amenities, including earthwork, grading, landscaping, drainage,

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<sup>1</sup> Contractor must meet concept design criteria while incorporating avoidance and minimization measures to protect wetlands, streams and Waters of the United States.

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**Contractors must incorporate avoidance and minimization measures in order to comply with the national policy to permit no overall net loss of wetlands.**

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stormwater management, parking lot and paved roadway, sidewalks, site excavation, sanitary sewer system extensions, and domestic water extensions, avoids, to the maximum degree feasible, wetlands destruction or degradation.

Identified and mapped boundaries of legally defined wetlands on all Marine Corps lands within the project area will be distributed to the ROICC or Contract Representative for use (if available) and shall be included in all design products including drawings, plans, and figures.

### 14.6.2 Permits

All unavoidable potential impacts to wetlands or Waters of the United States require prior coordination as described in this section. Failure to acquire written authorization for impacts to wetlands and/or Waters of the United States may result in significant project delays or design modifications.

No discharge of fill material, mechanized land clearing, or any other activity is allowed in jurisdictional wetlands or Waters of the United States without the proper approvals. The contractor may be responsible for obtaining the following permits (including pre-permit coordination, preparation, and submission of all permit applications after review and concurrence by the Installation) and complying with all regulations and requirements stipulated by the State of North Carolina as conditions upon issuance of the permits:

- United States Army Corps of Engineers (USACE), Section 404 Permit (Individual or applicable Nationwide Permit); Clean Water Act (CWA) of 1977, as Amended (Public Law 95-217, 33 U. S. C. 1251 et seq.)
- North Carolina Division of Water Quality (NCDWQ), Section 401 Water Quality Certification – (15A NCAC 02H) N.C. Department of Environment and Natural Resources (NCDENR); Clean Water Act (CWA) of 1977, as Amended (Public Law 95-217, 33 U. S. C. 1251 et seq.)

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**If work in wetlands is required, be sure you know who is responsible for obtaining permits, and what the terms and conditions of the permits require.**

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- North Carolina Division of Coastal Management (NCDCM), Federal Consistency Determination (15A NCAC 07) NCDENR; Coastal Zone Management Act (CZMA) of 1972 (16 U. S. C. 1451 et seq.)

Two types of activities generally require a permit from the USACE:

- **Activities within navigable waters.** Activities such as dredging, constructing docks and bulkheads, and placing navigation aides require review under Section 10 of the Rivers and Harbors Act of 1899 to ensure that they will not cause an obstruction to navigation.
- **Activities in wetlands and Waters of the United States** (regulated by Section 404 of the CWA of 1972). A major aspect of the regulatory program under Section 404 of the CWA is determining which areas qualify for protection as wetlands. Contractors should contact the USACE, the NCDWQ, or the NCDCM if there is any question about whether performing any activities could impact wetlands.

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**Contractors working on the Installation will not perform any work in Waters of the United States or wetlands without an approved permit (even if the work is temporary).**

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Contractors working on the Installation will not perform any work in Waters of the United States or wetlands without an approved permit (even if the work is temporary). Examples of temporary discharges include dewatering of dredged material prior to final disposal and temporary fills for access roadways, cofferdams, storage, and work areas.

### 14.6.3 Impacts

Any disturbance to the soil or substrate (bottom material) of a wetland or water body, including a stream bed, is an impact and may adversely affect the hydrology of an area. Discharges of fill material generally include the following, without limitation:

- Placement of fill material that is necessary for the construction of any structure or impoundment requiring rock, sand, dirt, or other material for its construction; site-development fills for recreational, industrial, commercial, residential, and other uses; and causeways or road fills
- Dams and dikes
- Artificial islands

- Property protection or reclamation devices such as riprap, groins, seawalls, breakwaters, revetments, and beach nourishment
- Levees
- Fill for intake and outfall pipes and subaqueous utility lines
- Fill associated with the creation of ponds
- Any other work involving the discharge of fill or dredged material

#### 14.6.4 Mitigation

Any facility requirement that cannot be sited to avoid wetlands must be designed to minimize wetlands degradation and must include compensatory mitigation as required by wetland regulatory agencies in all phases of project planning, programming, and budgeting.

The contractor may be required to develop on-site mitigation, consisting of wetland/stream restoration or creation for all unavoidable wetland and stream impacts whenever possible and feasible. Use of Marine Corps lands and lands of other entities may be permissible for mitigation purposes for Marine Corps projects when consistent with USEPA and USACE guidelines or permit provisions. Land within the project area suitable for establishment of wetlands mitigation may be evaluated by the contractor and used for mitigation where compatible with mission requirements and approved by the Commanding Officer. Proposals for permanent resource areas must be approved by the Assistant Secretary of the Navy (Installations and Environment) or his/her designee.

Off-site mitigation should be proposed only if there is no other reasonable compensatory mitigation alternative.

#### 14.7 Temporary Construction

Traces of temporary construction facilities, such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other signs of construction, should be removed.

Temporary roads, parking areas, and similar temporarily used areas should be graded to conform to surrounding contours.

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**The contractor may be required to develop on-site mitigation consisting of wetland/stream restoration or creation for all unavoidable wetland and stream impacts whenever possible and feasible.**

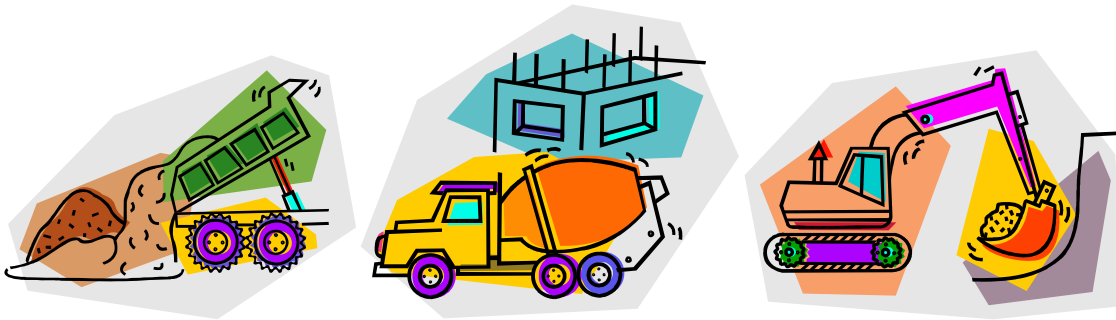
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# General EMS & Environmental Awareness Training for Contractors & Vendors



## Attachment (1)







**MCB Camp Lejeune, NC/  
MCAS New River**



**General EMS and  
Environmental Awareness  
Training  
for  
Contractors and Vendors**



Revised: April 2008



# Disclaimer

- This training does not replace any required regulatory environmental training as per your contract
  - Required environmental training should be completed *prior* to working aboard the Installation
  - Training records should be available for review upon request





# Training Overview

- EMS and the Environmental Policy
- Environmental Management Division
- General Environmental Awareness
- Spill Response Basics
- Summary





# EMS and the Environmental Policy





# What is an EMS?

- MCB Camp Lejeune and MCAS New River have implemented an Environmental Management System (EMS) that is founded on the principles of our respective **Environmental Policy**.
- The purpose of the EMS is to sustain and enhance mission readiness and access to training areas through effective and efficient environmental management.
- The EMS emphasizes that the authority and principal responsibility for controlling environmental impacts belong to those commands, units, offices, and personnel, *including contractors and vendors*, whose activities have the potential to impact the environment.





# Why have an EMS?

“To sustain our operations and training capabilities, and to safeguard land-use availability, ..... will comply with environmental laws and conserve the natural and cultural resources with which it has been entrusted.”

Excerpt from the Commanding Officer's Environmental Policy Statement





# What YOU Need to Know

- The Installation has an EMS
- These three goals are the foundation of our **Environmental Policy**:
  1. **Comply** with relevant environmental laws and regulations
  2. **Prevent pollution**
  3. **Continually improve** our EMS





# YOUR EMS Responsibilities

- Be aware of the Environmental Policy
- Be familiar with spill procedures
- Keep your eyes open for potential problems
- Report any environmental problems or concerns promptly and notify your ROICC or Contract Representative
- Utilize this training for your workers







# **Environmental Management Division (EMD), MCBCL**

**Environmental Affairs  
Department  
(EAD), MCASNR**





# EMD/EAD can help!

- The appropriate environmental office works with your ROICC or Contract Representative to ensure:
  - Proper management of waste
  - Compliance with regulations
  - Required environmental plans are developed and followed, if applicable
  - Required environmental training material is provided for contractor use





# What Does EMD/EAD Do for You?



- If you have EMS or environmentally related questions, contact your ROICC or Contract Representative who will then work with EMD & EAD to determine how to proceed





# Remember...

**ALL** environmental program requirements are applicable to **ALL** contractors and vendors working aboard the Installation!





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# General Environmental Awareness





# Water Quality

## ■ Construction/demolition and other projects can result in:

- Stormwater pollution
- Erosion and sedimentation



## ■ If a project could impact water quality:

- Don't dispose of oil, chemicals, or any other material/debris down storm drains
- Keep sediment, leaves, and construction debris away from storm drains (use barriers)
- Sediment Erosion Control Plans are required for sites when more than 1 acre will be disturbed





# Used Oil

## ■ Oil handling/changing operations can result in:

- Spills
- Waste
- Groundwater, stormwater, or soil contamination



## ■ If a project involves the use of oil:

- Perform maintenance in paved, designated areas
- Recycle used oil, oil filters, and other fluids...don't dump down storm drain or dispose of in the trash
- Clean up spills immediately and properly!





# Air Quality

## If a project could impact air quality:

- Prior to beginning operations, have your ROICC or Contract Representative contact the Installation Air Quality Program representative for applicable Federal and state permitting requirements
- Follow all permit requirements, including material usage recordkeeping for Title V permit sources
- Notify your ROICC or Contract Representative before bringing new equipment on site
- Notify your ROICC or Contract Representative before modifying an existing permitted source (including physical changes and material changes). Examples of permitted sources include boilers, generators, fuel tanks, and welding/soldering operations







# Hazardous Waste Management

## ■ Hazardous waste generation can result in:

- Consumption of natural resources
- Increased Regulatory Burden

## ■ If a project generates hazardous waste:

- Reduce/Minimize the generation of hazardous waste
- Contact your ROICC or Contract Representative if unsure how to manage a waste
- Don't put hazardous wastes into general trash dumpsters
- Ensure satellite accumulation areas (SAA) are managed properly
  - Notify your ROICC or Contract Representative prior to creating a new SAA!
- Ensure hazardous waste drums are labeled and lids are secured





# Hazardous Materials

- **If a project requires the use hazardous material (HAZMAT):**
  - Keep flammable materials in HAZMAT lockers
  - Don't store large quantities – keep on hand only what you will use
  - Maintain MSDSs for each material on-site
  - Place materials stored outside in secondary containment to prevent spill/reduce releases
  - Stop work if you unearth a hazardous material (i.e., ordnance) and report to your ROICC or Contract Representative





# PCB and Asbestos

- **If a project generates or involves the removal of PCB or asbestos:**

- Manage and handle PCB and asbestos only if you are properly trained



- Manage PCB and asbestos in proper containers with appropriate labeling





# Solid Waste Management

- **Solid waste generation can result in:**
  - Consumption of natural resources
  - Decreased landfill space
- **If a project generates regulated or solid waste:**
  - Reduce/Reuse/Recycle when possible; meet contract requirements for recycling
  - Contact your ROICC or Contract Representative if unsure how to manage a waste
  - Don't put unauthorized wastes into general trash dumpsters – Recyclable products should be placed in appropriate containers & not co-mingled with solid waste
  - Don't use government-owned dumpsters for your contractor waste and debris





# Good Housekeeping

## ■ Poor housekeeping can result in:

- Fines, termination of contract
- Environmental contamination, spills
- Injuries



## ■ Maintain good housekeeping:

- **DO** store flammable materials in HAZMAT lockers
- **DO** ensure containers are labeled and lids are secured
- **DO** keep stormwater drains clear of debris
- **DO** clean up work sites at the end of *each* day
- **DO** clean up spills immediately and properly
- **DO** clean up work area after job completion
- **DON'T** pour material down storm or floor drains
- **DON'T** stockpile waste – put it where it belongs!





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# Spill Response Basics





# If You Have or See a Spill...

# Call 911





# Natural Resources – Threatened & Endangered Species

- The Installation is currently home to nine federally listed endangered species: red-cockaded woodpecker (RCW), green sea turtle, loggerhead sea turtle), rough-leaved loosestrife, seabeach amaranth, piping plover, American alligator, and American bald eagle and Hirst's panic grass.



- The following restrictions apply:
  - Construction activities are restricted within 1500 ft of a bald eagle's nest
  - Vehicles & lighting are prohibited on the beaches overnight = 1 May -31 Oct
  - Cutting or damaging pine trees in not permitted
  - Fish & wildlife must not be disturbed







# Natural Resources – Wetlands

- The US Army Corps of Engineers defines a wetland as " 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."
- No discharge of fill material, mechanized land clearing, or any other activity is allowed in jurisdictional wetlands or Waters of the United States without the proper approvals.
- Permits will be required





# Natural Resources – Timber

There are over 127,000 acres of forested land aboard the Installation

- The MCBCL Forest Management Program has 1<sup>st</sup> right of refusal for all timber products on construction projects
  - The following restrictions apply:



- Do not cut or deface trees w/o authorization
- Protect existing trees that are to remain in place
- Do not fasten or attach ropes or cables to existing nearby trees for anchorages w/o authorization





# Cultural Resources

The Installation manages a variety of historic and prehistoric archaeological sites, as well as historic structures.

- **IF YOU FIND A BONE, BOTTLE OR PIECE OF POTTERY THAT YOU THINK MIGHT HAVE ARCHAEOLOGICAL OR HISTORIC INTEREST, DON'T PICK IT UP. IF YOU FIND ANY OF THESE THINGS, MARK THE AREA & NOTIFY THE BASE ARCHAEOLOGIST, EMD AT 451-5063.**





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# Summary





# Summary

- MCB Camp Lejeune and MCAS New River protect, preserve, and enhance their natural resources through their EMS and Environmental Policies
  - **We comply** with relevant environmental laws and regulations
  - **We prevent pollution**
  - **We continually improve** the EMS
- **YOU** are responsible for complying with applicable environmental requirements too
- If you aren't sure what to do...**ASK!**
  - Your ROICC or Contract Representative and EMD/EAD are here to help





# Remember...

Consult the *Contractor Environmental Guide* for more detailed information pertaining to environmental requirements applicable to the work you do.

If you have any questions or concerns about the information in this training, please consult with your ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.



SECTION 01 78 00

CLOSEOUT PROCEDURES

12/10

PART 1 GENERAL

1.1 SUBMITTALS

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

SD-10, Operation and Maintenance Data

Equipment/product warranty list

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

SD-11 Closeout Submittals

As-built drawings

Record of materials

Maximo requirements

Complete Submittal Package - 1 copy

Equipment/product warranty tag

1.2 PROJECT RECORD DOCUMENTS

As-Built Drawings will be submitted as specified in 1.2.1.

1.2.1 As-Built Drawings

"FAC 5252.236-9310, Record Drawings." In addition to the requirements of FAC 5252.236-9310, the Contractor shall survey the horizontal and vertical location of all new utilities and structures to within 0.1 feet relative to the station datum. All utilities shall be surveyed at each fitting and every 100 LF of run length and at each change of direction. All structures shall be surveyed at corners of buildings. Locations and elevations shall be recorded on the Record Drawings. Submit drawings with QC certification. Submit drawings in AutoCAD format versions 2000 or 2002.

1.2.2 As-Built Record of Materials

Furnish a record of materials.

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

MATERIALS DESIGNATION	SPECIFICATION	MANUFACTURER	MATERIALS USED (MANUFACTURER'S DESIGNATION)	WHERE USED
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1.2.3 Maximo Requirements

Submit maximo requirements as specified in Section 23 03 00 and 26 00 00.

1.3 EQUIPMENT/PRODUCT WARRANTIES

1.3.1 Equipment/Product Warranty List

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

1.3.2 Equipment Warranty Tags and Guarantor's Local Representative

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

EQUIPMENT/PRODUCT WARRANTY TAG

Type of Equipment/Product \_\_\_\_\_  
Warranty Period \_\_\_\_\_ From \_\_\_\_\_ To \_\_\_\_\_  
Contract No. \_\_\_\_\_  
Inspector's Signature \_\_\_\_\_ Date Accepted \_\_\_\_\_

Construction Contractor:  
Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Telephone: \_\_\_\_\_

Warranty Contact: \_\_\_\_\_  
Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Telephone: \_\_\_\_\_

STATION PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE



1.4 COMPLETE SUBMITTAL PACKAGE

Contractor shall make electronic copies of all submittals, including the transmittal sheet, and provide a CD/DVD containing all submittals for project close out.

The CD/DVD shall be marked "Complete Submittal Package - Contract #N40085-12-B-0121."

1.5 CLEANUP

Leave premises "broom clean." Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Clean filters of operating equipment. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --



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.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 145 (1991; R 2008) Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.6 (2006) Safety Requirements for Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011) Safety and Health Requirements Manual

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

40 CFR 61 National Emission Standards for Hazardous Air Pollutants

1.2 PROJECT DESCRIPTION

1.2.1 Demolition/Deconstruction Plan

Prepare a Demolition Plan and submit proposed demolition, and removal procedures for approval before work is started. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Identify components and materials to be salvaged for reuse or recycling with reference to paragraph Existing Facilities to be Removed. Append tracking forms for all removed materials indicating type, quantities, condition, destination, and end use. Coordinate with Waste Management Plan. Plan shall be approved by Contracting Officer prior to work beginning.

### 1.2.2 General Requirements

Do not begin demolition or deconstruction until authorization is received from the Contracting Officer. **The work of this section is to be performed in a manner that maximizes salvage and recycling of materials.** Remove rubbish and debris from the project site; do not allow accumulations inside or outside the buildings. The work includes demolition,, salvage of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with **EM 385-1-1.**

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

#### 1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove snow, dust, dirt, and debris from work areas daily.

#### 1.3.2 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas.

#### 1.3.3 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Prior to start of work the Government will disconnect and seal utilities serving each area of alteration or removal upon written request from the Contractor.

#### 1.3.4 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, 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 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be coordinated between the Contractor and Contracting Officer.

#### 1.6 SUBMITTALS

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

##### SD-01 Preconstruction Submittals

##### Existing Conditions

##### SD-07 Certificates

##### Demolition Plan

##### Notification

#### 1.7 QUALITY ASSURANCE

Submit timely [notification](#) of demolition and renovation projects to Federal, State, regional, and local authorities in accordance with [40 CFR 61](#), Subpart M. Notify the Regional Office of the United States Environmental Protection Agency (USEPA), State's environmental protection agency, 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.

##### 1.7.1 Dust and Debris Control

Prevent the spread of dust and debris to occupied portions of the building and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Vacuum and dust the work area daily. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to aircraft.

## 1.8 PROTECTION

### 1.8.1 Traffic Control Signs

a. Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor barricades in a manner to prevent displacement by wind, jet or prop blast. Notify the Contracting Officer prior to beginning such work.

### 1.8.2 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

## 1.9 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair or replace items to be relocated which are damaged by the Contractor with new undamaged items as approved by the Contracting Officer.

## 1.10 EXISTING CONDITIONS

Before beginning any demolition work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results.

## PART 2 PRODUCTS

### 2.1 FILL MATERIAL

a. Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill basements, voids, depressions or excavations resulting from demolition or deconstruction of structures. Fill material shall be waste products from demolition or deconstruction until all waste appropriate for this purpose is consumed.

b. Fill material shall conform to the definition of satisfactory soil material as defined in AASHTO M 145, Soil Classification Groups A-1, A-2-4, A-2-5 and A-3. In addition, fill material shall be free from roots and other organic matter, trash, debris, frozen materials, and stones larger than 2 inches in any dimension.

### PART 3 EXECUTION

#### 3.1 EXISTING FACILITIES TO BE REMOVED

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.

##### 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.

###### 3.1.1.2 Disconnecting Existing Utilities

Remove existing utilities , as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered but are not indicated on the drawings, notify the Contracting Officer prior to further work in that area. Remove meters and related equipment and deliver to a location in accordance with instructions of the Contracting Officer.

##### 3.1.2 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated, and shall include:

- a. Concrete and Masonry: Completely fill holes and depressions, caused by previous physical damage or left as a result of removals in existing masonry walls to remain, with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.

##### 3.1.3 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 each item of equipment and fixtures as a whole unit; listed, indexed, tagged, and stored. Salvage each unit with its normal operating auxiliary equipment. Transport salvaged equipment and fixtures, including motors and machines, to a designated storage area as directed by the Contracting Officer. Do not remove equipment until approved. Do not offer

low-efficiency equipment for reuse; provide to recycling service for disassembly and recycling of parts.

#### 3.1.3.1 Piping

Disconnect piping at unions, flanges and valves, and fittings as required to reduce the pipe into straight lengths for practical storage. Store salvaged piping according to size and type. 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 salvage, or not reusable, as scrap metal.

#### 3.1.4 Electrical Equipment and Fixtures

Salvage motors, motor controllers, and operating and control equipment that are attached to the driven equipment. Salvage wiring systems and components. Box loose items and tag for identification. Disconnect primary, secondary, control, communication, and signal circuits at the point of attachment to their distribution system.

### 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, 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.



3.4 CLEANUP

Remove debris and rubbish from basement and similar excavations. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.5 DISPOSAL OF REMOVED MATERIALS

3.5.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified in the Waste Management Plan. Storage of removed materials on the project site is prohibited.

3.5.2 Burning on Government Property

Burning will not be permitted on Government property.

3.5.3 Removal from Government Property

Transport waste materials removed from demolished structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

-- End of Section --



## SECTION 03 30 00

## CAST-IN-PLACE CONCRETE

11/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 182 (2005; R 2009) Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI/MCP-1 (2012) Manual of Concrete Practice Part 1

ACI/MCP-2 (2012) Manual of Concrete Practice Part 2

ACI/MCP-3 (2012) Manual of Concrete Practice Part 3

ACI/MCP-4 (2012) Manual of Concrete Practice Part 4

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995; R 2004) Basic Hardboard

ASTM INTERNATIONAL (ASTM)

ASTM A185/A185M (2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

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 A615/A615M (2009b) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM A82/A82M (2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement

ASTM C1017/C1017M (2007) Standard Specification for Chemical Admixtures for Use in Producing Flowing

## Concrete

ASTM C1107/C1107M	(2011) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C1260	(2007) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C143/C143M	(2010a) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2011) Standard Specification for Portland Cement
ASTM C156	(2011) Standard Test Method for Water Retention by Concrete Curing Materials
ASTM C1567	(2011) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
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 C192/C192M	(2007) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231/C231M	(2010) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C233/C233M	(2011) Standard Test Method for Air-Entraining Admixtures for Concrete
ASTM C260/C260M	(2010a) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C295/C295M	(2011) Petrographic Examination of Aggregates 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 C311	(2011b) Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral

	Admixture in Portland-Cement Concrete
ASTM C33/C33M	(2011a) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2011) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42/C42M	(2011) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
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 C881/C881M	(2010) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM C932	(2006) Standard Specification for Surface-Applied Bonding Compounds for Exterior Plastering
ASTM C94/C94M	(2011b) Standard Specification for Ready-Mixed Concrete
ASTM C989/C989M	(2011) Standard Specification for Slag Cement for Use in Concrete and Mortars
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 D1751	(2004; R 2008) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2004a; R 2008) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D5759	(1995; R 2005) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
ASTM D6690	(2007) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

ASTM E1745 (2011) Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

ASTM E329 (2011c) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP (2009; 28th Ed) Manual of Standard Practice

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST PS 1 (2009) DOC Voluntary Product Standard PS 1-07, Structural Plywood

U.S. DEPARTMENT OF COMMERCE (DOC)

DOC/NIST PS1 (1995) Construction and Industrial Plywood with Typical APA Trademarks

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED NC (2009) Leadership in Energy and Environmental Design(tm) New Construction Rating System

1.2 DEFINITIONS

- a. "Cementitious material" as used herein must include all portland cement, pozzolan, fly ash, ground granulated blast-furnace slag.
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.
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.

1.3 SUBMITTALS

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

SD-02 Shop Drawings

Reinforcing steel

### SD-03 Product Data

#### Materials for curing concrete

#### Joint sealants

Submit manufacturer's product data, indicating VOC content. Manufacturer's catalog data for the following items must include printed instructions for admixtures, bonding agents, epoxy-resin adhesive binders, waterstops, and liquid chemical floor hardeners.

#### Joint filler; (LEED NC)

#### Vapor retarder

#### Bonding Materials

#### Reinforcement; (LEED NC)

### 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, ground slag, 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, and pozzolan test results, in addition. The approval of fly ash, and pozzolan test results must be within 6 months of submittal date. Obtain acknowledgement of receipt prior to concrete placement.

### SD-06 Test Reports

#### Concrete mix design

#### Fly ash

#### Pozzolan

#### Ground granulated blast-furnace slag

#### Aggregates

#### Compressive strength tests

#### Air Content

## Slump

## Air Entrainment

### 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 retarder, 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 Drawings

##### 1.6.2.1 [Reinforcing Steel](#)

[ACI/MCP-4](#). Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars.

#### 1.6.3 Test Reports

##### 1.6.3.1 [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, 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.

##### 1.6.3.2 [Fly Ash and Pozzolan](#)

Submit test results in accordance with [ASTM C618](#) for fly ash and pozzolan. Submit test results performed within 6 months of submittal date. Submit



manufacturer's policy statement on fly ash use in concrete.

#### 1.6.3.3 Ground Granulated Blast-Furnace Slag

Submit test results in accordance with [ASTM C989/C989M](#) for ground granulated blast-furnace slag. Submit test results performed within 6 months of submittal date. Submit manufacturer's policy statement on slag use in concrete.

#### 1.6.3.4 Aggregates

[ASTM C1260](#) for potential alkali-silica reactions, [ASTM C295/C295M](#) for petrographic analysis.

### 1.7 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 E329](#).

### 1.8 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 C33/C33M](#).

Sample and test portland cement in accordance with [ASTM C150/C150M](#).

Sample and test air-entraining admixtures in accordance with [ASTM C233/C233M](#).

Testing must be performed by a Grade I Testing Technician.

## PART 2 PRODUCTS

### 2.1 MATERIALS FOR FORMS

Provide wood, plywood, plastic, carton, or steel. Use plywood or steel forms where a smooth form finish is required.

#### 2.1.1 Wood Forms

Provide lumber that is square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Provide plywood that complies with [DOC/NIST PS1](#), B-B concrete form panels or better or [AHA A135.4](#), hardboard for smooth form lining.

##### 2.1.1.1 Concrete Form Plywood (Standard Rough)

Provide plywood that conforms to [NIST PS 1](#), B-B, concrete form, not less than [5/8-inch](#) thick.

##### 2.1.1.2 Overlaid Concrete Form Plywood (Standard Smooth)

Provide plywood that conforms to [NIST PS 1](#), B-B, high density form overlay, not less than [5/8-inch](#) thick.

2.1.2 Steel Forms

Provide steel form surfaces that do not contain irregularities, dents, or sags.

2.2 FORM TIES AND ACCESSORIES

The use of wire alone is prohibited. Provide form ties and accessories that do not reduce the effective cover of the reinforcement.

2.3 CONCRETE

2.3.1 Contractor's Option for Material Only

At the option of the Contractor, those applicable material sections of North Carolina DOT RBS for Class A 4 strength concrete must govern in lieu of this specification for concrete. Do not change the selected option during the course of the work.

2.3.2 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 (Min. 28-Day Comp. Strength (psi))	ASTM C33/C33M Maximum Nominal Aggregate (Size No.)	Range of Slump (inches)	Maximum Water-Cement Ratio (by weight)	Air Entr. (percent)
All areas	4000	57	5 inch max	0.50	6

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.

2.3.2.1 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 C192/C192M and tested in accordance with ASTM C39/C39M. Samples of all materials used in mixture proportioning studies must be representative of those proposed for use in the project and must be accompanied by the manufacturer's or producer's test report indicating compliance with these specifications. Base trial mixtures having proportions, consistencies, and air content suitable for the work on methodology described in ACI/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, 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 C192/C192M](#) and tested in accordance with [ASTM C39/C39M](#) 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.

#### 2.3.2.2 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.

#### 2.3.3 Ready-Mix Concrete

Provide concrete that meets the requirements of [ASTM C94/C94M](#).

Ready-mixed concrete manufacturer must provide duplicate delivery tickets with each load of concrete delivered. Provide delivery tickets with the following information in addition to that required by [ASTM C94/C94M](#):

Type and brand cement

Cement content in [94-pound](#) bags per cubic [yard](#) of concrete

Maximum size of aggregate

Amount and brand name of admixtures

Total water content expressed by water/cement ratio

#### 2.3.4 Concrete Curing Materials

##### 2.3.4.1 Absorptive Cover

Provide burlap, cotton mats, and other absorbent materials for curing concrete, as described in [ACI 308R](#).

##### 2.3.4.2 Moisture-Retaining Cover

Provide waterproof paper cover for curing concrete conforming to [ASTM C171](#), regular or white, or polyethylene sheeting conforming to [ASTM C171](#), 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 C171](#), Class 3, and polyethylene film must conform to [ASTM C171](#). When tested for water retention in accordance with [ASTM C156](#), 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.

#### 2.3.4.3 Membrane-Forming Curing Compound

Provide liquid type compound conforming to [ASTM C309](#), Type 1, clear, Type 1D with fugitive dye for interior work and Type 2, white, pigmented for exterior work.

### 2.4 MATERIALS

#### 2.4.1 Cement

[ASTM C150/C150M](#), Type I or II blended cement except as modified herein. Provide blended cement that consists of a mixture of [ASTM C150/C150M](#), Type II, cement and one of the following materials: [ASTM C618](#) pozzolan or fly ash, [ASTM C989/C989M](#) ground granulated blast-furnace slag. For portland cement manufactured in a kiln fueled by hazardous waste, maintain a record of source for each batch.

##### 2.4.1.1 Fly Ash and Pozzolan

[ASTM C618](#), 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. Report the chemical analysis of the fly ash in accordance with [ASTM C311](#). Evaluate and classify fly ash in accordance with [ASTM D5759](#).

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: 40 percent
2. For fly ash or natural pozzolan: 40 percent

##### 2.4.1.2 Ground Granulated Blast-Furnace Slag

[ASTM C989/C989M](#), Grade 80 or better. Slag content must be a minimum of 25 percent by weight of cementitious material.

##### 2.4.1.3 Portland Cement

Provide cement that conforms to [ASTM C150/C150M](#), Type I, IA, II, or IIA. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.

#### 2.4.2 Water

Minimize the amount of water in the mix. The amount of water must not exceed 50 percent by weight of cementitious materials (cement plus 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.

### 2.4.3 Aggregates

ASTM C33/C33M, except as modified herein. Furnish aggregates for exposed concrete surfaces from one source. Provide aggregates that do not contain any substance which may be deleteriously reactive with the alkalis in the cement.

Fine and coarse aggregates must show expansions less than 0.08 percent at 16 days after casting when testing in accordance with ASTM C1260. Should the test data indicate an expansion of 0.08 percent or greater, reject the aggregate(s) or perform additional testing using ASTM C1567 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> plus Al<sub>2</sub>O<sub>3</sub> plus Fe<sub>2</sub>O<sub>3</sub>) is 65 percent or more,
  - b. 25 percent if (SiO<sub>2</sub> plus Al<sub>2</sub>O<sub>3</sub> plus Fe<sub>2</sub>O<sub>3</sub>) is 70 percent or more,
  - c. 20 percent if (SiO<sub>2</sub> plus Al<sub>2</sub>O<sub>3</sub> plus Fe<sub>2</sub>O<sub>3</sub>) is 80 percent or more,
  - d. 15 percent if (SiO<sub>2</sub> plus Al<sub>2</sub>O<sub>3</sub> plus Fe<sub>2</sub>O<sub>3</sub>) is 90 percent or more.

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 C1567.

Aggregates must not possess properties or constituents that are known to have specific unfavorable effects in concrete when tested in accordance with ASTM C295/C295M.

### 2.4.4 Nonshrink Grout

ASTM C1107/C1107M.

### 2.4.5 Admixtures

ASTM C494/C494M: Type A, water reducing; Type B, retarding; Type C, accelerating; Type D, water-reducing and retarding; and Type E, water-reducing and accelerating admixture. Do not use calcium chloride admixtures.

#### 2.4.5.1 Air-Entrainment

ASTM C260/C260M.

#### 2.4.5.2 High Range Water Reducer (HRWR) (Superplasticizers)

ASTM C494/C494M, Type F and Type G (HRWR retarding admixture) and ASTM C1017/C1017M.

#### 2.4.5.3 Pozzolan

Provide fly ash or other pozzolans used as admixtures that conform to ASTM C618.

#### 2.4.6 Vapor Retarder

ASTM E1745 Class A polyethylene sheeting, minimum 10 mil thickness or other equivalent material.

#### 2.4.7 Materials for Curing Concrete

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).

##### 2.4.7.1 Impervious Sheeting

ASTM C171; waterproof paper, clear or white polyethylene sheeting, or polyethylene-coated burlap.

##### 2.4.7.2 Pervious Sheeting

AASHTO M 182.

##### 2.4.7.3 Liquid Membrane-Forming Compound

ASTM C309, white-pigmented, Type 2, Class B.

#### 2.4.8 Expansion/Contraction Joint Filler

ASTM D1751, ASTM D1752, cork or 100 percent post-consumer paper meeting ASTM D1752 (subparagraphs 5.1 to 5.4). Material must be 1/2 inch thick, unless otherwise indicated.

#### 2.4.9 Joint Sealants

##### 2.4.9.1 Horizontal Surfaces, 3 Percent Slope, Maximum

ASTM D6690 or ASTM C920, Type M, Class 25, Use T.

##### 2.4.10 Epoxy Bonding Compound

ASTM C881/C881M. 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.

## 2.5 REINFORCEMENT

Galvanize bars, fabrics, connectors, and chairs.

### 2.5.1 Reinforcing Bars

ACI/MCP-2 unless otherwise specified. Use deformed steel. ASTM A615/A615M

Grade 60. 2.5.2 Wire

ASTM A82/A82M or ASTM A496/A496M.

#### 2.5.2.1 Welded Wire Fabric

ASTM A185/A185M or ASTM A497/A497M. Provide flat sheets of welded wire fabric .

#### 2.5.3 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, ACI/MCP-4 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.

### 2.6 BONDING MATERIALS

#### 2.6.1 Concrete Bonding Agent

Provide aqueous-phase, film-forming, nonoxidizing, freeze and thaw-resistant compound agent suitable for brush or spray application conforming to ASTM C932.

#### 2.6.2 Epoxy-Resin Adhesive Binder

Provide two-component, epoxy-polysulfide polymer type binder with an amine-type curing-agent conforming to ASTM C881/C881M.

## 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 vapor retarder; 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 D1557](#).

<u>SOIL MATERIAL</u>	<u>PERCENT MAXIMUM DENSITY</u>
Capillary water barrier	100
Cohesionless soil material	100
Cohesive soil material	95

Finish surface of capillary water barrier under interior slabs on ground must not show deviation in excess of 1/4 inch when tested with a 10-foot straightedge parallel with and at right angles to building lines.

Finished surface of subgrade or fill under exterior slabs on ground must not be more than 0.02-foot above or 0.10-foot below elevation indicated.

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 **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 Reuse

Reuse forms providing the structural integrity of concrete and the aesthetics of exposed concrete are not compromised.

#### 3.3.5 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.

#### 3.3.6 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.

#### 3.3.7 Tolerances for Form Construction

Construct formwork to ensure that after removal of forms and prior to patching and finishing of formed surfaces, provide concrete surfaces in accordance with tolerances specified in [ACI/MCP-1](#) and [ACI/MCP-2](#).

#### 3.3.8 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.

#### 3.3.8.1 Special Requirements for Reduced Time Period

Forms may be removed earlier than specified if **ASTM C39/C39M** 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 FORMED SURFACES

#### 3.4.1 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.

#### 3.4.2 Tolerances

**ACI/MCP-4** and as indicated.

#### 3.4.3 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.

### 3.5 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.

#### 3.5.1 General

Provide details of reinforcement that are in accordance with **ACI/MCP-3** and **ACI/MCP-4** and as specified.

### 3.5.2 Vapor Retarder

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 . Remove torn, punctured, or damaged vapor retarder material and provide with new vapor retarder prior to placing concrete. Concrete placement must not damage vapor retarder material.

### 3.5.3 Reinforcement Supports

Place reinforcement and secure with galvanized or non corrodible chairs, spacers, or metal hangers. For supporting reinforcement on the ground, use concrete or other non corrodible material, having a compressive strength equal to or greater than the concrete being placed.

### 3.5.4 Splicing

As indicated. For splices not indicated ACI/MCP-2. Do not splice at points of maximum stress. Overlap welded wire fabric the spacing of the cross wires, plus 2 inches. Welded splices shall not be used.

### 3.5.5 Cover

ACI/MCP-2 for minimum coverage, unless otherwise indicated.

### 3.5.6 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.

### 3.5.7 Construction Joints

Locate joints to least impair strength. Continue reinforcement across joints unless otherwise indicated.

### 3.5.8 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.

### 3.5.9 Fabrication

Shop fabricate reinforcing bars to conform to shapes and dimensions indicated for reinforcement, and as follows:

Provide fabrication tolerances that are in accordance with ACI/MCP-1, ACI/MCP-2 and ACI/MCP-3.

Provide hooks and bends that are in accordance with ACI/MCP-3 and ACI/MCP-4.

Reinforcement must be bent cold to shapes as indicated. Bending must be done in the shop. Rebending of a reinforcing bar that has been bent incorrectly is not permitted. Bending must be in accordance with standard approved practice and by approved machine methods.

Tolerance on nominally square-cut, reinforcing bar ends must be in accordance with ACI/MCP-3.

Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

Do not use reinforcement that has any of the following defects:

- a. Bar lengths, depths, and bends beyond specified fabrication tolerances
- b. Bends or kinks not indicated on drawings or approved shop drawings
- c. Bars with reduced cross-section due to rusting or other cause

Replace defective reinforcement with new reinforcement having required shape, form, and cross-section area.

#### 3.5.10 Placing Reinforcement

Place reinforcement in accordance with ACI/MCP-3 and ACI/MCP-4.

For slabs on grade (over earth or over capillary water barrier) and for footing reinforcement, support bars or welded wire fabric on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

Contractor must cooperate with other trades in setting of anchor bolts, inserts, and other embedded items. Where conflicts occur between locating reinforcing and embedded items, the Contractor must notify the Contracting Officer so that conflicts may be reconciled before placing concrete. Anchors and embedded items must be positioned and supported with appropriate accessories.

Provide reinforcement that is supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

Provide supports for reinforcing bars that are sufficient in number and sufficiently heavy to carry the reinforcement they support, and in accordance with ACI/MCP-3, ACI/MCP-4 and CRSI 10MSP. Do not use supports to support runways for concrete conveying equipment and similar construction loads.

Equip supports on ground and similar surfaces with sand-plates.

Support welded wire fabric as required for reinforcing bars.

Secure reinforcements to supports by means of tie wire. Wire must be

black, soft iron wire, not less than 16 gage.

With the exception of temperature reinforcement, tied to main steel approximately 24 inches on center, reinforcement must be accurately placed, securely tied at intersections with 18-gage annealed wire, and held in position during placing of concrete by spacers, chairs, or other approved supports. Point wire-tie ends away from the form. Unless otherwise indicated, numbers, type, and spacing of supports must conform to ACI/MCP-3.

Bending of reinforcing bars partially embedded in concrete is permitted only as specified in ACI/MCP-3 and ACI/MCP-4.

#### 3.5.11 Spacing of Reinforcing Bars

Spacing must be as indicated. If not indicated, spacing must be in accordance with the ACI/MCP-3 and ACI/MCP-4.

Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If any reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement is subject to approval.

#### 3.5.12 Concrete Protection for Reinforcement

Concrete protection must be in accordance with the ACI/MCP-3 and ACI/MCP-4.

#### 3.5.13 Welding

Welding of reinforcing steel is not permitted.

### 3.6 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

ASTM C94/C94M, 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.

#### 3.6.1 Measuring

Make measurements at intervals as specified in paragraphs entitled "Sampling" and "Testing."

#### 3.6.2 Mixing

ASTM C94/C94M 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.

### 3.6.3 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.

## 3.7 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.

### 3.7.1 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 rettempered concrete is permitted. Remove rejected concrete from the site.

### 3.7.2 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.

### 3.7.3 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. Penetrate the previously placed lift with the vibrator when more than one lift is required. Use external vibrators on the exterior surface of the forms when internal vibrators do not provide adequate consolidation of the concrete.

#### 3.7.4 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.

#### 3.7.5 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.

#### 3.7.6 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.

#### 3.7.7 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.

#### 3.7.8 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.



### 3.7.9 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. Provide vibrating equipment adequate in number of units and power of each unit to properly consolidate concrete. 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.

### 3.7.10 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.

### 3.7.11 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.

### 3.8 SURFACE FINISHES EXCEPT FLOOR, SLAB, AND PAVEMENT FINISHES

#### 3.8.1 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.

#### 3.8.2 Formed Surfaces

##### 3.8.2.1 Tolerances

ACI/MCP-1 and as indicated.

##### 3.8.2.2 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.

##### 3.8.2.3 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.

### 3.9 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

ACI/MCP-2, unless otherwise specified. Where straightedge measurements are specified, Contractor must provide straightedge.

### 3.9.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater.

#### 3.9.1.1 Floated

Use for utility room floor slabs and 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.

#### 3.9.1.2 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.

### 3.9.2 Concrete Walks

Provide 4 inches thick minimum. Provide contraction joints spaced every 5 linear feet unless otherwise indicated. Cut contraction joints one inch deep with a jointing tool after the surface has been finished. Provide 0.5 inch thick transverse expansion joints at changes in direction where sidewalk abuts curb, steps, rigid pavement, or other similar structures; space expansion joints every 50 feet maximum. Give walks a broomed finish. Unless indicated otherwise, provide a transverse slope of 1/48. Limit variation in cross section to 1/4 inch in 5 feet.

### 3.9.3 Splash Blocks

Provide at outlets of downspouts emptying at grade. Splash blocks may be precast concrete, and must be 24 inches long, 12 inches wide and 4 inches thick, unless otherwise indicated, with smooth-finished countersunk dishes sloped to drain away from the building.

## 3.10 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.

### 3.10.1 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.

### 3.10.2 Moist Curing

Remove water without erosion or damage to the structure. Prevent water run-off.

#### 3.10.2.1 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.

#### 3.10.2.2 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.

#### 3.10.2.3 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.

#### 3.10.2.4 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.

### 3.10.3 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**.

#### 3.10.3.1 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.

#### 3.10.3.2 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.

#### 3.10.4 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.

#### 3.10.5 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.

### 3.10.6 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.

### 3.10.7 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 of finish flooring by moisture-retaining cover curing.

### 3.10.8 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.

### 3.10.9 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.

### 3.10.10 Protection After Curing

Protect finished concrete surfaces from damage by construction operations.

## 3.11 FIELD QUALITY CONTROL

### 3.11.1 Sampling

ASTM C172/C172M. Collect samples of fresh concrete to perform tests specified. ASTM C31/C31M for making test specimens.

### 3.11.2 Testing

#### 3.11.2.1 Slump Tests

ASTM C143/C143M. 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.

#### 3.11.2.2 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.

### 3.11.2.3 Compressive Strength Tests

**ASTM C39/C39M.** Make five test cylinders for each set of tests in accordance with **ASTM C31/C31M.** 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 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. 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 C42/C42M** 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.

### 3.11.2.4 Air Content

**ASTM C173/C173M** or **ASTM C231/C231M** for normal weight concrete . Test air-entrained concrete for air content at the same frequency as specified for slump tests.

### 3.11.2.5 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

### 3.11.2.6 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 C42/C42M**, and as follows:

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



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

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

Strength of cores from each member or area are considered satisfactory if their average is equal to or greater than 85 percent of the 28-day design compressive strength of the class of concrete.

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.

### 3.12 WASTE MANAGEMENT

As specified in the Waste Management Plan and as follows.

#### 3.12.1 Mixing Equipment

Before concrete pours, designate Company-owned site meeting environmental standards for cleaning out concrete mixing trucks. Minimize water used to wash equipment.

#### 3.12.2 Hardened, Cured Waste Concrete

Remove to designated location on base for recycling.

#### 3.12.3 Reinforcing Steel

Collect reinforcing steel and place in designated area for recycling.

### 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 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 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 or break every other bar before placing concrete.

### 3.13.3 Sealing Joints in Slabs on Ground

Control joints which are indicated 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

## 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 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.

## AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 530/530.1 (2011; Errata 2011) Building Code Requirements and Specification for Masonry Structures and Related Commentaries

ACI SP-66 (2004) ACI Detailing Manual

## ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M (2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

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 C1019 (2011) Standard Test Method for Sampling and Testing Grout

ASTM C1072 (2011) Standard Test Method for Measurement of Masonry Flexural Bond Strength

ASTM C1142 (1995; R 2007) Standard Specification for Extended Life Mortar for Unit Masonry

ASTM C144 (2011) Standard Specification for Aggregate for Masonry Mortar

ASTM C150/C150M (2011) Standard Specification for Portland Cement

ASTM C207 (2006; R 2011) Standard Specification for Hydrated Lime for Masonry Purposes

ASTM C216	(2011) Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C270	(2012) Standard Specification for Mortar for Unit Masonry
ASTM C476	(2010) Standard Specification for Grout for Masonry
ASTM C494/C494M	(2011) Standard Specification for Chemical Admixtures for Concrete
ASTM C55	(2011) Concrete Brick
ASTM C593	(2006; R 2011) Fly Ash and Other Pozzolans for Use with Lime for Soil Stabilization
ASTM C62	(2010) Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C641	(2009) Staining Materials in Lightweight Concrete Aggregates
ASTM C652	(2011) Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
ASTM C67	(2011) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C780	(2011) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C90	(2011b) Loadbearing Concrete Masonry Units
ASTM C91	(2005) Masonry Cement
ASTM C94/C94M	(2011b) Standard Specification for Ready-Mixed Concrete
ASTM C989/C989M	(2011) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM D1972	(1997; R 2005) Standard Practice for Generic Marking of Plastic Products
ASTM D2000	(2012) Standard Classification System for Rubber Products in Automotive Applications
ASTM D2240	(2005; R 2010) Standard Test Method for Rubber Property - Durometer Hardness
ASTM D2287	(2011) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

## 1.2 SYSTEM DESCRIPTION

### 1.2.1 Plastic Identification

Verify that plastic products to be incorporated into the project are labeled in accordance with ASTM D1972. Where products are not labeled, submit product data indicating polymeric information in the Operation and Maintenance Manual.

- a. Type 1: Polyethylene Terephthalate (PET, PETE).
- b. Type 2: High Density Polyethylene (HDPE).
- c. Type 3: Vinyl (Polyvinyl Chloride or PVC).
- d. Type 4: Low Density Polyethylene (LDPE).
- e. Type 5: Polypropylene (PP).
- f. Type 6: Polystyrene (PS).
- g. Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

### 1.2.2 Design Requirements

#### 1.2.2.1 Unit Strength Method

Compute compressive strength of masonry system "Unit Strength Method", ACI 530/530.1. Submit calculations and certifications of unit and mortar strength.

### 1.2.3 Additional Requirements

- a. Maintain at least one spare vibrator on site at all times.
- b. 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-02 Shop Drawings

Reinforcing Steel Drawings

#### SD-03 Product Data

Concrete Masonry Units (CMU)  
Clay or Shale Brick  
Cement  
Flashing  
Mortar Net  
Masonry Cleaning Agent and Cleaners

#### SD-04 Samples

Clay or Shale Brick  
Expansion-Joint Materials

SD-05 Design Data

Pre-mixed Mortar  
Unit Strength Method

SD-06 Test Reports

Efflorescence Test  
Field Testing of Grout  
Masonry Cement

SD-07 Certificates

Clay or Shale Brick  
Concrete Masonry Units (CMU)  
Anchors, Ties, and Bar Positioners  
Expansion-Joint Materials  
Joint Reinforcement  
Masonry Cement  
Admixtures for Masonry Mortar  
Admixtures for Grout

SD-08 Manufacturer's Instructions

Masonry Cement

1.4 QUALITY ASSURANCE

1.4.1 Appearance

Blend all brick to produce a uniform appearance when installed. An observable "banding" or "layering" of colors or textures caused by improperly mixed brick is unacceptable.

1.4.2 Contamination

When using bricks containing contaminated soil, supplier shall certify that the hazardous waste is neutralized by the manufacturing process and that no additional pollutants will be released, or that the product is free from hazardous contaminants.

1.4.3 Sample Masonry Panels

After material samples are approved and prior to starting masonry work, construct a portable panel of clay or shale brick and sample masonry panels for each type and color of masonry required. At least 48 hours prior to constructing the sample panel or panels, submit written notification to the Contracting Officer. Submit one panel of clay or shale brick, 2 by 2 feet, containing approximately 24 brick facings to establish range of color and texture. Sample panels shall not be built in, or as part of the structure, but shall be located where directed.

1.4.3.1 Configuration

Panels shall be L-shaped or otherwise configured to represent all of the

wall elements. Panels shall be of the size necessary to demonstrate the acceptable level of workmanship for each type of masonry represented on the project. The minimum size of a straight panel or a leg of an L-shaped panel shall be 8 feet long by 6 feet high.

#### 1.4.3.2 Composition

Panels shall show full color range, texture, and bond pattern of the masonry work. The Contractor's method for mortar joint tooling; grouting of reinforced vertical cores, collar joints, bond beams, and lintels; positioning, securing, and lapping of reinforcing steel; positioning and lapping of joint reinforcement (including prefabricated corners); and cleaning of masonry work shall be demonstrated during the construction of the panels. Installation or application procedures for anchors, wall ties, CMU control joints, brick expansion joints, insulation (if applicable), flashing, damp proofing brick soldier, row lock courses and weep holes and flashing shall be shown in the sample panels. The panels shall contain a masonry bonded corner that includes a bond beam corner. Panels shall show sample of wall penetrations. Panels that represent reinforced masonry shall contain a 2 by 2 foot opening placed at least 2 feet above the panel base and 2 feet away from all free edges, corners, and control joints. Required reinforcing shall be provided around this opening as well as at wall corners and control joints.

#### 1.4.3.3 Construction Method

Where anchored veneer walls are required, demonstrate and receive approval for the method of construction; i.e., either bring up the two wythes together or separately, with appropriate ties placed within the specified tolerances across the cavity. Temporary provisions shall be demonstrated to preclude mortar or grout droppings in the cavity and to provide a clear open air space of the dimensions shown on the drawings. Where masonry is to be grouted, demonstrate and receive approval on the method that will be used to bring up the masonry wythes; support the reinforcing bars; and grout cells, bond beams, lintels, and collar joints using the requirements specified herein. If sealer is specified to be applied to the masonry units, sealer shall be applied to the sample panels. Panels shall be built on a properly designed concrete foundation.

#### 1.4.3.4 Usage

The completed panels shall be used as the standard of workmanship for the type of masonry represented. Masonry work shall not commence until the sample panel for that type of masonry construction has been completed and approved. Panels shall be protected from the weather and construction operations until the masonry work has been completed and approved. After completion of the work, the sample panels, including all foundation concrete, shall become the property of the Contractor and shall be removed from the construction site.

#### 1.4.4 Reinforcing Steel Shop Drawings

Reinforcement bending details shall conform to the requirements of ACI SP-66. Submit drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; lintels; and wall openings.

### 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 C90](#). 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 be as indicated and shall conform to the approved sample. Brick shall conform to ASTM C62; Grade SW shall be used for brick in contact with earth or grade and for all exterior work and for all nonvertical surfaces. Grade SW or MW shall be used in other brickwork. Average dimensions of brick shall be 3-5/8 inches thick, 2-1/4 inches high, and 8 inches long modular subject to the tolerances specified in ASTM C62. Brick shall be tested for efflorescence. 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 C216, 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 8 inches long (nominal) Minimum compressive strength of the brick shall be 2500 psi. Match existing brick.

### 2.2.2 Hollow Clay or Shale Brick

Hollow clay or shale brick shall conform to ASTM C652, Type HBS. 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. Where vertical reinforcement is shown in hollow brick, the minimum cell dimension shall be 2-1/2 inches and the units shall be designed to provide precise vertical alignment of the cells. Minimum compressive strength of the brick shall be 2500 psi Match existing brick.

## 2.3 CONCRETE BRICK

Concrete brick shall conform to ASTM C55, Grade N. Concrete brick may be used where necessary for filling out in concrete masonry unit construction. Submit samples as specified.

## 2.4 CONCRETE MASONRY UNITS (CMU)

Submit samples and certificates as specified. 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 C90, made with lightweight, medium weight or normal weight aggregate. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls.

### 2.4.1 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 C641](#): 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 C989/C989M](#); Grade 80.

#### 2.4.2 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 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.

#### 2.5 MORTAR FOR STRUCTURAL MASONRY

[ASTM C270](#), Type M or S. Strength (f'm) as indicated. Test in accordance with [ASTM C780](#). Use Type I, II or III portland cement. Use Type IS, IP, or I(PM) blended hydraulic cement. At Contractor's option, use Masonry 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 C593](#).

#### 2.6 MASONRY MORTAR

Mortar Type S shall conform to the proportion specification of [ASTM C270](#) except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate; Type N or S mortar shall be used for non-load-bearing, non-shear-wall interior masonry; and Type S for remaining masonry work; except where higher compressive strength is indicated on structural drawings. When masonry cement [ASTM C91](#) 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 C780](#) and [ASTM C1072](#). Pointing mortar in showers and kitchens shall contain ammonium stearate, or aluminum tri-stearate, or calcium stearate in an amount equal to 3 percent by weight of cement used. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

##### 2.6.1 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 C494/C494M](#), Type C. Submit the required certifications.

##### 2.6.2 Colored Mortar

Mortar coloring shall be added to the mortar used for exposed masonry surfaces to produce a uniform color matching existing brick. Quantity of pigment to cementitious content of the masonry cement shall not exceed 5 by weight; carbon black shall not exceed 1 percent by weight. Quantity of pigment to cementitious content of cement-lime mix shall not exceed 10

percent by weight, carbon black no more than 2 percent by weight. Mortar coloring shall be chemically inert, of finely ground limeproof pigment, and furnished in accurately pre-measured and packaged units that can be added to a measured amount of cement. Compressive strength of colored mortar shall equal 1800 psi.

### 2.6.3 Hydrated Lime and Alternates

Hydrated lime shall conform to [ASTM C207](#), Type S.

### 2.6.4 Cement

Portland cement shall conform to [ASTM C150/C150M](#), Type I, II, or III. [Masonry cement](#) shall conform to [ASTM C91](#), 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.

### 2.6.5 Pre-Mixed Mortar

Pre-mixed mortar shall conform to [ASTM C1142](#), Type RS. Submit pre-mixed mortar composition.

### 2.6.6 Sand and Water

Sand shall conform to [ASTM C144](#). Water shall be clean, potable, and free from substances which could adversely affect the mortar.

## 2.7 WATER-REPELLANT ADMIXTURE

Polymeric type formulated to reduce porosity and water penetration and water absorption of the mortar and masonry units required to provide for the exterior single-wythe masonry wall water penetration resistance indicated in Paragraph SINGLE-WYTHE MASONRY WALL WATER PENETRATION TEST.

## 2.8 GROUT AND READY-MIXED GROUT

Grout shall conform to [ASTM C476](#), fine or coarse. 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 C1019](#). 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 C94/C94M](#).

### 2.8.1 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 C494/C494M](#), 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.

### 2.8.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

## 2.9 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.

### 2.9.1 Wire Mesh Ties

Wire mesh for tying  $4$  inch thick concrete masonry unit partitions to other intersecting masonry partitions shall be  $1/2$  inch mesh of minimum  $16$  gauge steel wire. Minimum lengths shall be not less than  $12$  inches.

### 2.9.2 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.

### 2.9.3 Dovetail Anchors

Provide dovetail anchors of the flexible wire type,  $3/16$  inch diameter zinc-coated steel wire, triangular shaped, and attached to a  $12$  gauge or heavier steel dovetail section. Use these anchors for anchorage of veneer wythes or composite-wall facings extending over the face of concrete columns, beams, or walls. Fill cells within vertical planes of these anchors solid with grout for full height of walls or partitions, or solid units may be used. Dovetail slots are specified in Section [03 30 00](#) CAST-IN-PLACE CONCRETE.

### 2.9.4 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.

#### 2.9.5 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.

#### 2.10 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.

#### 2.11 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to [ASTM A615/A615M](#), Grade 60.

#### 2.12 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to [ASTM D2000](#) or polyvinyl chloride conforming to [ASTM D2287](#). 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 D2240](#).

#### 2.13 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.

#### 2.14 THROUGH WALL FLASHING

Provide Through Wall Flashing as indicated below. Provide the following types except that the material shall be one which is not adversely affected by dampproofing material.

- a. Reinforced Membrane Flashing: Flexible Polyester film core with a reinforcing fiberglass scrim bonded to one side and self adhering. The membrane shall be impervious to moisture, flexible, and not affected by

caustic alkalis. The material, after being exposed for not less than 1/2 hour to a temperature of 32 degrees F, shall show no cracking when, at that temperature, it is bent 180 degrees over a 1/16 inch diameter mandrel and then bent at the same point over the same size mandrel in the opposite direction 360 degrees.

#### 2.15 WEEP HOLE VENTILATORS

Weep hole ventilators shall be prefabricated aluminum or plastic or wood blocking sized to form the proper size opening in head joints. Provide aluminum and plastic inserts with grill or screen-type openings designed to allow the passage of moisture from cavities and to prevent the entrance of insects. Ventilators shall be sized to match modular construction with a standard 3/8 inch mortar joint.

#### 2.16 MORTAR NET

Provide open weave polyester mesh (dovetail shape) drainage system.

### 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 all mortar and mortar smears 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. Install mortar net per written manufacturers written installation instructions. 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. Provide solid units at all lintels.



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 C67. 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 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. 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. or as indicated wherever the cavity is interrupted and at base of wall and vertical obstructions (e.g. lintels). Cavity face of interior wythe shall be dampproofed in accordance with Section 07 11 13 BITUMINOUS DAMPPROOFING.

3.2.4.5 Brick Veneer

Provide a continuous cavity as indicated. Install brick veneer after masonry anchors, and flashing have been installed. Care shall be provided to avoid damaging the dampproofing. Means shall be provided to keep cavities clean and clear of mortar droppings.

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	
In adjacent masonry units	1/8 inch
In 10 feet	1/4 inch

TABLE II TOLERANCES	
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
Variations from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines	
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	
In 10 feet	1/4 inch
In 40 feet or more	1/2 inch
Variations from horizontal lines	
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	
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, except for prefaced concrete masonry units.

#### 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. Tothing 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.

### 3.3 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. A 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 at head joints at 24 inches o.c. or as indicated. Weep holes shall be provided not more than 24 inches or as indicated 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 constructed using weep hole ventilators. Other approved methods may be used for providing weep holes. 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 facing to concrete backing with wire dovetail anchors set in slots built in the face of the concrete as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE. 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 Horizontal Grout Barriers

Embed grout barriers in mortar below cells of hollow units receiving grout where indicated.

### 3.9.2 Grout Holes and Cleanouts

#### 3.9.2.1 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.

#### 3.9.2.2 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.

### 3.9.3 Grouting Equipment

#### 3.9.3.1 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.

#### 3.9.3.2 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.

### 3.9.4 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.

#### 3.9.4.1 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.

#### 3.9.4.2 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

			Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells in inches (1,2)	
Maximum Grout Pour Height feet (4)	Grout Type	Grouting Procedure	Multiwythe Masonry (3)	Hollow-unit 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 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. Exposed interior control joints shall be raked to a depth of 1/4 inch and sealed. 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.

### 3.14 SILLS

Sills shall be set in a full bed of mortar with faces plumb and true.

### 3.15 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

#### 3.15.1 Anchorage to Concrete

Anchorage of masonry to the face of concrete columns, beams, or walls shall be with dovetail anchors spaced not over 16 inches on centers vertically and 24 inches on center horizontally.

### 3.16 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, completely remove mortar, mortar smears 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 fully 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.

### 3.16.1 Dry-Brushing

- a. Exposed concrete masonry unit
- b. Exposed concrete brick surfaces
- c. shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

### 3.16.2 Clay or Shale Brick Surfaces

Clean exposed clay or shale brick masonry surfaces as necessary to obtain surfaces free of stain, dirt, mortar, mortar smears 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.

### 3.17 BEARING PLATES

Set bearing plates for beams, joists, joist girders and similar structural members to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Bedding mortar and non-shrink grout shall be as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

### 3.18 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.

### 3.19 WASTE MANAGEMENT

Manage waste according to the Waste Management Plan and as follows. Minimize water used to wash mixing equipment. Use trigger operated spray nozzles for water hoses.

### 3.19.1 Separate and Recycle Waste

Place materials defined as hazardous or toxic waste in designated containers. Fold up metal banding, flatten, and place in designated area for recycling. Collect wood packing shims and pallets and place in designated area. Separate masonry waste and place in designated area for use as structural fill. Separate selected masonry waste and excess for landscape uses, either whole or crushed as ground cover.

### 3.20 TEST REPORTS

#### 3.20.1 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of **ASTM C1019**. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of **2000 psi** at 28 days. Submit test results.

#### 3.20.2 Efflorescence Test

Test brick, which will be exposed to weathering, for efflorescence. Schedule tests far enough in advance of starting masonry work to permit retesting if necessary. Sampling and testing shall conform to the applicable provisions of **ASTM C67**. Units meeting the definition of "effloresced" will be subject to rejection. Submit test results.

-- End of Section --



## SECTION 05 30 00

## STEEL DECKS

11/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI D100 (1991; R 2008) Cold-Formed Steel Design Manual

AISI SG03-3 (2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2010; Errata 2010) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M (2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened

ASTM A123/A123M (2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A36/A36M (2008) Standard Specification for Carbon Structural Steel

ASTM A653/A653M (2011) 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 A792/A792M (2010) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

STEEL DECK INSTITUTE (SDI)

- SDI 31 (2007) Design Manual for Composite Decks, Form Decks, and Roof Decks
- SDI DDMO3 (2004; Errata 2006; Add 2006) Diaphragm Design Manual; 3rd Edition
- SDI DDP (1987; R 2000) Deck Damage and Penetrations
- SDI MOC2 (2006) Manual of Construction with Steel Deck

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

- SSPC Paint 20 (2002; E 2004) Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic)

1.2 SUBMITTALS

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

SD-02 Shop Drawings

- Fabrication Drawings
- Ridge and Valley Plates
- Metal Closure Strips

SD-03 Product Data

- Accessories
- Deck Units
- Galvanizing Repair Paint
- Joint Sealant Material

SD-04 Samples

- Accessories

SD-05 Design Data

- Deck Units

Submit manufacturer's design calculations, or applicable published literature for the structural properties of the proposed deck units.

1.3 QUALITY ASSURANCE

1.3.1 Deck Units

Furnish deck units and accessory products from a manufacturer regularly engaged in manufacture of steel decking.

### 1.3.2 Qualifications for Welding Work

Follows Welding Procedures in accordance with [AWS D1.1/D1.1M](#).

### 1.3.3 Fabrication Drawings

Show type and location of units, location and sequence of connections, bearing on supports, methods of anchoring, attachment of accessories, adjusting plate details, size and location of holes to be cut and reinforcement to be provided, the manufacturer's erection instructions and other pertinent details.

## 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver deck units to the site in a dry and undamaged condition. Store and handle steel deck in a manner to protect it from corrosion, deformation, and other types of damage. Do not use decking for storage or as working platform until units have been fastened into position. Exercise care not to damage material or overload decking during construction. The maximum uniform distributed storage load must not exceed the design live load. Stack decking on platforms or pallets and cover with weathertight ventilated covering. Elevate one end during storage to provide drainage. Maintain deck finish at all times to prevent formation of rust. Repair deck finish using touch-up paint. Replace damaged material.

## 1.5 DESIGN REQUIREMENTS FOR ROOF DECKS

### 1.5.1 Properties of Sections

Properties of metal roof deck sections must comply with engineering design width as limited by the provisions of [AISI D100](#).

### 1.5.2 Allowable Loads

Indicate total uniform dead and live load for detailing purposes.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Steel Sheet

Flat rolled carbon steel sheets of structural quality, thickness not less than indicated meeting the requirements of [AISI SG03-3](#), except as modified herein.

#### 2.1.2 Steel Coating

[ASTM A653/A653M](#) designation [G90](#) galvanized, . Apply coating to both sides of sheet.

#### 2.1.3 Galvanized Steel Angles for Roof Decks

Provide hot-rolled carbon steel angles conforming to [ASTM A36/A36M](#), merchant quality, Grade Designation SAE/AISI 1023 or SAE/AISI 1025, and hot-dip galvanized in accordance with [ASTM A123/A123M](#).

#### 2.1.4 Joint Sealant Material for Roof Decks

Provide a nonskinning, gun-grade, bulk compound material as recommended by the manufacturer.

#### 2.1.5 Galvanizing Repair Paint for Roof Decks

Provide a high zinc-dust content paint for regalvanizing welds in galvanized steel and shall conform to ASTM A780/A780M.

### 2.2 ACCESSORIES

Provide accessories of same material as deck, unless specified otherwise. Provide manufacturer's standard type accessories, as specified.

#### 2.2.1 Sheet Metal Collar

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

#### 2.2.2 Cover Plates

Sheet metal to close panel edge and end conditions, and where panels change direction or butt. Polyethylene-coated, self-adhesive, 2 inch wide joint tape may be provided in lieu of cover plates on flat-surfaced decking butt joints.

#### 2.2.3 Access Hole Covers

Sheet metal, minimum 0.0474 inch thick.

#### 2.2.4 Miscellaneous Accessories

Furnish the manufacturer's standard accessories to complete the deck installation. Furnish metal accessories of the same material as the deck and with the minimum design thickness to match the deck except for welding washers, 0.0598 inch.

### 2.3 FABRICATION

#### 2.3.1 Deck Units

#### 2.3.2 Roof Deck

Conform to ASTM A792/A792M or ASTM A1008/A1008M for deck used in conjunction with insulation. Fabricate roof deck units of the steel design thickness required by the design drawings and zinc-coated in conformance with ASTM A653/A653M, G90 coating class..

#### 2.3.2.1 Ridge and Valley Plates for Roof Decks

Fabricate plates from the specified structural-quality steel sheets, not less than nominal thickness of the decking before galvanizing. Provide plates of minimum 4-1/2 inch wide and bent to provide tight fitting closures at ridges and valleys. Provide a minimum length of ridge and valley plates of 10 feet.



#### 2.3.2.2 Metal Closure Strips for Roof Decks

Fabricate strips from the specified commercial-quality steel sheets not less than nominal 0.0359 inch thick before galvanizing. Provide strips from the configuration required to provide tight-fitting closures at open ends and sides of steel roof decking.

#### 2.3.3 Touch-Up Paint

Provide touch-up paint for zinc-coated units of an approved galvanizing repair paint with a high-zinc dust content. Touch-up welds with paint conforming to SSPC Paint 20 in accordance with ASTM A780/A780M. Maintain finish of deck units and accessories by using touch-up paint whenever necessary to prevent the formation of rust.

After roof decking installation, wire brush, clean, and touchup paint the scarred areas on top and bottom surfaces of metal roof decking. The scarred areas include welds, weld scars, bruises, and rust spots. Touchup galvanized surfaces with galvanizing repair paint.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Prior to installation of decking units and accessories, examine worksite to verify that as-built structure will permit installation of decking system without modification.

#### 3.2 INSTALLATION

Install steel deck units in accordance with SDI 31, SDI DDMO3 and approved shop drawings. Place units on structural supports, properly adjusted, leveled, and aligned at right angles to supports before permanently securing in place. Damaged deck and accessories including material which is permanently stained or contaminated, deformed, or with burned holes shall not be installed. Extend deck units over three or more supports unless absolutely impractical. Report inaccuracies in alignment or leveling to the Contracting Officer and make necessary corrections before permanently anchoring deck units. Locate deck ends over supports only. Do not use unanchored deck units as a work or storage platform. Permanently anchor units placed by the end of each working day. Do not support suspended ceilings, light fixtures, ducts, utilities, or other loads by steel deck unless indicated. Distribute loads by appropriate means to prevent damage.

##### 3.2.1 Attachment

Immediately after placement and alignment, and after correcting inaccuracies, permanently fasten steel deck units to structural supports and to adjacent deck units by or fastened with screws as indicated on the design drawings and in accordance with manufacturer's recommended procedure and SDI 31. Use screws for attachment of deck to cold formed metal framing or trusses. Clamp or weight deck units to provide firm contact between deck units and structural supports while performing fastening. Attachment of adjacent deck units by button-punching is prohibited.

##### 3.2.1.1 Fastening

Anchor deck to structural supports and adjoining units with mechanical

fasteners as listed by the Steel Deck Institute, the fastener and steel deck manufacturers, and approved by the Contracting Officer. Drive pneumatically fasteners with a low-velocity fastening tool and comply with the manufacturer's recommendations.

### 3.2.2 Openings

Cut or drill all holes and openings required and be coordinated with the drawings, specifications, and other trades. Frame and reinforce openings through the deck in conformance with **SDI DDP**. Reinforce holes and openings **6 to 12 inch** across by **0.0474 inch** thick steel sheet at least **12 inch** wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of **6 inch** on center. Reinforce holes and openings larger than **12 inch** by steel channels or angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Install steel channels or angles perpendicular to the deck ribs and fasten to the channels or angles perpendicular to the steel joists.

### 3.2.3 Deck Damage

**SDI MOC2**, for repair of deck damage.

### 3.2.4 Accessory Installation

#### 3.2.4.1 Access Hole Covers

Provide to seal holes cut in decking to facilitate welding of decking to structural supports.

### 3.3 JOINT SEALING FOR ROOF DECKS

Seal sidelaps and endlaps with manufacturer's recommended joint sealing material. Shop or field apply the material. Before applying the sealing material, completely remove dust, dirt, moisture, and other foreign material from the surfaces to which the sealing material is to be applied. Apply sealing material in strict accordance with the sealing material manufacturer's printed instructions.

### 3.4 RIDGE AND VALLEY PLATES FOR ROOF DECKS

Provide plates to be fusion welded to top surface of roof decking. Lap end joints a minimum **3 inch**. For valley plates, provide endlaps to be in the direction of water flow.

### 3.5 ROOF INSULATION SUPPORT FOR ROOF DECKS

Provide metal closure strips for support of roof insulation where rib openings in top surface of metal roof decking occur adjacent to edges and openings. Weld metal closure strips in position.

### 3.6 CLEANING AND PROTECTION FOR ROOF DECKS

Upon completion of the deck, sweep surfaces clean and prepare for installation of the roofing.

### 3.7 FIELD QUALITY CONTROL

#### 3.7.1 Decks Not Receiving Concrete

Inspect the decking top surface for distortion after installation. For roof decks not receiving concrete, verify distortion by placing a straight edge across three adjacent top flanges. The maximum allowable gap between the straight edge and the top flanges is  $1/16$  inch; when gap is more than  $1/16$  inch, provide corrective measures or replacement. Reinspect decking after performing corrective measures or replacement.

-- End of Section --



## SECTION 05 40 00

## COLD-FORMED METAL TRUSSES AND FRAMING

## 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.

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG02-KIT (2001; Supp 1 2004) North American Specification for the Design of Cold-Formed Steel Structural Members

AISI SG03-3 (2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.3/D1.3M (2008; Errata 2008) Structural Welding Code - Sheet Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2009) 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 A653/A653M (2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM C1513 (2010) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections

ASTM C955 (2011c) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases

## 1.2 SUBMITTALS

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

## SD-02 Shop Drawings

### Truss and Framing Components

a. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.

b. Connection details showing fastener type, quantity, location, and other information to assure proper installation.

## SD-03 Product Data

Steel joists, bracing, bridging, truss components and accessories

## SD-05 Design Data

Metal truss and framing calculations

### 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to job site and store in adequately ventilated, dry locations. Storage area shall permit easy access for inspection and handling. If necessary to store materials outside, stack off the ground, support on a level platform, and protect from the weather as approved. Handle materials to prevent damage. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content, galvanizing repair paint whenever necessary to prevent the formation of rust. Replace damaged items with new, as directed by the Contracting Officer.

### 1.4 LOAD-BEARING COLD-FORMED METAL FRAMING

Include bracing, fastenings, and other accessories necessary for complete installation. Framing members shall have the structural properties indicated. Where physical structural properties are not indicated, they shall be as necessary to withstand all imposed loads. Design framing in accordance with [AISI SG03-3](#).

### 1.5 MAXIMUM DEFLECTION

a. Roof Trusses and Rafters:

L/240 - Live load only

### 1.6 QUALITY ASSURANCE

#### 1.6.1 Drawing Requirements

Submit truss and framing components to show sizes, thicknesses, layout, material designations, methods of installation, and accessories.

#### 1.6.2 Design Data Required

Submit metal truss and framing calculations to verify sizes, gages, and spacing of members and connections. Show methods and practices used in installation.

## PART 2 PRODUCTS

## 2.1 STEEL STUDS, JOISTS, TRACKS, BRACING, BRIDGING AND ACCESSORIES

Framing components shall comply with [ASTM C955](#) and the following.

## 2.1.1 Joists and truss components of 16 Gage (0.0598 Inch) and Heavier

Galvanized steel, [ASTM A653/A653M](#), SS Grade 50, G90.

## 2.1.2 Joists and truss components of 18 Gage (0.0478 Inch) and Lighter and accessories (all gages).

Galvanized steel, [ASTM A653/A653M](#), SS, Grade 50 33,000 psi G60.

## 2.1.3 Sizes, Gages, Section Modulus, and Other Structural Properties

Size and gage as required to meet load and deflection requirements..

## 2.2 MARKINGS

Joists and truss compounds shall have product markings stamped on the web of the section. The markings shall be repeated throughout the length of the member at a maximum spacing of 4 feet on center and shall be legible and easily read. The product marking shall include the following:

- a. An ICC number.
- b. Manufacturer's identification.
- c. Minimum delivered uncoated steel thickness.
- d. Protective coating designator.
- e. Minimum yield strength.

## 2.3 CONNECTIONS

Screws for steel-to-steel connections shall be self-drilling, tapping screws in compliance with [ASTM C1513](#) of the type, size and location as shown on the drawings. Screws, bolts, and anchors shall be hot-dipped galvanized in accordance with [ASTM A123/A123M](#) or [ASTM A153/A153M](#) as appropriate.

## PART 3 EXECUTION

## 3.1 FASTENING

Fasten framing members together by welding or by using self-drilling or self-tapping screws. Electrodes and screw connections shall be as required and indicated in the design calculations.

## 3.1.1 Welds

All welding shall be performed in accordance with [AWS D1.3/D1.3M](#), as modified by [AISI SG02-KIT](#). All welders, welding operations, and welding procedures shall be qualified according to [AWS D1.3/D1.3M](#). All welds shall be cleaned and coated with rust inhibitive galvanizing paint. Do not field weld materials lighter than 18 gage.

3.1.2 Screws

Screws shall be self-drilling self-tapping type. Screw penetration through joined materials shall not be less than three exposed threads. Minimum spacings and edge distances for screws shall be as specified in AISI SG02-KIT. Screws covered by sheathing materials shall have low profile heads.

3.1.3 Anchors

Anchors shall be of the type, size, and location shown on the drawings.

3.2 INSTALLATION

3.2.1 Joists and Trusses

Joists shall have at least 2.50 inches of bearing on steel or as indicated on drawings, 4 inches on masonry or as indicated on drawings, and shall be reinforced over bearings where required to prevent web crippling. Splice joists over bearings only. Lap and weld splices as indicated. Provide manufacturer's standard bridging which shall not be less than the following:

<u>CLEAR SPAN</u>	<u>BRIDGING</u>
Up to 14 feet	One row near center
14 to 20 feet	Two rows at 1/3 points
20 to 26 feet	Three rows at 1/4 points
26 to 32 feet	Four rows at 1/5 points

Temporary bracing shall be provided and remain in place until work is permanently stabilized.

3.2.2 Erection Tolerances

a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:

- (1) Layout of walls and partitions: 1/4 inch from intended position;
- (2) Plates and runners: 1/4 inch in 8 feet from a straight line;
- (3) Face of framing members: 1/4 inch in 8 feet from a true plane.

-- 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.

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303 (2010) 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; Errata 2010) Structural Welding Code - Steel

## ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2010) 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 B18.2.2 (2010) Standard for Square and Hex Nuts

ASME B18.6.2 (1998; R 2010) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws: Inch Series

ASME B18.6.3 (2010) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)

## ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2009) 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 A307 (2010) Standard Specification for Carbon

	Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A653/A653M	(2011) 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 A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM C1513	(2010) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
ASTM D1187/D1187M	(1997; R 2011e1) Asphalt-Base Emulsions for Use as Protective Coatings for Metal

MASTER PAINTERS INSTITUTE (MPI)

MPI 79	(Oct 2009) Alkyd Anti-Corrosive Metal Primer
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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

Embedded [angles and plates](#), installation drawings

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in [AISC 303](#).

## 1.3 QUALIFICATION OF WELDERS

Qualify welders in accordance with [AWS D1.1/D1.1M](#). Use procedures, materials, and equipment of the type required for the work.

## 1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

## PART 2 PRODUCTS

## 2.1 MATERIALS

## 2.1.1 Structural Carbon Steel

ASTM A36/A36M.

## 2.1.2 Anchor Bolts

ASTM A307. Where exposed, shall be of the same material, color, and finish as the metal to which applied.

## 2.1.2.1 Expansion Anchors and Adhesive Anchors

Provide anchors of indicated size and embedment.

## 2.1.2.2 Lag Screws and Bolts

ASME B18.2.1, type and grade best suited for the purpose.

## 2.1.2.3 Toggle Bolts

ASME B18.2.1.

## 2.1.2.4 Bolts, Nuts, Studs and Rivets

ASME B18.2.2 or ASTM A307.

## 2.1.2.5 Powder Actuated Fasteners

Follow safety provisions of ASSE/SAFE A10.3.

## 2.1.2.6 Screws

ASME B18.2.1, ASME B18.6.2, ASME B18.6.3 and ASTM C1513.

## 2.1.2.7 Washers

Provide plain washers to conform to ASME B18.21.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers to conform to ASME B18.21.1.

## 2.2 FABRICATION FINISHES

## 2.2.1 Galvanizing

Hot-dip galvanize items to be exposed to the weather and other specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, G90, as applicable.

## 2.2.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

### 2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to [ASTM A780/A780M](#) or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

### 2.2.4 Shop Cleaning and Painting

#### 2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with [SSPC SP 6/NACE No.3](#). Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with [SSPC SP 3](#) in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete shall be free of dirt and grease. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints, but coat with rust preventative applied in the shop.

#### 2.2.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions. On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of [1.0 mil](#). Tint additional prime coat with a small amount of tinting pigment.

### 2.3 MISCELLANEOUS PLATES AND SHAPES

Provide for items that do not form a part of the structural steel framework, such as lintels, sill angles, support framing for ceiling-mounted toilet partitions, miscellaneous mountings and frames. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as indicated to support wall loads over openings. Provide with indicated connections. Construct to have at least [8 inches](#) bearing on masonry at each end.

Provide [angles and plates](#), [ASTM A36/A36M](#), for embedment as indicated. Galvanize embedded items exposed to the elements according to [ASTM A123/A123M](#).

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners shall be cause for rejection. Conceal fastenings where practicable. Thickness of metal

and details of assembly and supports shall provide strength and stiffness. Form joints exposed to the weather shall be formed to exclude water. Items listed below require additional procedures.

### 3.2 WORKMANSHIP

Provide miscellaneous metalwork that is well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections of work in place and ground smooth. Provide a smooth finish on exposed surfaces of work in place and unless otherwise approved, flush exposed riveting. Mill joints where tight fits are required. Corner joints shall be coped or mitered, well formed, and in true alignment. Accurately set work to established lines and elevations and securely fastened in place. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

### 3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

### 3.4 BUILT-IN WORK

Form for anchorage metal work built-in with concrete or masonry, or provide with suitable anchoring devices as indicated or as required. Furnish metal work in ample time for securing in place as the work progresses.

### 3.5 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with [AWS D1.1/D1.1M](#). Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

### 3.6 FINISHES

#### 3.6.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to [MPI 79](#) to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with [ASTM D1187/D1187M](#), asphalt-base emulsion.

#### 3.6.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, shall be free of rust, grease, dirt and other foreign matter.

3.6.3 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

-- End of Section --

## SECTION 06 10 00

## ROUGH 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 FOREST &amp; PAPER ASSOCIATION (AF&amp;PA)

- AF&PA T10 (2001) Wood Frame Construction Manual for One- and Two-Family Dwellings
- AF&PA T101 (2005) National Design Specification (NDS) for Wood Construction

## AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

- ALSC PS 20 (2010) American Softwood Lumber Standard

## AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

- AWPA BOOK (2009) AWPA Book of Standards
- AWPA M2 (2007) Standard for Inspection of Treated Wood Products
- AWPA M6 (2007) Brands Used on Forest Products
- AWPA P18 (2007) Nonpressure Preservatives
- AWPA P5 (2009) Standard for Waterborne Preservatives

## APA - THE ENGINEERED WOOD ASSOCIATION (APA)

- APA E445 (2002) Performance Standards and Qualification Policy for Structural-Use Panels (APA PRP-108)
- APA F405 (1999) Performance Rated Panels
- APA L870 (2010) Voluntary Product Standard, PS 1-09, Structural Plywood
- APA S350 (2011) Performance Standard for Wood-Based Structural-Use Panels

## ASME INTERNATIONAL (ASME)

- ASME B18.2.1 (2010) Square and Hex Bolts and Screws  
(Inch Series)
- ASME B18.2.2 (2010) Standard for Square and Hex Nuts
- ASME B18.5.2.1M (2006; R 2011) Metric Round Head Short  
Square Neck Bolts
- ASME B18.5.2.2M (1982; R 2010) Metric Round Head Square  
Neck Bolts
- ASME B18.6.1 (1981; R 2008) Wood Screws (Inch Series)

## ASTM INTERNATIONAL (ASTM)

- ASTM A153/A153M (2009) Standard Specification for Zinc  
Coating (Hot-Dip) on Iron and Steel  
Hardware
- ASTM A307 (2010) Standard Specification for Carbon  
Steel Bolts and Studs, 60 000 PSI Tensile  
Strength
- ASTM F1667 (2011) Driven Fasteners: Nails, Spikes,  
and Staples
- ASTM F547 (2006) Nails for Use with Wood and  
Wood-Base Materials

## INTERNATIONAL CODE COUNCIL (ICC)

- ICC IBC (2009; Errata First Printing)  
International Building Code

## NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

- NHLA Rules (2007) Rules for the Measurement &  
Inspection of Hardwood & Cypress

## NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

- NELMA Grading Rules (2006) Standard Grading Rules for  
Northeastern Lumber

REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD  
ASSOCIATION (CRA)

- RIS Grade Use (1998) Redwood Lumber Grades and Uses

## SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

- SCMA Spec (1986; Supple. No. 1, Aug 1993) Standard  
Specifications for Grades of Southern  
Cypress



SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003 (2002) Standard Grading Rules for Southern Pine Lumber

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1923 (Rev A; Notice 2) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)

CID A-A-1924 (Rev A; Notice 2) Shield, Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors)

CID A-A-1925 (Rev A; Notice 2) Shield Expansion (Nail Anchors)

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED NC (2009) Leadership in Energy and Environmental Design(tm) New Construction Rating System

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17 (2000) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5 (1998) Western Lumber Grading Rules

1.2 SUBMITTALS

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

SD-03 Product Data

Adhesives; (LEED NC)

Submit manufacturer's product data, indicating VOC content.

SD-06 Test Reports

Preservative-treated lumber

1.3 DELIVERY AND STORAGE

Deliver materials to the site in an undamaged condition. Store, protect, handle, and install prefabricated structural elements in accordance with manufacturer's instructions and as specified. Store materials off the ground to provide proper ventilation, with drainage to avoid standing water, and protection against ground moisture and dampness. Store materials with a moisture barrier at both the ground level and as a cover forming a well ventilated enclosure. Adhere to requirements for stacking, lifting, bracing, cutting, notching, and special fastening requirements. Remove defective and damaged materials and provide new materials. Store separated reusable wood waste convenient to cutting

station and area of work.

#### 1.4 GRADING AND MARKING

##### 1.4.1 Lumber

Mark each piece of framing and board lumber or each bundle of small pieces of lumber with the grade mark of a recognized association or independent inspection agency. Such association or agency shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Surfaces that are to be exposed to view shall not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

##### 1.4.2 Plywood

Mark each sheet with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark shall identify the plywood by species group or span rating, exposure durability classification, grade, and compliance with [APA L870](#). Surfaces that are to be exposed to view shall not bear grademarks or other types of identifying marks.

##### 1.4.3 [Preservative-Treated](#) Lumber and Plywood

The Contractor shall be responsible for the quality of treated wood products. Each treated piece shall be inspected in accordance with [AWPA M2](#) and permanently marked or branded, by the producer, in accordance with [AWPA M6](#). The Contractor shall provide Contracting Officer's Representative (COR) with the inspection report of an approved independent inspection agency that offered products comply with applicable AWPA Standards. The appropriate Quality Mark on each piece will be accepted, in lieu of inspection reports, as evidence of compliance with applicable AWPA treatment standards.

#### 1.5 SIZES AND SURFACING

[ALSC PS 20](#) for dressed sizes of yard and structural lumber. Lumber shall be surfaced four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced. Other measurements are IP or SI standard.

#### 1.6 MOISTURE CONTENT

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products shall be as follows at the time of delivery to the job site:

- a. Framing lumber and board, 19 percent maximum
- b. Timbers [5 inches](#) and thicker, 25 percent maximum
- c. Materials other than lumber; moisture content shall be in accordance with standard under which the product is produced

#### 1.7 PRESERVATIVE TREATMENT

Treat [wood products with waterborne wood preservatives conforming to AWPA P5](#).

Pressure treatment of wood products shall conform to the requirements of **AWPA BOOK** Use Category System Standards U1 and T1. Pressure-treated wood products shall not contain arsenic, chromium, or other agents classified as carcinogenic, probably carcinogenic, or possibly carcinogenic to humans (compounds in Groups 1, 2A, or 2B) by the International Agency for Research on Cancer (IARC), Lyon, France. Pressure-treated wood products shall not exceed the limits of the U.S. EPA's Toxic Characteristic Leaching Procedure (TCLP), and shall not be classified as hazardous waste. Submit certification from treating plant stating chemicals and process used and net amount of preservatives retained are in conformance with specified standards.

- a. 0.25 pcf intended for above ground use.
- b. 0.40 pcf intended for ground contact and fresh water use. 0.60 pcf intended for Ammoniacal Copper Quaternary Compound (ACQ)-treated foundations. 0.80 to 1.00 pcf intended for ACQ-treated pilings. All wood shall be air or kiln dried after treatment. Specific treatments shall be verified by the report of an approved independent inspection agency, or the AWPA Quality Mark on each piece. Minimize cutting and avoid breathing sawdust. Brush coat areas that are cut or drilled after treatment with either the same preservative used in the treatment or with a 2 percent copper naphthenate solution. All lumber and woodwork shall be preservative treated. The following items shall be preservative treated:
  1. Wood framing, and plywood.
  2. Wood members that are in contact with water.
  3. Nailers, plates and furring.

#### 1.7.1 New Construction

Use a boron-based preservative conforming to **AWPA P18**, sodium silicate wood mineralization process, or Ammoniacal Copper Quaternary Compound to treat wood. Use boron-based preservatives for above-ground applications only.

#### 1.8 QUALITY ASSURANCE

##### 1.8.1 Certificates of Grade

Submit certificates attesting that products meet the grade requirements specified in lieu of grade markings where appearance is important and grade marks will deface material.

#### 1.9 ENVIRONMENTAL REQUIREMENTS

During and immediately after installation of treated wood laminated wood products at interior spaces, provide temporary ventilation.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

##### 2.1.1 Virgin Lumber

Lumber fabricated from old growth timber is not permitted. Avoid companies who buy, sell, or use old growth timber in their operations, when

possible.

2.2 LUMBER

2.2.1 Framing Lumber

Framing lumber such as studs, nailing strips, and nailers and board lumber shall be one of the species listed in the table below. Minimum grade of species shall be as listed.

<u>Table of Grades for Framing and Board Lumber</u>			
<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
WWPA G-5 standard grading rules	Aspen, Douglas Fir-Larch, Douglas Fir South, Engelmann Spruce-Lodgepole Pine, Engelmann Spruce, Hem-Fir, Idaho White Pine, Lodgepole Pine, Mountain Hemlock, Mountain Hemlock-Hem-Fir, Ponderosa Pine-Sugar Pine, Ponderosa Pine-Lodgepole Pine, Subalpine Fir, White Woods, Western Woods, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common

<u>Table of Grades for Framing and Board Lumber</u>			
<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
WCLIB 17 standard grading rules	Douglas Fir-Larch, Hem-Fir, Mountain Hemlock, Sitka Spruce, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: Standard
SPIB 1003 standard grading rules	Southern Pine	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	No. 2 Boards
SCMA Spec standard specifications	Cypress	No. 2 Common	No. 2 Common
NELMA Grading Rules standard grading rules	Balsam Fir, Eastern Hemlock-Tamarack, Eastern Spruce, Eastern White Pine, Northern Pine, Northern Pine-Cedar	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common except Standard for Eastern White and Northern Pine

<u>Table of Grades for Framing and Board Lumber</u>			
<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
RIS Grade Use standard specifications	Redwood	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	Construction Heart
NHLA Rules rules for the measurement and inspection of hardwood and cypress lumber	Cypress	No. 2 Dimension	No. 2 Common

### 2.3 PLYWOOD

APA L870, APA S350, APA E445, and APA F405 respectively.

#### 2.3.1 Plywood Panels

##### 2.3.1.1 Plywood

C-D Grade, Exposure 1 durability classification, Span rating of 24/16 or greater.

### 2.4 ROUGH HARDWARE

Unless otherwise indicated or specified, rough hardware shall be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials shall be as recommended by the product manufacturer unless otherwise indicated or specified. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs shall be hot-dip zinc-coated in accordance with ASTM A153/A153M.

#### 2.4.1 Bolts, Nuts, Studs, and Rivets

ASME B18.2.1, ASME B18.5.2.1M, ASME B18.5.2.2M and ASME B18.2.2.

#### 2.4.2 Anchor Bolts

ASTM A307, size as indicated, complete with nuts and washers.

#### 2.4.3 Expansion Shields

CID A-A-1923, CID A-A-1924, and CID A-A-1925. Except as shown otherwise, maximum size of devices shall be 3/8 inch.

#### 2.4.4 Lag Screws and Lag Bolts

ASME B18.2.1.

#### 2.4.5 Wood Screws

ASME B18.6.1.

#### 2.4.6 Nails

ASTM F547, size and type best suited for purpose. For sheathing and subflooring, length of nails shall be sufficient to extend 1 inch into supports. In general, 8-penny or larger nails shall be used for nailing through 1 inch thick lumber and for toe nailing 2 inch thick lumber; 16-penny or larger nails shall be used for nailing through 2 inch thick lumber. Nails used with treated lumber and sheathing shall be hot-dipped galvanized in accordance with ASTM A153/A153M. Nailing shall be in accordance with the recommended nailing schedule contained in AF&PA T10. Where detailed nailing requirements are not specified, nail size and spacing shall be sufficient to develop an adequate strength for the connection. The connection's strength shall be verified against the nail capacity tables in AF&PA T101. Reasonable judgment backed by experience shall ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.

#### 2.4.7 Wire Nails

ASTM F1667.

#### 2.4.8 Clip Angles

Steel, 3/16 inch thick, size as indicated; or zinc-coated steel or iron commercial clips designed for connecting wood members.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Conform to AF&PA T10 and install in accordance with the National Association of Home Builders (NAHB) Advanced Framing Techniques: Optimum Value Engineering, unless otherwise indicated or specified. Select lumber sizes to minimize waste. Fit framing lumber and other rough carpentry, set accurately to the required lines and levels, and secure in place in a rigid manner. Do not splice framing members between bearing points. Provide adequate support as appropriate to the application, climate, and modulus of elasticity of the product. Do not cut or bore structural members for the passage of ducts or pipes without approval. Reinforce all members damaged by such cutting or boring by means of specially formed and approved sheet metal or bar steel shapes, or remove and provide new, as approved. Provide as necessary for the proper completion of the work all framing members not indicated or specified. Spiking and nailing not indicated or specified otherwise shall be in accordance with the Nailing Schedule contained in ICC IBC; perform bolting in an approved manner. Spikes, nails, and bolts

shall be drawn up tight.

3.2 MISCELLANEOUS

3.2.1 Wood Nailers, and Blocking

Provide sizes and configurations indicated or specified and anchored securely to continuous construction.

3.2.2 Wood Blocking

Provide proper sizes and shapes at proper locations for the installation and attachment of wood and other finish materials, fixtures, equipment, and items indicated or specified.

-- 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 D1227 (1995; R 2007) Emulsified Asphalt Used as a Protective Coating for Roofing
- ASTM D4263 (1983; R 2005) Indicating Moisture in Concrete by the Plastic Sheet Method
- ASTM D4479 (2007) Asphalt Roof Coatings - Asbestos-Free

1.2 SUBMITTALS

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

SD-03 Product Data

Materials

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 FIBROUS ASPHALT

ASTM D4479, Type I for horizontal surfaces, Type II for vertical surfaces.

2.2 EMULSION-BASED ASPHALT DAMPPROOFING

2.2.1 Fibrated Emulsion-Based Asphalt

Fibrated emulsion-based asphalt dampproofing shall be cold-applied type conforming to ASTM D1227 Type II, Class 1, asbestos-free, manufactured of

refined asphalt, emulsifiers and selected clay, fibrated with mineral fibers. For spray or brush application, emulsion shall contain a minimum of 59 percent solids by weight, 56 percent solids by volume. For trowel application, emulsion shall contain a minimum of 58 percent solids by weight, 55 percent solids by volume.

### PART 3 EXECUTION

#### 3.1 SURFACE PREPARATION

Clean concrete and masonry surfaces to receive dampproofing of foreign matter and loose particles. Apply dampproofing to clean dry surfaces. Moisture test in accordance with [ASTM D4263](#). 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.

##### 3.1.1 Metal Surfaces

Metal surfaces shall be dry and be free of rust, scale, loose paint, oil, grease, dirt, frost and debris.

#### 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. Drains and conductors shall be protected from clogging with dampproofing material.

#### 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 Surface Priming

Prime surfaces to receive fibrous asphalt dampproofing with asphalt. primer  
Apply primer when ambient temperature is above [40 degrees F](#) and at rate of approximately [one gallon per 100 square feet](#), fully covering entire surface to be dampproofed.

##### 3.3.2 Cold-Application Method

###### 3.3.2.1 Fibrous Asphalt

Apply two coats of fibrous asphalt to surfaces to be dampproofed. Apply each coat uniformly using not less than [one gallon](#) fibrous asphalt per [50 square feet](#). Apply first coat by brush or spray to provide full bond with primed surface. Brush or spray second coat over thoroughly dry first coat unless recommended otherwise by dampproofing materials manufacturer. Provide finished surface that is of uniform thickness and impervious to moisture. Recoat porous areas.

###### 3.3.2.2 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.

-- End of Section --



## SECTION 07 22 00

## ROOF AND DECK INSULATION

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 C1289 (2011a) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
- ASTM D312 (2000; R 2006) Standard Specification for Asphalt Used in Roofing
- ASTM D41/D41M (2011) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
- ASTM D4586 (2007) Asphalt Roof Cement, Asbestos-Free
- ASTM D4601 (2004) Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
- ASTM E84 (2012) Standard Test Method for Surface Burning Characteristics of Building Materials

## FM GLOBAL (FM)

- FM 4470 (2010) Single-Ply, Polymer-Modified Bitumen Sheet, Built-up Roof (BUR), and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction
- FM APP GUIDE (updated on-line) Approval Guide <http://www.approvalguide.com/>
- FM P9513 (2002) Specialist Data Book Set for Roofing Contractors; contains 1-22 (2001), 1-28 (2002), 1-29 (2002), 1-28R/1-29R (1998), 1-30 (2000), 1-31 (2000), 1-32 (2000), 1-33 (2000), 1-34 (2001), 1-49 (2000), 1-52 (2000), 1-54 (2001)

## UNDERWRITERS LABORATORIES (UL)

- UL Bld Mat Dir (2011) Building Materials Directory

## 1.2 SUBMITTALS

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

### SD-03 Product Data

#### Fasteners

#### Insulation

## 1.3 QUALITY ASSURANCE

### 1.3.1 Insulation on Steel Decks

Roof insulation shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance with ASTM E84. Insulation bearing the UL label and listed in the UL Bld Mat Dir as meeting the flame spread and smoke developed ratings will be accepted in lieu of copies of test reports. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the type used for this project and the construction is listed as fire-classified in the UL Bld Mat Dir or listed as Class I roof deck construction in the FM APP GUIDE. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

## 1.4 DELIVERY, STORAGE, AND HANDLING

### 1.4.1 Delivery

Deliver materials to site in manufacturer's unopened and undamaged standard commercial containers bearing the following legible information:

- a. Name of manufacturer;
- b. Brand designation;
- c. Specification number, type, and class, as applicable, where materials are covered by a referenced specification; and

Deliver materials in sufficient quantity to allow continuity of the work.

### 1.4.2 Storage and Handling

Store and handle materials in a manner to protect from damage, exposure to open flame or other ignition sources, and from wetting, condensation or moisture absorption. Store in an enclosed building or trailer that provides a dry, adequately ventilated environment. Replace damaged material with new material.

## 1.5 ENVIRONMENTAL CONDITIONS

Do not install roof insulation during inclement weather or when air temperature is below 40 degrees F and interior humidity is 45 percent or greater, or when there is visible ice, frost, or moisture on the roof deck.

## PART 2 PRODUCTS

## 2.1 INSULATION

## 2.1.1 Insulation Types

Roof insulation shall be a composite assembly of the following materials and compatible with attachment methods for the specified insulation and roof membrane:

- a. Polyisocyanurate Board: [ASTM C1289](#).
- b. Composite Boards: [ASTM C1289](#), Type V, oriented strand board on one side and fibrous felt or glass fiber mat membrane or aluminum foil on the other.; [ASTM C1289](#) (Polyisocyanurate).

## 2.1.2 Insulation Thickness

As necessary to provide a thermal resistance (R value) of 6.5 or more . Thickness shall be based on the "R" value for aged insulation. Insulation over steel decks shall satisfy both specified R value and minimum thickness for width of rib opening recommended in insulation manufacturer's published literature.

## 2.2 BITUMENS

## 2.2.1 Asphalt Primer

[ASTM D41/D41M](#).

## 2.2.2 Asphalt

[ASTM D312](#), Type III or IV. Asphalt flash point, finished blowing temperature, and equiviscous temperature (EVT) for mop and for mechanical spreader application shall be indicated on bills of lading or on individual containers.

## 2.2.3 Asphalt Roof Cement

[ASTM D4586](#), Type I for horizontal surfaces and for surfaces sloped from 0 to 3 inches per foot, Type II for vertical and surfaces sloped more than 3 inches per foot.

## 2.3 MOISTURE CONTROL

## 2.3.1 Vapor Retarder

## 2.3.1.1 Asphalt-Saturated Felt Base Sheet for Single Layer Application

[ASTM D4601](#), weighing not less than 35 pounds per 100 square feet.

## 2.4 FASTENERS

Flush-driven through flat round or hexagonal steel or plastic plates. Steel plates shall be zinc-coated, flat round not less than 1 3/8 inch diameter or hexagonal not less than 28 gage. Plastic plates shall be high-density, molded thermoplastic with smooth top surface, reinforcing ribs and not less than 3 inches in diameter. Fastener head shall recess fully into the plastic plate after it is driven. Plates shall be formed to prevent

dishing. Do not use bell-or cup-shaped plates. Fasteners shall conform to insulation manufacturer's recommendations except that holding power, when driven, shall be not less than 40 pounds each in steel deck. Fasteners for steel or concrete decks shall conform to FM APP GUIDE for Class I roof deck construction, and shall be spaced to withstand an uplift pressure of 90 pounds per square foot.

#### 2.4.1 Fasteners for Steel Decks

Approved hardened penetrating fasteners or screws conforming to FM 4470 and listed in FM APP GUIDE for Class I roof deck construction. Quantity and placement to withstand a minimum uplift pressure of 90 psf conforming to FM APP GUIDE.

### PART 3 EXECUTION

#### 3.1 EXAMINATION AND PREPARATION

##### 3.1.1 Surface Inspection

Surfaces shall be clean, smooth, and dry. Surfaces receiving vapor retarder shall be free of projections which might puncture the vapor retarder. Check roof deck surfaces, including surfaces sloped to roof drains and outlets, for defects before starting work.

The Contractor shall inspect and approve the surfaces immediately before starting installation. Prior to installing vapor retarder/insulation, perform the following:

- a. Examine steel decks to ensure that panels are properly secured to structural members and to each other and that surfaces of top flanges are flat or slightly convex.

##### 3.1.2 Surface Preparation

Correct defects and inaccuracies in roof deck surface to eliminate poor drainage and hollow or low spots and perform the following:

- a. Cover steel decks with a layer of insulation board of sufficient thickness to span the width of a deck rib opening, and conforming to fire safety requirements. Secure with piercing or self-drilling, self-tapping fasteners of quantity and placement conforming to FM APP GUIDE. Insulation joints parallel to ribs of deck shall occur on solid bearing surfaces only, not over open ribs.

#### 3.2 INSTALLATION OF VAPOR RETARDER

Install vapor retarder in direct contact with roof deck surface. Vapor retarder shall consist of one layer of asphalt-saturated felt base sheet. Lay vapor retarder at right angles to direction of slope.

#### 3.3 INSULATION INSTALLATION

Apply insulation with staggered joints when total required thickness of insulation exceeds 1/2 inch. Lay insulation so that continuous longitudinal joints are perpendicular to direction of roofing, and end joints of each course are staggered with those of adjoining courses. When using multiple layers of insulation, joints of each succeeding layer shall be parallel and offset in both directions with respect to layer below.



Keep insulation 1/2 inch clear of vertical surfaces penetrating and projecting from roof surface.

### 3.3.1 Installation Using Only Mechanical Fasteners

Secure total thickness of insulation with penetrating type fasteners.

### 3.3.2 Special Precautions for Installation of Foam Insulation

#### 3.3.2.1 Composite Polyisocyanurate Insulation and (Nailable) OSB Panel

Follow manufacturer's instructions for installation for application indicated.

## 3.4 PROTECTION

### 3.4.1 Protection of Applied Insulation

Completely cover each day's installation of insulation with the finished roofing on same day. Do not permit phased construction. Protect open spaces between insulation or other walls and spaces at curbs, scuttles, and expansion joints, until permanent roofing and flashing are applied. Do not permit storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces. Provide smooth, clean board or plank walkways, runways, and platforms near supports, as necessary, to distribute weight to conform to . Exposed edges of the insulation shall be protected by cutoffs at the end of each work day or whenever precipitation is imminent.

### 3.4.2 Damaged Work and Materials

Restore work and materials that become damaged during construction to original condition or replace with new materials.

## 3.5 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roof insulation with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.
- b. Verification of certification, listing or label compliance with FM P9513.
- c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.
- d. Inspection of vapor retarder application, including edge envelopes and mechanical fastening.
- e. Inspection of mechanical fasteners; type, number, length, and spacing.

- f. Coordination with other materials, and nailing strips.
- g. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.
- h. Installation of cutoffs and proper joining of work on subsequent days.
- i. Continuation of complete roofing system installation to cover insulation installed same day.

-- End of Section --

SECTION 07 31 13

ASPHALT SHINGLES

11/11

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM D1970/D1970M (2011) Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection

ASTM D226/D226M (2009) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

ASTM D3018/D3018M (2011) Standard Specification for Class A Asphalt Shingles Surfaced With Mineral Granules

ASTM D3161 (2009) Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method)

ASTM D3462/D3462M (2010a) Standard Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules

ASTM D41/D41M (2011) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

ASTM D4586 (2007) Asphalt Roof Cement, Asbestos-Free

ASTM D4869/D4869M (2005e1; R 2011) Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing

UNDERWRITERS LABORATORIES (UL)

UL 790 (2004; Reprint Oct 2008) Standard Test Methods for Fire Tests of Roof Coverings

1.2 DEFINITIONS

1.2.1 Top Lap

That portion of shingle overlapping shingle in course below.

1.2.2 Head Lap

The triple coverage portion of top lap which is the shortest distance from the butt edge of an overlapping shingle to the upper edge of a shingle in the second course below.

1.2.3 Exposure

That portion of a shingle exposed to the weather after installation.

1.3 SUBMITTALS

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

SD-03 Product Data

Shingles

Submit data including type, weight, class, UL labels, and special types of underlayment and eave flashing.

SD-04 Samples

Shingles

Full shingle sample and manufacturer's standard size samples of materials and products requiring color or finish selection.

Color charts

SD-08 Manufacturer's Instructions

Application

1.4 DELIVERY AND STORAGE

Deliver materials in the manufacturer's unopened bundles and containers bearing the manufacturer's brand name. Keep materials dry, completely covered, and protected from the weather. Store according to manufacturer's written instructions. Roll goods shall be stored on end in an upright position or in accordance with manufacturer's recommendations. Immediately before laying, roofing felt shall be stored for 24 hours in an area maintained at a temperature not lower than 50 degrees F.

1.5 WARRANTIES

Warranties shall begin on the date of Government acceptance of the work.

1.5.1 Manufacturer's Warranty

Furnish the asphalt shingle manufacturer's standard 30 year warranty for the asphalt shingles. The warranty shall run directly to the Government.

1.5.2 Contractor's Warranty

The Contractor shall warrant for 5 years that the asphalt shingle roofing system, as installed, is free from defects in workmanship. When repairs due to defective workmanship are required during the Contractor's warranty

period, the Contractor shall make such repairs within 72 hours of notification. When repairs are not performed within the specified time, emergency repairs performed by others will not void the warranty.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Shingles

Mineral granule-surfaced asphalt/fiberglass shingles, self-sealing, architectural (wood shake) tabs, strip, fungus-resistant. [ASTM D3018/D3018M](#), Type I, and [ASTM D3462/D3462M](#) architectural shingles weighing not less than 300 pounds per 100 square feet. Shingles shall meet the fire resistance requirements of [UL 790](#) for Class A and the wind resistance requirements of [ASTM D3161](#), Class F. Color shall be as selected from the manufacturer's standard color charts.

#### 2.1.2 Underlayment

Asphalt-saturated felt conforming to [ASTM D4869/D4869M](#) or [ASTM D226/D226M](#), Type II, number 30, without perforations or other material specified by the shingle manufacturer for use as underlayment.

##### 2.1.2.1 Leak Barrier Underlayment

Self-adhering leak barrier or ice dam underlayment shall comply with [ASTM D1970/D1970M](#) for sealability around nails.

#### 2.1.3 Nails for Applying Shingles and Asphalt-Saturated Felt

Aluminum or hot-dipped galvanized steel or equivalent corrosion resistant with sharp points and flat heads  $3/8$  to  $7/16$  inch in diameter. Shank diameter of nails shall be a minimum of 0.105 inch and a maximum of 0.135 inch with garb or otherwise deformed for added pull-out resistance. Nails shall be long enough to penetrate completely through or extend a minimum of  $3/4$  inch into roof deck, whichever is less, when driven through materials to be fastened.

#### 2.1.4 Asphalt Roof Cement

[ASTM D4586](#), Type II.

#### 2.1.5 Asphalt Primer

[ASTM D41/D41M](#).

## PART 3 EXECUTION

### 3.1 VERIFICATION OF CONDITIONS

Ensure that roof deck is smooth, clean, dry, and without loose knots. Roof surfaces shall be firm and free from loose boards, large cracks, and projecting ends that might damage the roofing. Vents and other projections through roofs shall be properly flashed and secured in position, and projecting nails shall be driven flush with the deck.

### 3.2 SURFACE PREPARATION

Cover knotholes and cracks with sheet metal nailed securely to sheathing. Flash and secure vents and other roof projections, and drive projecting nails firmly home.

### 3.3 APPLICATION

Apply roofing materials as specified herein unless specified or recommended otherwise by shingle manufacturer's written instructions.

#### 3.3.1 Underlayment

Provide for roof slopes 4 inches per foot and greater. Apply one layer of shingle underlayment to roof deck. Lay underlayment parallel to roof eaves, starting at eaves. Provide minimum 2 inch head laps, 4 inch end laps, and 6 inch laps from both sides over hips and ridges. Nail sufficiently to hold until shingles are applied. Turn up vertical surfaces a minimum of 4 inches.

Provide leak barrier/ice dam underlayment at all ridges, hips, eaves and roof edges, and entire roof deck surface. Installed per manufacturer's written instructions for installation.

#### 3.3.2 Drip Edges

Provide metal drip edges applied directly on the wood deck at eaves and over the underlayment at rakes. Extend back from edge of deck a minimum of 3 inches, and secure with nails spaced a maximum of 10 inches o.c. along inner edge.

#### 3.3.3 Starter Strip

Apply starter strip at eaves, using 9 inch wide strip of mineral-surfaced roll roofing of a color to match shingles. Optionally, use a row of shingles with tabs removed and trimmed to ensure that joints are not exposed at shingle cutouts. Apply starter strip along eaves, overhanging the metal drip edge at eaves and rake edges 1/4 inch to 3/8 inch; fasten in a line parallel to and 3 to 4 inches above eave edge. Place nails so top of nail is not exposed in cutouts of first course of shingles. When roll roofing is provided, seal tabs of first course of shingles with asphalt roof cement. Fasten with 6 nails per strip of shingles or space nails at 6 inches o.c. for roll roofing. Seal tabs of first course of shingles with asphalt roof cement as specified below.

#### 3.3.4 Shingle Courses

Start first course with full shingle, and apply succeeding courses with joints staggered at thirds or halves. Butt-end joints of shingles shall not align vertically more often than every fourth course. Apply shingle courses as follows:

- a. Fastening: Do not drive fasteners into or above the factory-applied adhesive unless adhesive is located 5/8 inch or closer to top of cutouts. Place fasteners so they are concealed by shingle top lap and penetrate the head lap.
- b. Shingles applied with nails: Nominal 5 inch exposure. Apply each shingle with minimum of four nails. Place one nail one inch from each

end, and evenly space nails on a horizontal line a minimum of  $5/8$  inch above top of cutouts. Cement each tab with one spot of asphalt roof cement placed **one to 2 inches** from bottom edge of shingle.

- c. Nailing: Apply shingles with nominal **5 inch** exposure. Apply each shingle with minimum of six nails. Place one nail **one inch** from each end and one nail on each side of each cutout, on a horizontal line  $5/8$  inch above cutouts.

#### 3.3.5 Hips and Ridges

Provide premium ridge cap shingles in 8 or 10 inch widths and 8 inch exposure preformed caps for ridge and hips.

-- End of Section --





SECTION 07 40 00

SOLID VINYL SIDING WORK  
(Aluminum Soffit and Trim is Included)

07/07

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 209 (1996) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM D 3679 (1999) Rigid Poly (Vinyl Chloride) (PVC) Siding

1.2 SUBMITTALS

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

SD-04 Samples

Custom trim shapes

A sample of each standard shape and a sample of each custom trim shape 12 inches long shall be submitted to and approved by the Contracting Officer

SD-03 Product Data

Vinyl V-Groove Soffit (non-vented)

Vinyl or Aluminum Fascia

"J" channels

Trim

SD-07 Certificates

Manufacturer's certificates or test reports shall be submitted indicating that the vinyl siding, "J" channel, trim, and other accessories meet the requirements of ASTM D 3679, and that aluminum accessories and custom trim shapes meet requirements of ASTM B 209

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original

unopened containers, with brand name clearly marked thereon. All materials shall be carefully handled and stored to prevent damage.

## PART 2 PRODUCTS

### 2.1 VINYL SIDING

The siding shall be rigid polyvinyl chloride horizontal lap siding of patterns indicated, conforming to **ASTM D 3679**, Class 2, except as otherwise specified herein. The siding and trim shall be made from a powder, not pellet, base. The vinyl shall have a minimum thickness of 0.040 inches. The color shall be as indicated and distributed throughout the thickness of the vinyl. The surface texture shall be as indicated. Where 3 colors are indicated, the color for each building shall be as directed by the Contracting Officer. The nailing hem shall have a protective ridge or other device to prevent over driving of nails. Nail slots shall be elongated to allow for horizontal expansion and contraction.

### 2.2 TRIM

Starter strips, trim, "J" Channels, and other trim as required shall be rigid polyvinyl chloride and shall be of appropriate size and construction to accept the siding without loose joints or unsightly reveals.

### 2.3 CUSTOM TRIM SHAPES AND OTHER ACCESSORIES

Shall be aluminum, 0.019 inch thickness with factory applied vinyl finish. Custom trim shapes shall be factory or site fabricated with a mechanical breaking machine in minimum lengths of 8 feet. Working tolerances for custom shapes shall be plus or minus 1/32 inch.

#### 2.3.1 Finish Coating System

Factory-applied, minimum total dry film thickness of 1.0 mil, available in a minimum of six manufacturer's standard colors. Provide finish coating system on the exterior face. The interior face may receive an acrylic wash coat applied to a minimum total dry film thickness of 0.20 mil. Color shall be as selected from manufacturer's standard colors.

#### 2.3.2 Accessories

Sheet metal flashings, trim, moldings, closure strips, caps, and other similar sheet metal accessories used in conjunction with preformed metal panels shall be made of the same material and finish as used for the panels. Thickness of the metal shall be not less than that used for the siding. Molded closure strips shall be closed-cell or solid-cell synthetic rubber, neoprene, or polyvinyl chloride premolded to match the configurations of the preformed metal panels.

#### 2.3.3 Fasteners for attaching siding and accessories

Fasteners for attaching siding and accessories to adjoining panels shall be as approved and in accordance with the manufacturer's recommendations. Unless specified otherwise, the fasteners shall be either self-tapping screws, bolts and nuts, self-locking rivets, self-locking bolts, end-welded studs, bolted or riveted studs, or step rivets held by aluminum straps. Design the fastening system to withstand the design loads indicated. Fasteners shall be Series 305 stainless steel or aluminum. Fasteners, with the exception of those having integral hexagonal washer heads and those

having aluminum drive caps, shall have composite metal and neoprene washers. Fasteners having integral hexagonal washer heads and fasteners having aluminum drive caps shall have polychloroprene washers. Heads of screws or bolts exposed on exterior face of factory-finished wall shall be nylon headed to match color of wall.

#### 2.4 POP RIVETS

Shall be used to secure corners or joints which cannot be secured by nailing to backup materials and shall be aluminum or material which is non-reactive with aluminum.

#### 2.5 NAILS

Aluminum or galvanized steel, with 5/16-inch head for siding, 7/16-inch head for insulation and 0.125 inch diameter, and of length required to penetrate existing wood 3/4 inch.

#### 2.6 EXPOSED NAILS

Nails which will be exposed in the finish work shall have a 3/32-inch head or smaller and shall be color matched to the material being nailed.

### PART 3 EXECUTION

#### 3.1 SURFACE PREPARATION

Drive in loose nails wood trim and blocking. If any existing wood or plywood to be covered by vinyl shows evidence not suitable base material for installation of siding and trim, replace as needed, the Contractor shall inform the Contracting Officer.

#### 3.2 SOFFIT AND FASCIA TRIM

Installation shall be as recommended by the manufacturer's installation instructions for application. All trim shall be installed level and true with anchoring as recommended. Allow trim for adequate expansion. Soffit panels are to be installed perpendicular to wall surface with a "H" shaped trim channel at the outside corners. Attach fascia to fascia board with top of fascia under drip edge and bottom of fascia lapping over soffit for clean and straight appearance.

#### 3.3 CUSTOM TRIM

Shall be fabricated to a tolerance of plus or minus 1/32-inch with a mechanical breaking apparatus in lengths of 8 feet or longer. The trim shall be nailed with small color matched aluminum nails and shall be blind nailed where possible. Exposed cut ends or edges shall be calked against the abutting material to make a smooth transition. Where splices in trim are required they shall be lapped in shingle fashion to repel water, and where there is no backup material for nailing, the trim shall be pop riveted as required to make a smooth joint without unsightly reveals or puckers.

#### 3.4 PROTECTION AND CLEANING

The Contractor shall take such measures as required to protect his work from damage and upon completion of work, all stains, smears, and other soiling shall be removed and the work left in clean and neat condition.

The Contractor shall clean the site of construction debris daily.

-- 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 C1311	(2010) Standard Specification for Solvent Release Agents
ASTM C509	(2006; R 2011) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D1056	(2007) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1667	(2005; R 2011) Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D2452	(2003; R 2009) Standard Test Method for Extrudability of Oil- and Resin-Base Caulking Compounds
ASTM D2453	(2003; R 2009) Standard Test Method for Shrinkage and Tenacity of Oil- and Resin-Base Caulking Compounds

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 subjection 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.

**1.6 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 C920, Type S or M, Grade NS, Class 25, Use NT. Location(s) and color(s) of sealant for the following:

LOCATION	COLOR
a. Small voids between walls or partitions, door frames, built-in or surface-mounted equipment wall louvers, and similar items.	As selected

LOCATION	COLOR
b. Perimeter of frames at doors, and access panels which adjoin exposed interior concrete and masonry surfaces.	As selected
c. Joints of interior masonry walls and partitions which adjoin 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

2.1.2 Exterior Sealant

For joints in vertical surfaces, provide **ASTM C920**, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide **ASTM C920**, Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows:

LOCATION	COLOR
a. Joints and recesses formed where frames and subsills of doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	Match adjacent surface color
b. Joints between new and existing exterior masonry walls.	Match adjacent surface color
c. Masonry joints where shelf angles occur.	Match adjacent surface color
d. Expansion and control joints.	Match adjacent surface color
e. Voids where items pass through exterior walls.	Match adjacent surface color

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 .

#### 2.4.1 Rubber

Conform to [ASTM D1056](#), Type 1, open cell, or Type 2, closed cell, Class A B D, Grade 1, round cross section for cellular rubber sponge backing.

#### 2.4.2 PVC

Conform to [ASTM D1667](#), Grade VO 12, open-cell foam, round cross section for Polyvinyl chloride (PVC) backing.

#### 2.4.3 Synthetic Rubber

Conform to [ASTM C509](#), Option II, Type II preformed rods or tubes for Synthetic rubber backing.

#### 2.4.4 Neoprene

Conform to [ASTM D1056](#), closed cell expanded neoprene cord Type 2, Class C, Grade 2C2 or open cell neoprene sponge Type 1, Class C, Grade 1C3 for Neoprene backing.

#### 2.4.5 Butyl Rubber Based

Provide Butyl Rubber Based Sealants of single component, solvent release, color as selected, conforming to [ASTM C1311](#).

### 2.5 CAULKING

Conform to [ASTM D2452](#) and [ASTM D2453](#).

### 2.6 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 caulk 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 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.

### 3.3.2 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:

- a. Where indicated.
- b. Where backstop is not indicated but joint cavities exceed the acceptable maximum depths specified in paragraph entitled, "Joint Width-to-Depth Ratios".

### 3.3.3 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.

### 3.3.4 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.

### 3.3.5 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; Errata 2010) Structural Welding Code - Steel

## ASTM INTERNATIONAL (ASTM)

ASTM A653/A653M (2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A879/A879M (2006) Standard Specification for Steel Sheet, zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface

ASTM A924/A924M (2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM C578 (2011b) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

ASTM C591 (2011) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

ASTM C612 (2010) Mineral Fiber Block and Board Thermal Insulation

ASTM D2863 (2010) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.115 (2006) Hardware Preparation in Steel Doors and Steel Frames

STEEL DOOR INSTITUTE (SDI/DOOR)

- SDI/DOOR 113 (2001; R2006) Standard Practice for Determining the Steady State Thermal Transmittance of Steel Door and Frame Assemblies
- SDI/DOOR A250.11 (2001) Recommended Erection Instructions for Steel Frames
- SDI/DOOR A250.4 (2001) Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing
- SDI/DOOR A250.6 (2003; R2009) Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
- SDI/DOOR A250.8 (2003; R2008) Recommended Specification for Standard Steel Doors and Frames

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. When "custom hollow metal doors" are provided in lieu of "standard steel doors," provide additional details and data sufficient for comparison to SDI/DOOR A250.8 requirements.

### 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4 inch airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

## PART 2 PRODUCTS

### 2.1 STANDARD STEEL DOORS

SDI/DOOR A250.8, except as specified otherwise. Prepare doors to receive door hardware as specified in Section 08 71 00. Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 1-3/4 inch thick, unless otherwise indicated.

#### 2.1.1 Classification - Level, Performance, Model

##### 2.1.1.1 Extra Heavy Duty Doors

SDI/DOOR A250.8, Level 3, physical performance Level A, Model 1 with core construction as required by the manufacturer for indicated exterior doors, of size(s) and design(s) indicated. Provide Level 3 for all exterior doors.

### 2.2 INSULATED STEEL DOOR SYSTEMS

Insulated steel doors shall have a core of polyurethane or polystyrene foam and an R factor of 7.0 or more. Doors shall have been tested in accordance with SDI/DOOR A250.4. Prepare doors to receive specified hardware. Doors shall be 1-3/4 inch thick.

### 2.3 ACCESSORIES

#### 2.3.1 Astragals

For pairs of exterior steel doors which will not have aluminum astragals or removable mullions, as specified in Section 08 71 00 DOOR HARDWARE provide overlapping steel astragals with the doors.

### 2.4 INSULATION CORES

Insulated cores shall be of type specified, and provide an apparent U-factor of .48 in accordance with SDI/DOOR 113 and shall conform to:

- a. Rigid Cellular Polyisocyanurate Foam: ASTM C591, Type I or II, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with ASTM D2863; or
- b. Rigid Polystyrene Foam Board: ASTM C578, Type I or II; or
- c. Mineral board: ASTM C612, Type I.

### 2.5 STANDARD STEEL FRAMES

SDI/DOOR A250.8, Level 3, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners. Provide steel frames for doors, unless otherwise indicated.

### 2.5.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

Weld frames in accordance with the recommended practice of the Structural Welding Code Sections 1 through 6, [AWS D1.1/D1.1M](#) and in accordance with the practice specified by the producer of the metal being welded.

### 2.5.2 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than [18 gage](#).

#### 2.5.2.1 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.

### 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](#).

#### 2.8.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate exterior doors and frames from hot dipped zinc coated steel, alloyed type, that complies with [ASTM A924/A924M](#) and [ASTM A653/A653M](#). The coating weight shall meet or exceed the minimum requirements for coatings having [0.4 ounces per square foot](#), total both sides, i.e., [A40](#). Repair damaged zinc-coated surfaces by the application of zinc dust paint.

Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in [SDI/DOOR A250.8](#). Provide for all exterior doors.

### 2.8.3 Electrolytic Zinc-Coated Anchors and Accessories

Provide electrolytically deposited zinc-coated steel in accordance with [ASTM A879/A879M](#), Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in [SDI/DOOR A250.8](#).

### 2.8.4 Field-Applied Finish

Color(s) of finish coat shall match approved color sample(s). Refer to Section 09 90 00 "Paints and Coatings".

## 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.

## 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, clean and adjust hardware.

### 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 71 00

DOOR HARDWARE

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 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)

- BHMA A156.1 (2006) Butts and Hinges
- BHMA A156.13 (2005) Mortise Locks & Latches, Series 1000
- BHMA A156.16 (2002) Auxiliary Hardware
- BHMA A156.18 (2006) Materials and Finishes
- BHMA A156.2 (2003) Bored and Preassembled Locks and Latches
- BHMA A156.21 (2006) Thresholds
- BHMA A156.22 (2005) Door Gasketing and Edge Seal Systems
- BHMA A156.4 (2000) Door Controls - Closers
- BHMA A156.6 (2005) Architectural Door Trim
- BHMA A156.7 (2003) Template Hinge Dimensions

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR A250.8 (2003; R2008) Recommended Specification for Standard Steel Doors and Frames

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-11 Closeout Submittals

Key Bitting

1.3 **HARDWARE SCHEDULE**

Prepare and submit hardware schedule in the following form:

Hard- ware Item	Quan- tity	Size	Reference		Mfr. Name and Catalog No.	Key Con- trol Symbols	UL Mark (If fire rated and listed)	BHMA Finish Designa- tion
			Publi- cation Type No.	Finish				
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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, and closers of one lock, hinge, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

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 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 doors 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 ITEMS

Clearly and permanently mark with the manufacturer's name or trademark, hinges, locks, latches, 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.

## 2.2.1 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. Other antifriction bearing hinges may be provided in lieu of ball-bearing hinges.

## 2.2.2 Locks and Latches

## 2.2.2.1 Mortise Locks and Latches

BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. Provide mortise locks with escutcheons not less than 7 by 2-1/4 inch with a bushing at least 1/4 inch long. Cut escutcheons to suit cylinders and provide trim items with straight, beveled, or smoothly rounded sides, corners, and edges. Install knobs and roses of mortise locks with screwless shanks and no exposed screws.

## 2.2.3 Cylinders and Cores

Provide cylinders for new locks, including locks provided under other sections of this specification. Provide fully compatible cylinders with products of the Best Lock Corporation with interchangeable cores which are removable by a special control key. Factory set the cores with seven pin tumblers using the A4 system and F keyway. Submit a core code sheet with the cores. Provide master keyed cores in one system for this project. Provide construction interchangeable cores.

## 2.2.4 Keying System

Provide an extension of the existing keying system. Existing locks were manufactured by Best and have interchangeable cores. Provide construction interchangeable cores.

## 2.2.5 Lock Trim

Cast, forged, or heavy wrought construction and commercial plain design.

## 2.2.5.1 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.

#### 2.2.5.2 Lever Handles

Provide lever handles in lieu of knobs where indicated in paragraph entitled "Hardware Schedule". Conform to the minimum requirements of BHMA A156.13 for mortise locks of lever handles for doors indicated. Provide lever handle locks with a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when force in excess of that specified in BHMA A156.13 is applied to the lever handle. Provide lever handles return to within 1/2 inch of the door face.

#### 2.2.6 Keys

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

#### 2.2.7 Door Bolts

BHMA A156.16.

#### 2.2.8 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. 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.

##### 2.2.8.1 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.

#### 2.2.9 Door Protection Plates

BHMA A156.6.

##### 2.2.9.1 Sizes of Kick Plates

2 inch 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.

#### 2.2.10 Thresholds

BHMA A156.21. Use J35100, with vinyl or silicone rubber insert in face of stop, for exterior doors opening out, unless specified otherwise.

#### 2.2.11 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 sealsand, for pairs of doors, astragals. Air leakage of weather stripped doors not to exceed 0.5 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:

#### 2.2.11.1 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.

#### 2.2.11.2 Interlocking Type

Zinc or bronze not less than 0.018 inch thick.

#### 2.2.11.3 Spring Tension Type

Spring bronze or stainless steel not less than 0.008 inch thick.

#### 2.2.12 Rain Drips

Extruded aluminum, not less than 0.08 inch thick, clear anodized. Set drips in sealant and fasten with stainless steel screws.

##### 2.2.12.1 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 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.

### 2.4 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) unless indicated otherwise 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. Match exposed parts of concealed closers to lock and door trim.

## 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.

#### 3.1.1.2 Interlocking Type Weather Stripping

Provide interlocking, self-adjusting type on heads and jambs and flexible hook type at sills. Nail weather stripping to door one inch on center and to heads and jambs at 4 inch on center

#### 3.1.1.3 Spring Tension Type Weather Stripping

Provide spring tension type on heads and jambs. Provide bronze nails with bronze, stainless steel nails with stainless steel. Space nails not more than 1-1/2 inch on center.

### 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 HARDWARE LOCATIONS

SDI/DOOR A250.8, unless indicated or specified otherwise.

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

## 3.3 FIELD QUALITY CONTROL

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

## 3.4 HARDWARE SETS

Provide Hardware set as indicated or approved equal.

### Manufacturers List

BE	Best
CR	Corbin-Russwin
MC	McKinney
NO	Norton

### 3.4.1 HARDWARE SET #1

6	Hinges	T4B3386	4 1/2 x 4 1/2	NRP	32	MC
2	Flush Bolt	FB01M	US26			MC

- 1 Storeroom Lock 45H-7D-15J 629 BE
- 1 Mortize Cylinder Type, Length & cam per Owner's key system 625 BE
- 1 Core Per Owner's Key System 630 CR
- 2 Closer UNI-7501 H 689 NO
- 2 Kickplate KP50 10" x 2" LDW HB4E US32 MC
- 1 Astragal MCK357 SP x LAR MC
- 1 Raindrip MCK346 C x Door Width + 4" MC
- 1 Gasket MCKS88 x LAR MC
- 1 Threshold MCK2005AV SS/MS&ES 25 X LAR MC

-- 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 (2007) Laboratory Methods of Testing Dampers for Rating

AMCA 511 (2010) Certified Ratings Program for Air Control Devices

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 2603 (2002) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

ASTM INTERNATIONAL (ASTM)

ASTM B209 (2007) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B221 (2008) 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

SD-04 Samples

Wall louvers

### 1.3 DELIVERY, STORAGE, AND PROTECTION

Deliver materials to the site in an undamaged condition. Carefully store materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

### 1.4 DETAIL DRAWINGS

Show all information necessary for fabrication and installation of [wall louvers](#). Indicate materials, sizes, thicknesses, fastenings, and profiles.

### 1.5 COLOR SAMPLES

Colors of finishes for [wall louvers](#) shall closely approximate colors indicated. Where color is not indicated, submit the manufacturer's standard colors to the Contracting Officer for selection.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Aluminum Sheet

[ASTM B209](#), alloy 3003 or 5005 with temper as required for forming.

#### 2.1.2 Extruded Aluminum

[ASTM B221](#), alloy 6063-T5 or -T52.

### 2.2 COMBINATION [METAL WALL LOUVERS](#)/MOTORIZED DAMPERS

Weather resistant type, with bird screens and made to withstand a wind load of not less than [25 pounds per square foot](#). Wall louvers shall bear the AMCA certified ratings program seal for air performance and water penetration in accordance with [AMCA 500-D](#) and [AMCA 511](#). The rating shall show a water penetration of [0.20 or less ounce per square foot](#) of free area at a free velocity of [800 feet](#) per minute.

#### 2.2.1 Extruded Aluminum Louvers

Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than [0.081 inch](#).

#### 2.2.2 Formed Metal Louvers

Formed of aluminum sheet not less than [0.08 inch](#) thick.

#### 2.2.3 Desing and Operation

Refer to drawings.

#### 2.2.4 Screens and Frames

For aluminum louvers, provide [14 or 16 gage](#) aluminum 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 or organic coating. Color shall be as selected. Louvers for each building shall have the same finish.

##### 2.4.1.1 Organic Coating

Clean and prime exposed aluminum surfaces. Provide a baked enamel finish conforming to AAMA 2603, with total dry film thickness not less than 0.8 mil color as selected.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Wall Louvers

Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations.

#### 3.1.2 Screens and Frames

Attach frames to louvers with screws or bolts.

### 3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

#### 3.2.1 Copper or Copper-Bearing Alloys

Paint copper or copper-bearing alloys in contact with dissimilar metal with heavy-bodied bituminous paint or separate with inert membrane.

#### 3.2.2 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

#### 3.2.3 Metal

Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

#### 3.2.4 Wood

Paint wood or other absorptive materials that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

-- 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 0100 (2001; Supplements 2002-2008) Documentation of the Threshold Limit Values and Biological Exposure Indices

ASTM INTERNATIONAL (ASTM)

ASTM D4263 (1983; R 2005) Indicating Moisture in Concrete by the Plastic Sheet Method

ASTM D523 (2008) Standard Test Method for Specular Gloss

ASTM D6386 (2010) Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

ASTM F1869 (2011) Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

MASTER PAINTERS INSTITUTE (MPI)

MPI 107 (Oct 2009) Rust Inhibitive Primer (Water-Based)

MPI 11 (Oct 2009) Exterior Latex, Semi-Gloss, MPI Gloss Level 5

MPI 134 (Oct 2009) Galvanized Primer (Waterbased)

MPI 141 (Oct 2009) Interior High Performance Latex MPI Gloss Level 5

MPI 79 (Oct 2009) Alkyd Anti-Corrosive Metal Primer

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 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
SSPC VIS 4/NACE VIS 7	(1998; E 2000; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-313	(Rev D; Notice 1) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities
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## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000	Air Contaminants
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## 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; (LEED)

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

Qualification Testing laboratory for coatings

#### SD-08 Manufacturer's 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.

### 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 1.4.1.1 Sampling Procedure

The Contracting Officer will select paint at random from the products that have been delivered to the job site for sample testing. The Contractor shall provide one quart samples of the selected paint materials. The samples shall be taken in the presence of the Contracting Officer, and labeled, identifying each sample. Provide labels in accordance with the paragraph "Packaging, Labeling, and Storage" of this specification.

1.5 REGULATORY REQUIREMENTS

1.5.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

1.5.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.



### 1.5.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

### 1.5.4 Asbestos Content

Materials shall not contain asbestos.

### 1.5.5 Mercury Content

Materials shall not contain mercury or mercury compounds.

### 1.5.6 Silica

Abrasive blast media shall not contain free crystalline silica.

### 1.5.7 Human Carcinogens

Materials shall not contain **ACGIH 0100** confirmed human carcinogens (A1) or suspected human carcinogens (A2).

## 1.6 PACKAGING, LABELING, AND STORAGE

Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons. Paints and thinners shall be stored in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 40 to 95 degrees F. Do not store paint, polyurethane, varnish, or wood stain products with materials that have a high capacity to adsorb VOC emissions. Do not store paint, polyurethane, varnish, or wood stain products in occupied spaces.

## 1.7 SAFETY AND HEALTH

Apply coating materials using safety methods and equipment in accordance with the following:

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

### 1.7.1 Safety Methods Used During Coating Application

Comply with the requirements of **SSPC PA Guide 3**.

### 1.7.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

- a. The applicable **manufacturer's Material Safety Data Sheets** (MSDS) or local regulation.

- b. 29 CFR 1910.1000.
- c. ACGIH 0100, threshold limit values.

#### 1.8 ENVIRONMENTAL CONDITIONS

Comply, at minimum, with manufacturer recommendations for space ventilation during and after installation.

##### 1.8.1 Coatings

Do not apply coating when air or substrate conditions are:

- a. Less than 5 degrees F above dew point;
- b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

##### 1.8.2 Post-Application

Vacate space for as long as possible after application. Wait a minimum of 48 hours before occupying freshly painted rooms.

#### 1.9 COLOR SELECTION

Colors of finish coats shall be as indicated or specified. Where not indicated or specified, colors shall be selected by the Contracting Officer. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors approximate colors indicated and the product conforms to specified requirements.

Tint each coat progressively darker to enable confirmation of the number of coats.

Color, texture, and pattern of wall coating systems shall be as selected.

#### 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.

##### 1.10.1.1 Exterior Painting

Includes new surfaces of the buildings and appurtenances. Also included are existing coated surfaces made bare by cleaning operations.

#### 1.10.1.2 Interior Painting

Includes new surfaces of the buildings and appurtenances as indicated and existing coated surfaces made bare by cleaning operations.

#### 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 Definitions and Abbreviations

##### 1.10.3.1 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.

##### 1.10.3.2 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.

##### 1.10.3.3 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.

##### 1.10.3.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

## 1.10.3.5 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.

## 1.10.3.6 EPP

Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

## 1.10.3.7 EXT

MPI short term designation for an exterior coating system.

## 1.10.3.8 INT

MPI short term designation for an interior coating system.

## 1.10.3.9 micron / microns

The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

## 1.10.3.10 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.

## 1.10.3.11 mm

The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

## 1.10.3.12 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:

<u>Gloss Level</u>	<u>Description</u>	<u>Units at 60 degrees</u>	<u>Units at 85 degrees</u>
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	

<u>Gloss Level</u>	<u>Description</u>	<u>Units at 60 degrees</u>	<u>Units at 85 degrees</u>
G7	High Gloss		

Gloss is tested in accordance with [ASTM D523](#). Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

#### 1.10.3.13 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.

#### 1.10.3.14 Paint

See Coating definition.

#### 1.10.3.15 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

#### 1.10.3.16 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

Conform to the [coating](#) specifications and standards referenced in PART 3. Submit [manufacturer's technical data sheets](#) for specified coatings and solvents. Comply with applicable regulations regarding toxic and hazardous materials.

### PART 3 EXECUTION

#### 3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

#### 3.2 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, 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.

### 3.3 PREPARATION OF METAL SURFACES

#### 3.3.1 Existing and New Ferrous Surfaces

- a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: Solvent clean or detergent wash in accordance with [SSPC SP 1](#) to remove oil and grease. Where shop coat is missing or damaged, clean according to [SSPC SP 2](#), [SSPC SP 3](#), [SSPC SP 6/NACE No.3](#), or [SSPC SP 10/NACE No. 2](#). Brush-off blast remaining surface in accordance with [SSPC SP 7/NACE No.4](#); Use inhibitor as recommended by coating manufacturer to prevent premature rusting. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.
- b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with [SSPC SP 6/NACE No.3](#) /[SSPC SP 12/NACE No.5](#) WJ-3.

#### 3.3.2 Final Ferrous Surface Condition:

For tool cleaned surfaces, the requirements are stated in [SSPC SP 2](#) and [SSPC SP 3](#). As a visual reference, cleaned surfaces shall be similar to photographs in [SSPC VIS 3](#).

For abrasive blast cleaned surfaces, the requirements are stated in [SSPC 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](#).

For waterjet cleaned surfaces, the requirements are stated in [SSPC SP 12/NACE No.5](#). As a visual reference, cleaned surfaces shall be similar to photographs in [SSPC VIS 4/NACE VIS 7](#).

#### 3.3.3 Galvanized Surfaces

- a. New or Existing Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with solvent, steam, or non-alkaline detergent solution in accordance with [SSPC SP 1](#). If the galvanized metal has been passivated or stabilized, the coating shall be completely removed by brush-off abrasive blast. New galvanized steel to be coated shall not be "passivated" or "stabilized" If the absence of hexavalent stain inhibitors is not documented, test as described in [ASTM D6386](#), Appendix X2, and remove by one of the methods described therein.
- b. Galvanized with Slight Coating Deterioration or with Little or No Rusting: Water jetting to [SSPC SP 12/NACE No.5](#) WJ3 to remove loose coating from surfaces with less than 20 percent coating deterioration and no blistering, peeling, or cracking. Use inhibitor as recommended by the coating manufacturer to prevent rusting.
- c. Galvanized With Severe Deteriorated Coating or Severe Rusting: Water jet to [SSPC SP 12/NACE No.5](#) WJ3 degree of cleanliness. Spot abrasive blast rusted areas as described for steel in [SSPC SP 6/NACE No.3](#), and

waterjet to [SSPC SP 12/NACE No.5](#), WJ3 to remove existing coating.

### 3.4 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 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.
- c. Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.
- d. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not to surfaces with droplets of water. Do not apply epoxies to damp vertical surfaces as determined by [ASTM D4263](#) or horizontal surfaces that exceed 3 lbs of moisture per 1000 square feet in 24 hours as determined by [ASTM F1869](#). In all cases follow manufacturers recommendations. Allow surfaces to cure a minimum of 30 days before painting.

### 3.5 APPLICATION

#### 3.5.1 Coating Application

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Apply coating materials in accordance with [SSPC PA 1](#). [SSPC PA 1](#) methods are applicable to all substrates, except as modified herein.

At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application.

Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Use trigger operated spray nozzles for water hoses. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be

coated. Wear protective clothing and respirators when applying oil-based paints or using spray equipment with any paints.

Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

Thoroughly work coating materials into joints, crevices, and open spaces. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.

Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

3.5.2 **Mixing** and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.5.3 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.5.4 Coating Systems

- a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table	
<u>EXTERIOR</u>	
Division 5.	Exterior Metal, Ferrous and Non-Ferrous Paint Table
<u>INTERIOR</u>	
Division 4.	Interior Concrete Masonry Units Paint Table



Table	
Division 5.	Interior Metal, Ferrous and Non-Ferrous 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.

### 3.6 COATING SYSTEMS FOR METAL

Apply coatings of Tables in Division 5 for Exterior and Interior.

- a. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.
- b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.
- c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.
- d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.
- e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.
- f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

### 3.7 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings of Tables in Division 3, 4 and 9 for Exterior and Interior.

### 3.8 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.

### 3.9 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. Set aside extra paint for future color matches or reuse by the Government.

3.10 PAINT TABLES

All DFT's are minimum values. 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>.

3.10.1 EXTERIOR PAINT TABLES

DIVISION 5: EXTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLES			
STEEL/FERROUS SURFACES			
EXTERIOR GALVANIZED SURFACES			
New Galvanized surfaces:			
Waterborne Primer/Latex			
MPI EXT 5.3H-G5 (Semigloss)			
Primer: MPI 134	Intermediate MPI 11	Topcoat: MPI 11	
System DFT: 112 microns 4.5 mils			

3.10.2 INTERIOR PAINT TABLES

DIVISION 4: INTERIOR CONCRETE MASONRY UNITS PAINT TABLE

New Concrete Masonry:			
1. High Performance			
MPI INT 4.2D-G5 (Semigloss)			
Filler: MPI 4	Primer: N/A	Intermediate: MPI 141	Topcoat: MPI 141
System DFT: 275 microns 11			
Fill all holes in masonry surface			

DIVISION 5: INTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

INTERIOR STEEL/FERROUS SURFACES

A. Metal surfaces adjacent to painted surfaces (match surrounding finish) and miscellaneous metal items not otherwise specified except floors, hot metal surfaces and new prefinished equipment:

1. High Performance Architectural Latex

MPI INT 5.1R-G5 (Semigloss)			
Primer: MPI 79	Intermediate: MPI 141	Topcoat: MPI 141	
System DFT: 125 microns 5 mils			

-- End of Section --



SECTION 10 44 10

BUILDING ENUMERATION

01/07

PART 1 GENERAL

1.1 REFERENCES

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

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT)

NCDOT (1995) Standard Specifications for Roads and Structures

1.2 BUILDING ENUMERATION

Shall appear at one points or more on each exterior wall upon completion. Locate signage at either right or left hand corner on the side clearly visible from the street.

1.2.1 On new buildings in the contract which have a rigidly attached new placards.

1.2.2 Deteriorated Placards

Deteriorated placards, in the opinion of the Contracting Officer, shall be classed as debris. Upon removal, new placards shall be provided.

PART 2 PRODUCTS

2.1 NEW PLACARD

Shall be made of aluminum conforming to 6063-T58 which is 1/8-inch thick and of size adequate to provide 1-1/2 inch clear area outside all enumeration. New building number(s) will match existing adjacent building that they serve with a letter designation following, ie "308 A", indicating it is an accessory building.

2.2 THE ENTIRE SIDE

Shall be surfaced with a reflective white finish.

2.3 NUMERALS AND LETTERS

Shall be solid black, five inches high, conforming to NCDOT, Standard Alphabets Series C.

2.4 PAINT

Shall be a product suited for permanent exterior use.

PART 3 EXECUTION

3.1 MOUNTING

Shall be rigid when placed on wall. Two holes 1/4-inch in diameter shall be provided in each sign and used for mounting. Mounting height shall be a minimum of seven feet above grade or shall match height of existing adjacent placards. Location of sign shall be similar to the building they serve at either a right or left hand corner of the side of the building visible from the nearest street.

-- End of Section --

SECTION 10 52 20

FIRE EXTINGUISHERS AND CABINETS

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.

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825 (2002) Approval Guide

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10 (2002) Potable Fire Extinguishers

UNDERWRITERS LABORATORIES (UL)

UL FPED (2002) Fire Protection Equipment Directory

1.2 SYSTEM DESCRIPTION

Provide fire extinguishers in accordance with the required and advisory provisions of NFPA 10, and as specified herein. Fire extinguishers shall be UL FPED listed or FM P7825 approved. In the publications referred to herein, 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 "authority having jurisdiction" shall be interpreted to mean the local fire department.

1.3 SUBMITTALS

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

SD-03 Product Data

Fire extinguishers

Wall Brackets

Submit for each type of fire extinguisher

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site in the manufacturer's original sealed containers or packages, bearing the manufacturer's name and brand designation. handle and store materials to protect them from damage during the entire construction period. Replace all damaged items with new items.

PART 2 PRODUCTS

2.1 DRY CHEMICAL FIRE EXTINGUISHERS

UL 299. Provide stored pressure multi-purpose dry chemical fire extinguishers, equipped with integral pressure indicating gage, 10 pound nominal charge weight having a minimum fire test rating of 2A:20B:C 20 pounds nominal charge weight having a minimum fire test rating of 4A:30B:C.

2.2 WALL BRACKETS

Provide manufacturer standard wall hook fire extinguisher wall bracket.

PART 3 EXECUTION

3.1 INSTALLATION

Install per NFPA 10 requirements. The top of installed extinguishers shall not be more that 5 feet above the finished floor. Provide fire extinguishers fully charged and ready for use.

-- 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.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI Z21.10.1/CSA 4.1 (2009; Addenda A 2009; Addenda B 2011) Gas Water Heaters Vol. I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less
- ANSI Z21.10.3/CSA 4.3 (2011) Gas Water Heaters Vol.III, Storage Water Heaters With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous
- ANSI Z21.22/CSA 4.4 (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 (2010) Energy Standard for Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

- ASSE 1001 (2008) Performance Requirements for Atmospheric Type Vacuum Breakers (ANSI approved 2009)
- ASSE 1003 (2009) Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI approved 2010)
- ASSE 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 1020 (2004; Errata 2004; Errata 2004)  
Performance Requirements for Pressure  
Vacuum Breaker Assembly (ANSI Approved  
2004)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA 10084 (2005) Standard Methods for the  
Examination of Water and Wastewater

AWWA B300 (2010; Addenda 2011) Hypochlorites

AWWA B301 (2010) Liquid Chlorine

AWWA C203 (2008) Coal-Tar Protective Coatings and  
Linings for Steel Water Pipelines - Enamel  
and Tape - Hot-Applied

AWWA C606 (2011) Grooved and Shouldered Joints

AWWA C651 (2005; Errata 2005) Standard for  
Disinfecting Water Mains

AWWA C652 (2011) Disinfection of Water-Storage  
Facilities

AWWA D100 (2011) Welded Steel Tanks for Water Storage

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M (2011) 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 A112.6.1M (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	(2011) Cast Bronze Alloy Threaded Fittings Classes 125 and 250
ASME B16.18	(2012) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(2011) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(2011) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500
ASME B16.29	(2007) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.34	(2009; Supp 2010) Valves - Flanged, Threaded and Welding End
ASME B16.39	(2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B16.4	(2011) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.5	(2009) 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	(2010) Power Piping
ASME B31.5	(2010) Refrigeration Piping and Heat Transfer Components
ASME B40.100	(2005; R 2010) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IV	(2010) BPVC Section IV-Rules for Construction of Heating Boilers
ASME CSD-1	(2009) Control and Safety Devices for

## Automatically Fired Boilers

## ASTM INTERNATIONAL (ASTM)

ASTM A105/A105M	(2011a) 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	(2011a) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A47/A47M	(1999; R 2009) Standard Specification for Ferritic Malleable Iron Castings
ASTM A515/A515M	(2010) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A516/A516M	(2010) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A518/A518M	(1999; R 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 A733	(2003; R 2009e1) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
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 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 B828	(2002; R 2010) Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM B88	(2009) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2005; R 2011) Standard Specification for Seamless Copper Water Tube (Metric)
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 D1785	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2000	(2012) Standard Classification System for Rubber Products in Automotive Applications
ASTM D2235	(2004; R 2011) Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D2239	(2012) Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
ASTM D2241	(2009) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated

	Pipe (SDR Series)
ASTM D2464	(2006) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2564	(2004; R 2009e1) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2661	(2011) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40, Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2665	(2011) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2672	(1996a; R 2009) Joints for IPS PVC Pipe Using Solvent Cement
ASTM D2683	(2010) Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D2737	(2012) Polyethylene (PE) Plastic Tubing
ASTM D2846/D2846M	(2009be1) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D2855	(1996; R 2010) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D2996	(2001; R 2007e1) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D3035	(2010) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3122	(1995; R 2009) Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings
ASTM D3138	(2004; R 2011) Solvent Cements for

	Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components
ASTM D3139	(1998; R 2011) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3212	(2007) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3261	(2010a) Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D4101	(2011) Standard Specification for Polypropylene Injection and Extrusion Materials
ASTM E1	(2007) Standard Specification for ASTM Liquid-in-Glass Thermometers
ASTM F1760	(2001; R 2011) Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
ASTM F2389	(2010) Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems
ASTM F437	(2009) Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F438	(2009) Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F439	(2011) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F441/F441M	(2009) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F442/F442M	(2009) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F477	(2010) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F493	(2010) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe

## and Fittings

- ASTM F628 (2008) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core
- ASTM F877 (2011a) Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
- ASTM F891 (2010) Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core

## CAST IRON SOIL PIPE INSTITUTE (CISPI)

- CISPI 301 (2009) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
- CISPI 310 (2011) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

## COPPER DEVELOPMENT ASSOCIATION (CDA)

- CDA A4015 (1994; R 1995) Copper Tube Handbook

## INTERNATIONAL CODE COUNCIL (ICC)

- ICC IPC (2009) International Plumbing Code

## MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

- MSS SP-110 (2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
- MSS SP-25 (2008) Standard Marking System for Valves, Fittings, Flanges and Unions
- MSS SP-44 (2010; Errata 2011) Steel Pipeline Flanges
- MSS SP-58 (2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
- MSS SP-67 (2011) Butterfly Valves
- MSS SP-69 (2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)
- MSS SP-70 (2011) Gray Iron Gate Valves, Flanged and Threaded Ends
- MSS SP-71 (2011) 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	(2011) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(2008) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(2006) Class 3000 Steel Pipe Unions Socket Welding and Threaded
MSS SP-85	(2011) 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	(2012) 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 31	(2011) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2012) National Fuel Gas Code
NFPA 90A	(2012) 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	(2011) Drinking Water System Components - Health Effects

## PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA Fire Man	(2010) Firestopping: Plastic Pipe in Fire Resistive Construction
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## U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

PL 93-523	(1974; A 1999) Safe Drinking Water Act
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## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 430	Energy Conservation Program for Consumer Products
40 CFR 141.80	National Primary Drinking Water

Regulations; Control of Lead and Copper;  
General Requirements

PL 109-58

Energy Policy Act of 2005 (EPAct05)

1.2 SUBMITTALS

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

SD-03 Product Data

Water heaters

Pumps

Backflow prevention assemblies

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-10 Operation and Maintenance Data

Plumbing System

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 F1760. HDPE pipe shall contain a minimum of 100 percent post-consumer recycled content. Cement pipe shall contain recycled content as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE. Steel pipe shall contain a minimum of 25 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 F2389. 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. 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 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: Copper ASTM A536.
- 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 D2000, maximum temperature 230 degrees F.

- l. Flexible Elastomeric Seals: ASTM D3139, ASTM D3212 or ASTM F477.
- 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 D3138.
- o. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D2235.
- p. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D2564 and ASTM D2855.
- q. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F493.
- 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 D3122.
- t. Copper tubing shall conform to ASTM B88, Type K, L or M.

#### 2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

- a. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.
- b. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.
- c. Hypochlorites: AWWA B300.
- d. Liquid Chlorine: AWWA B301.
- e. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.
- f. Thermometers: ASTM E1. 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
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASME BPVC SEC IV, Part HLW-810: Requirements for Potable-Water Heaters Bottom Drain Valve
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22/CSA 4.4

Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5
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### 2.3.1 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.

### 2.3.2 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22/CSA 4.4. Relief valves for systems where the maximum rate of heat input is less than 200,000 Btuh shall have 3/4 inch minimum inlets, and 3/4 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 200,000 Btuh shall have 1 inch minimum inlets, and 1 inch outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

### 2.3.3 Thermostatic Mixing Valves

Provide thermostatic mixing valve for lavatory faucets. Mixing valves, thermostatic type, pressure-balanced or combination thermostatic and pressure-balanced shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast bronze, and interior parts shall be brass, bronze, corrosion-resisting steel or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 5 degrees F of any setting.

## 2.4 BACKFLOW PREVENTERS

Backflow prevention devices must be approved by the State or local regulatory agencies. If there is no State or local regulatory agency requirements, the backflow prevention devices must be listed by the Foundation for Cross-Connection Control & Hydraulic Research, or any other approved testing laboratory having equivalent capabilities for both laboratory and field evaluation of backflow prevention devices and assemblies.

Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be meet the above requirements.

Backflow preventers with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure principle backflow preventers shall conform to



ASSE 1013. Hose connection vacuum breakers shall conform to ASSE 1011. Pipe applied atmospheric type vacuum breakers shall conform to ASSE 1001. Pressure vacuum breaker assembly shall conform to ASSE 1020. Air gaps in plumbing systems shall conform to ASME A112.1.2.

## 2.5 DRAINS

### 2.5.1 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.

## 2.6 WATER HEATERS

Water heater types and capacities shall be as indicated. Each water heater shall have replaceable anodes. Each primary water heater shall have controls with an adjustable range that includes 90 to 160 degrees F. Each gas-fired water heater and booster water heater shall have controls with an adjustable range that includes 120 to 180 degrees F. Hot water systems utilizing recirculation systems shall be tied into building off-hour controls. The thermal efficiencies and standby heat losses shall conform to TABLE III for each type of water heater specified. The only exception is that storage water heaters and hot water storage tanks having more than 500 gallons storage capacity need not meet the standard loss requirement if the tank surface area is insulated to R-12.5 and if a standing light is not used. Plastic materials polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases. A factory pre-charged expansion tank shall be installed on the cold water supply to each water heater. Expansion tanks shall be specifically designed for use on potable water systems and shall be rated for 200 degrees F water temperature and 150 psi working pressure. The expansion tank size and acceptance volume shall be as indicated.

### 2.6.1 Automatic Storage Type

Heaters shall be complete with control system, temperature gauge, and pressure gauge, and shall have ASME rated combination pressure and temperature relief valve.

#### 2.6.1.1 Gas-Fired Type

Gas-fired water heaters shall conform to ANSI Z21.10.1/CSA 4.1 when input is 75,000 BTU per hour or less or ANSI Z21.10.3/CSA 4.3 for heaters with input greater than 75,000 BTU per hour.

### 2.6.1.2 Indirect Heater Type

Each heater shall be of the counter current flow stainless steel, plate and frame heat exchanger designed and manufactured in accordance with ASME Code Section VIII, Div. 1 for 150 psi @ 302 degrees F. The heat exchanger shall be atmospherically vented with visible leak detection ports. The packaged heater shall be rated for not less than 150 psi on the service water side and not less than 150 PSIG 220 degrees F. on the boiler water side. The plates shall be AISI 316 stainless steel, and the gaskets shall be EPDM material

The heater shall maintain +/- 2 degrees F Max temperature fluctuation from temperature setpoint at 0% to 100 % load at a constant load and +/- 4 degrees F. under normal diversified domestic load conditions. The system shall consist of a 3-way electronic control valve, constant speed domestic water circulator pump, control panel enclosure housing a PID temperature controller with digital indication of shell outlet water temperature, boiler water inlet and boiler water outlet temperatures, digital over-temperature limit switch, and feed-forward and feedback temperature sensors. The controller shall close the control limit switch, and feed-forward and feedback temperature sensors. The controller shall close the control valve in an over temperature condition. The system shall have the following additional characteristics:

- a. Controller temperature setpoint range between 50 degrees F to 180 degrees maximum

The controller shall be capable of native BACnet Communication with the facility EMCS or configured with optional interface and Communications Gateway to act as a interface/translator between the BAS and the communications port of the temperature controller. The following information shall be accessible locally at the controller or remotely via the communications port:

- 1/ Setpoint - can be changed remotely
- Outlet Temperature
- Over Temperature Alarm
- Control Output signal to valve

Each heater shall be supplied by the manufacturer ready to accept existing boiler water and domestic water lines and furnished with the following accessories:

- a. Y-strainers with blowdown valve for boiler water and domestic water.
- b. boiler water strainer differential pressure gauge.
- c. Bronze T & P relief valve, conforming to ANZI Z21.22, set at 150 PSIG/210 degrees F.
- d. Bronze ball type isolation valves.
- e. 3/4 inch bronze domestic water drain valve.
- f. Domestic water Air Vent.
- g. In-place connections for easy and simple cleaning of the plate and frame heat exchanger.

### 2.6.2 Indirect Gas-Fired Water Heater

The WATER HEATER shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.10.3 test standard for

the US and Canada The WATER HEATER shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard. The WATER HEATER shall operate at a minimum of 95% thermal efficiency. The WATER HEATER shall be certified for indoor installation.

The WATER HEATER shall be supplied with a gas valve designed with negative pressure regulation and be equipped with a variable speed blower system, to precisely control the fuel/air mixture to provide modulating WATER HEATER firing rates for maximum efficiency. The WATER HEATER shall operate in a safe condition at a derated output with gas supply pressures as low as 4 inches of water column.

The WATER HEATER shall utilize a 24 VAC control circuit and components. The control system shall have an electronic display for water heater set-up, water heater status, and water heater diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The WATER HEATER shall be equipped with; a high limit temperature control certified to UL353, ASME certified pressure relief valve, outlet water temperature sensor, inlet water temperature sensor, a UL 353 certified flue temperature sensor, low water flow protection and built-in freeze protection. The manufacturer shall verify proper operation of the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping.

The WATER HEATER shall feature a control system with a LCD display, password security, pump exercise, and communication port connection. The WATER HEATER shall feature night setback for the domestic hot water tank and shall be capable of controlling a building recirculation pump while utilizing the night setback schedule for the building recirculation pump. The WATER HEATER shall have the capability to accept a 0-10 VDC input connection for BMS control of modulation or setpoint and enable/disable of the water heater, and a 0-10VDC output of water heater modulation rate. The WATER HEATER shall have a built-in cascading sequencer with modulation logic options of "lead lag" or "efficiency optimized". Both modulation logic options should be capable of rotation while maintaining modulation of up to eight water heaters without utilization of an external controller. Supply voltage shall be 120 volt / 60 hertz / single phase.

The WATER HEATER shall be installed and vented with a:

(a) Direct Vent Sidewall system with a horizontal sidewall termination of both the vent and combustion air. The flue shall be PVC, CPVC or Stainless Steel sealed vent material terminating at the sidewall with the manufacturers specified vent termination. A separate pipe shall supply combustion air directly to the WATER HEATER from the outside. The air inlet pipe may be PVC, CPVC, or Stainless Steel sealed pipe. The air inlet must terminate on the same sidewall with the manufacturer's specified air inlet cap. The WATER HEATER's total combined air intake length shall not exceed 100 equivalent feet. The WATER HEATER's total combined exhaust venting length shall not exceed 100 equivalent feet.

The WATER HEATER shall have an independent laboratory rating for Oxides of Nitrogen (NOx) of 20 ppm or less, corrected to 3% O2.

The WATER HEATER's firing control system shall be M9 Direct Spark Ignition with Electronic Supervision

## 2.7 HOT-WATER STORAGE TANKS

Hot-water storage tanks shall be constructed by one manufacturer, ASME stamped for the working pressure, and shall have the National Board (ASME) registration. The tank shall be cement-lined or glass-lined steel type in accordance with AWWA D100. The heat loss shall conform to TABLE III as determined by the requirements of ASHRAE 90.1 -

IP. Each tank shall be equipped with a thermometer, conforming to ASTM E1, Type I, Class 3, Range C, style and form as required for the installation, and with 7 inch scale. Thermometer shall have a separable socket suitable for a 3/4 inch tapped opening. Tanks shall be equipped with a pressure gauge 6 inch minimum diameter face. Insulation shall be as specified in Section 23 07 00 INSULATION OF MECHANICAL SYSTEMS. Storage tank capacity shall be as shown.

Storage tank shall be a vertical tank having a storage capacity of as indicated on plans. The tank shall be constructed with an inner chamber designed to receive all circulation to and from the water heater to eliminate turbulence in the tank. The baffled tank shall supply 80% of tank capacity without a drop in outlet temperature.

## 2.8 PUMPS

### 2.8.1 Circulating Pumps

Domestic hot water circulating pumps shall be electrically driven, single-stage, centrifugal, with mechanical seals, suitable for the intended service. Pump and motor shall be integrally mounted on a cast-iron or steel subbase, close-coupled with an overhung impeller, or supported by the piping on which it is installed. The shaft shall be one-piece, heat-treated, corrosion-resisting steel with impeller and smooth-surfaced housing of bronze.

Motor shall be totally enclosed, fan-cooled and shall have sufficient horsepower for the service required. Each pump motor shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in cover.

Integral size motors shall be premium efficiency type in accordance with NEMA MG 1. Pump motors smaller than 1 hp Fractional horsepower pump motors shall have integral thermal overload protection in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Guards shall shield exposed moving parts.

## 2.9 ELECTRICAL WORK

Provide electrical motor driven equipment specified complete with motors, motor starters, and controls as specified herein and in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide high efficiency type, single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, corresponding to the applications in accordance with NEMA MG 11. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor.

Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor

torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of the enclosure.

Controllers and contactors shall have auxiliary contacts for use with the controls provided. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers, including the required monitors and timed restart.

Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

## 2.10 MISCELLANEOUS PIPING ITEMS

### 2.10.1 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.

### 2.10.2 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.

#### 2.10.2.1 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.

#### 2.10.2.2 Sleeves Not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

### 2.10.3 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.

### 2.10.4 Nameplates

Provide 0.125 inch thick melamine laminated plastic nameplates, black matte

finish with white center core, for equipment, gages, thermometers, and valves; valves in supplies to faucets will not require nameplates. Accurately align lettering and engrave minimum of 0.25 inch high normal block lettering into the white core. Minimum size of nameplates shall be 1.0 by 2.5 inches. Key nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and schedule.

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA Fire Man. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. A full port ball valve and drain shall be installed on the water service line inside the building approximately 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 12 inches below the 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 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.

### 3.1.2 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 Mechanical Couplings

Mechanical couplings may be used in conjunction with grooved pipe for aboveground, ferrous or non-ferrous, domestic hot and cold water systems, in lieu of unions, brazed, soldered, welded, flanged, or threaded joints.

Mechanical couplings are permitted in accessible locations including behind access plates. Flexible grooved joints will not be permitted, except as vibration isolators adjacent to mechanical equipment. Rigid grooved joints shall incorporate an angle bolt pad design which maintains metal-to-metal contact with equal amount of pad offset of housings upon installation to ensure positive rigid clamping of the pipe.

Designs which can only clamp on the bottom of the groove or which utilize gripping teeth or jaws, or which use misaligned housing bolt holes, or which require a torque wrench or torque specifications will not be permitted.

Rigid grooved pipe couplings shall be for use with grooved end pipes, fittings, valves and strainers. Rigid couplings shall be designed for not less than 125 psi service and appropriate for static head plus the pumping head, and shall provide a watertight joint.

Grooved fittings and couplings, and grooving tools shall be provided from the same manufacturer. Segmentally welded elbows shall not be used. Grooves shall be prepared in accordance with the coupling manufacturer's latest published standards. Grooving shall be performed by qualified grooving operators having demonstrated proper grooving procedures in accordance with the tool manufacturer's recommendations.

The Contracting Officer shall be notified 24 hours in advance of test to demonstrate operator's capability, and the test shall be performed at the work site, if practical, or at a site agreed upon. The operator shall demonstrate the ability to properly adjust the grooving tool, groove the



pipe, and to verify the groove dimensions in accordance with the coupling manufacturer's specifications.

#### 3.1.2.3 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.

#### 3.1.2.4 Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. 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, 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.

#### 3.1.2.5 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.

#### 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 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

#### 3.1.4.1 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 one 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 or masonry wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant.

#### 3.1.4.2 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.

#### 3.1.4.3 Pipe Penetrations

Provide sealants for all pipe penetrations. All pipe penetrations shall be sealed to prevent infiltration of air, insects, and vermin.

#### 3.1.5 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.

#### 3.1.6 Supports

##### 3.1.6.1 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.

##### 3.1.6.2 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.

#### 3.1.6.3 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.

### 3.1.7 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.

### 3.1.8 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 WATER HEATERS AND HOT WATER STORAGE TANKS

### 3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the

tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 6 inches above the top of the tank or water heater.

### 3.2.2 Installation of Gas- and Oil-Fired Water Heater

Installation shall conform to NFPA 54 for gas fired and NFPA 31 for oil fired. Storage water heaters that are not equipped with integral heat traps and having vertical pipe risers shall be installed with heat traps directly on both the inlet and outlet. Circulating systems need not have heat traps installed. An acceptable heat trap may be a piping arrangement such as elbows connected so that the inlet and outlet piping make vertically upward runs of not less than 24 inches just before turning downward or directly horizontal into the water heater's inlet and outlet fittings. Commercially available heat traps, specifically designed by the manufacturer for the purpose of effectively restricting the natural tendency of hot water to rise through vertical inlet and outlet piping during standby periods may also be approved.

### 3.2.3 Heat Traps

Piping to and from each water heater and hot water storage tank shall be routed horizontally and downward a minimum of 2 feet before turning in an upward direction.

### 3.2.4 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

### 3.2.5 Expansion Tank

A pre-charged expansion tank shall be installed on the cold water supply between the water heater inlet and the cold water supply shut-off valve. The Contractor shall adjust the expansion tank air pressure, as recommended by the tank manufacturer, to match incoming water pressure.

### 3.2.6 Direct Fired and Domestic Water Heaters

Notify the Contracting Officer when any direct fired domestic water heater over 400,000 BTU/hour is operational and ready to be inspected and certified.

## 3.3 FIXTURES AND FIXTURE TRIMMINGS

### 3.3.1 Fixture Supports 3.3.2 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with ICC IPC at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment,

and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

### 3.3.3 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.

## 3.4 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.

## 3.5 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 IPC, 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. 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.

### 3.7.2 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 hot potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 4 fps through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. 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. Pump suction and discharge pressures.
- f. Temperature of each domestic hot-water supply.
- g. Operation of each floor and roof drain by flooding with water.
- h. Operation of each vacuum breaker and backflow preventer.
- i. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.
- j. Compressed air readings at each compressor and at each outlet. Each indicating instrument shall be read at 1/2 hour intervals. The report of the test shall be submitted in quadruplicate. The Contractor shall furnish instruments, equipment, and personnel required for the tests; the Government will furnish the necessary water and electricity.

#### 3.7.5 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 and booster pump until the entire system is completely filled.

Test the chlorine residual level in the water at 6 hour intervals for a continuous period of 24 hours. If at the end of a 6 hour interval, the chlorine residual has dropped to less than 25 ppm, flush the piping including tanks with potable water, and repeat the above chlorination procedures. During the chlorination period, each valve and faucet shall be opened and closed several times.

After the second 24 hour period, verify that no less than 25 ppm chlorine residual remains in the treated system. The 24 hour chlorination procedure must be repeated until no less than 25 ppm chlorine residual remains in the treated system.

Upon the specified verification, the system including tanks shall then be flushed with potable water until the residual chlorine level is reduced to less than one part per million. During the flushing period, each valve and faucet shall be opened and closed several times.

Take addition samples of water in disinfected containers, for bacterial examination, at locations specified by the Contracting Officer. Test these samples for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA 10084. The testing method used shall be EPA approved for drinking water systems and shall comply with applicable local and state requirements.

Disinfection shall be repeated until bacterial tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

### 3.8 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 PERFORMANCE OF WATER HEATING EQUIPMENT

Standard rating condition terms are as follows:

EF = Energy factor, minimum overall efficiency.

ET = Minimum thermal efficiency with 70 degrees F delta T.

SL = Standby loss is maximum (Btu/h) based on a 70 degrees F temperature difference between stored water and ambient requirements.

V = Rated volume in gallons

Q = Nameplate input rate in kW (Btu/h)

3.10.1 Storage Water Heaters

3.10.1.1 Gas

- a. Storage capacity of 50 gallons or less shall have a minimum energy factor (EF) of 0.62 or higher per FEMP requirements.
- b. Storage capacity of 20 gallons - or more and input rating of 75,000 Btu/h or less: minimum EF shall be 0.62 - 0.0019V per 10 CFR 430.
- c. Rating of less than 22980 W: (75,000 Btu/h) ET shall be 80 percent; maximum SL shall be  $(0/800+100x(V^{1/2}))$ , per ANSI Z21.10.3/CSA 4.3
- d. Storage capacity over 80 gallons shall be 90% and fully condensing type with maximum SL shall be  $(0/800+100x(V^{1/2}))$ , per ANSI Z21.10.3/CSA 4.3

3.10.2 Unfired Hot Water Storage

All volumes and inputs: shall meet or exceed R-12.5.

3.11 TABLES

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
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	

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
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	
7	Bronze sand casting grooved joint pressure fittings for non-ferrous pipe ASTM B584, for use with	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	

TABLE I							
PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, AND VENT PIPING SYSTEMS							
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F
10	Steel pipe, seamless galvanized, ASTM A53/A53M, Type S,	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	
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 D2661, ASTM F628	X	X	X	X	X	X

TABLE I							
PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, AND VENT PIPING SYSTEMS							
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F
20	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D2665, ASTM F891, (Sch 40) ASTM F1760	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 D4101						X
24	Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D2996						X
SERVICE: A - Underground Building Soil, Waste and Storm Drain B - Aboveground Soil, Waste, Drain In Buildings C - Underground Vent D - Aboveground Vent E - Interior Rainwater Conductors Aboveground F - Corrosive Waste And Vent Above And Belowground * - Hard Temper							

TABLE II					
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS					
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
1	Malleable-iron threaded fittings:				
	a. Galvanized, ASME B16.3 for use with Item 4a	X	X	X	X
	b. Same as "a" but not galvanized for use with Item 4b			X	
2	Grooved pipe couplings, ferrous pipe ASTM A536 and ASTM A47/A47M, non-ferrous pipe, ASTM A536 and ASTM A47/A47M	X	X	X	
3	Ductile iron grooved joint fittings for ferrous pipe ASTM A536 and ASTM A47/A47M, for use with Item 2	X	X	X	
4	Steel pipe:				
	a. Seamless, galvanized, ASTM A53/A53M, Type S, Grade B	X	X	X	X
	b. Seamless, black, ASTM A53/A53M, Type S, Grade B			X	
5	Seamless red brass pipe, ASTM B43	X	X		X
6	Bronze flanged fittings, ASME B16.24 for use with Items 5 and 7	X	X		X
7	Seamless copper pipe, ASTM B42	X	X		X
8	Seamless copper water tube, ASTM B88, ASTM B88M	X**	X**	X**	X***
9	Cast bronze threaded fittings, ASME B16.15 for use with Items 5 and 7	X	X		X



TABLE II					
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS					
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
10	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5, 7 and 8	X	X	X	X
11	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Item 8	X	X	X	X
12	Bronze and sand castings groovedjoint pressure fittings for non-ferrous pipe ASTM B584, for use with Item 2	X	X	X	
13	Polyethylene (PE) plastic pipe, Schedules 40 and 80, based on outside diameter	X			X
14	Polyethylene (PE) plastic pipe (SDR-PR), based on controlled outside diameter, ASTM D3035	X			X
15	Polyethylene (PE) plastic pipe (SIDR-PR), based on controlled inside diameter, ASTM D2239	X			X
16	Butt fusion polyethylene (PE) plastic pipe fittings, ASTM D3261 for use with Items 14, 15, and 16	X			X
17	Socket-type polyethylene fittings for outside diameter-controlled polyethylene pipe, ASTM D2683 for use with Item 15	X			X
18	Polyethylene (PE) plastic tubing, ASTM D2737	X			X
19	Chlorinated polyvinyl chloride (CPVC) plastic hot and cold water distribution system, ASTM D2846/D2846M	X	X		X

TABLE II					
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS					
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
20	Chlorinated polyvinyl chloride (CPVC) plastic pipe, Schedule 40 and 80, ASTM F441/F441M	X	X		X
21	Chlorinated polyvinyl chloride (CPVC) plastic pipe (SDR-PR) ASTM F442/F442M	X	X		X
22	Threaded chlorinated polyvinyl chloride (chloride CPVC) plastic pipe fittings, Schedule 80, ASTM F437, for use with Items 20, and 21	X	X		X
23	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 40, ASTM F438 for use with Items 20, 21, and 22	X	X		X
24	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings Schedule 80, ASTM F439 for use with Items 20, 21, and 22	X	X		X
25	Polyvinyl chloride (PVC) plastic pipe, Schedules 40, 80, and 120, ASTM D1785	X			X
26	Polyvinyl chloride (PVC) pressure-rated pipe (SDR Series), ASTM D2241	X			X
27	Polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40, ASTM D2466	X			X
28	Socket-type polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D2467 for use with Items 26 and 27	X			X

TABLE II					
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS					
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
29	Threaded polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D2464	X			X
30	Joints for IPS PVC pipe using solvent cement, ASTM D2672	X			X
31	Polypropylene (PP) plastic pipe and fittings; ASTM F2389	X	X		X
32	Steel pipeline flanges, MSS SP-44	X	X		
33	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B828	X	X		
34	Carbon steel pipe unions, socket-welding and threaded, MSS SP-83	X	X	X	
35	Malleable-iron threaded pipe unions ASME B16.39	X	X		
36	Nipples, pipe threaded ASTM A733	X	X	X	
37	Crosslinked Polyethylene (PEX) Plastic Pipe ASTM F877	X	X		X
38	Press Fittings: A - Cold Water Service Aboveground B - Hot and Cold Water Distribution 180 degrees F Maximum Aboveground C - Compressed Air Lubricated D - Cold Water Service Belowground Indicated types are minimum wall thicknesses. ** - Type L - Hard *** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors **** - In or under slab floors only brazed joints				

TABLE III STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT				
<u>FUEL</u>	<u>STORAGE CAPACITY GALLONS</u>	<u>INPUT RATING</u>	<u>TEST PROCEDURE</u>	<u>REQUIRED PERFORMANCE</u>
A. STORAGE WATER HEATERS				
Gas	1,000 (Btu/h)/gal max.	75,000 Btu/h min.	ANSI Z21.10.3	ET = 90 percent min. SL = $1.3+38/V$ max.
B. Unfired Hot Water Storage, R-12.5 min.				
C. Instantaneous Water Heater				
Gas	4,000 (btu/h)/gal and 2 gal max.	50,000 Btu/h min 200,000 Btu/h max.	10 CFR 430	EF = $0.62-0.0019V$
Gas	4,000 (btu/h)/gal and 2 gal max.	200,000 Btu/h min.	ANSI Z21.10.3	ET = 90 percent
Gas	4,000 (btu/h)/gal and 2 gal max.	200,000 Btu/h min. 400,000 Btu/h max.	ANSI Z21.10.3	ET = 90 percent SL = $(Q/800+110x(V^{1/2}))$
TERMS:  EF = Energy factor, minimum overall efficiency. ET = Minimum thermal efficiency with 70 degrees F delta T. SL = Standby loss is maximum Btu/h based on a 70 degree F temperature difference between stored water and ambient requirements. V = Rated storage volume in gallons Q = Nameplate input rate in Btu/h				

-- End of Section --

## SECTION 23 03 00

## BASIC MECHANICAL MATERIALS AND METHODS

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 117 (2009) Standing Practice for Operating Salt Spray (Fog) Apparatus

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2012) National Electrical Safety Code

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2012) 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 (2011; Errata 2 2012) National Electrical Code

## 1.2 RELATED REQUIREMENTS

This section applies to all sections of Division 15, "Mechanical" of this project specification, unless specified otherwise in the individual section.

## 1.3 QUALITY ASSURANCE

## 1.3.1 Material and Equipment Qualifications

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

### 1.3.2 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

### 1.3.3 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

### 1.3.4 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

### 1.3.5 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

#### 1.3.5.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

#### 1.3.5.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace

damaged or defective items.

#### 1.5 ELECTRICAL REQUIREMENTS

Furnish motors, controllers, disconnects and contactors with their respective pieces of equipment. Motors, controllers, disconnects and contactors shall conform to and have electrical connections provided under Section 26 20 00, "Interior Distribution System." Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted. Controllers and contactors shall have a maximum of 120 volt control circuits, and shall have auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment. Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 26 20 00, "Interior Distribution System."

#### 1.6 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 (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, the motor control equipment forming a part of motor control centers, and the electrical power circuits shall be provided under Division 16, 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 16.

##### 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, polyphase motors, except motors integral to equipment with a total efficiency rating, shall be selected based on

premium 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 3 phase motors rated one horsepower (.75 kilowatts) 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 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.

#### 1.8 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.

#### 1.9 EQUIPMENT INVENTORY UPDATE

Submit information for each piece of equipment removed and supplied for use of Camp Lejeune to update the Maximo equipment inventory. For the purposes of this paragraph, inventoried equipment is defined as equipment listed on the Maximo Equipment Inventory Update form.

##### 1.9.1 Requirements

The contractor shall prepare and submit one Maximo Equipment Inventory Update form for each individual item of inventoried equipment that is demolished, removed, replaced, or installed. (ex: three new condensing units would require the submission of three Equipment Inventory Update forms. The replacement of two existing air handling units with two new air handling units would require the submission of two Equipment Inventory Update forms). The contractor shall prepare and submit a VAV/TAB Room Number List for each VAV/Tab model installed in a single building. Only one Maximo Equipment Inventory Update form is required for each model of VAV or TAB in a single building.



#### 1.9.1.1 Demolition of all equipment in a structure or facility

When all the inventoried equipment in a building or structure is demolished or removed, and not replaced, an Equipment Inventory Update form is not required.

#### 1.9.1.2 Standards

The contractor shall provide accurate, complete, and legible information on all required forms. All required forms shall be completed and delivered to the Contracting Officer on or before the Beneficial Occupancy Date. All information on Equipment Inventory Update forms shall be obtained by visual inspection of equipment data plate(s).

#### 1.9.1.3 Form Preparation

Each required Maximo Equipment Inventory Update form shall contain the following information:

- (1) The name and telephone number of an individual who can be contacted for clarification or additional information pertaining to the data on the form.
- (2) The date of data collection
- (3) The building or structure identification number and the specific location of the equipment within the structure (ex: 3d deck mech room)
- (4) A check adjacent to the description of the new or replacement item, and a check adjacent to the supplemental description if applicable (ex: circulating pump and HVAC or steam)
- (5) The Maximo number or serial number of the demolished or removed item, if applicable
- (6) All applicable data from the equipment data plate

Each Room Number List form shall contain the following information:

- (1) The name and telephone number of the individual providing the information
- (2) The date the form was completed
- (3) The building or structure identification number
- (4) A check in the box adjacent to each applicable room number

### PART 2 PRODUCTS

Not used.

### PART 3 EXECUTION

#### 3.1 PAINTING OF NEW EQUIPMENT

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

### 3.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B 117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system shall be designed for the temperature service.

### 3.1.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees F shall be cleaned to bare metal.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

- a. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of one mil; and two coats of enamel applied to a minimum dry film thickness of one mil per coat.
- b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F shall receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.
- c. Temperatures Greater Than 400 Degrees F: Metal surfaces subject to temperatures greater than 400 degrees F shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

MAXIMO EQUIPMENT INVENTORY UPDATE

Employee: \_\_\_\_\_ Phone: \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

Bldg: \_\_\_\_\_ Specific Location: \_\_\_\_\_

- AC, Computer Room
- AC, Package
- AC, Package Terminal
- Assembly, Trap line
- Backflow Preventer
- Boiler
- Chiller, Air Cooled Recip
- Chiller, Air Cooled Screw
- Chiller, Air Cooled Scroll
- Chiller, Water Cooled Recip
- Chiller, Water Cooled Screw
- Compressor, Control Air
- Compressor, Industrial Air
- Dryer, Refrigerated Air
- Exchanger, Heat
- Evaporator, Freezer
- Evaporator, Refrigerator
- Fan, Exhaust
- Generator
- Heater, Space
- Heater, Unit
- Heat Pump, Geo-Thermal
- Heat Pump, Indoor Unit
- Heat Pump, Outdoor Unit
- Heat Pump, Package
- Heat Pump, Package Terminal
- Pump, Circulating, Chilled Water
- Pump, Circulating, Domestic Water
- Pump, Circulating, Dual Temp Water
- Pump, Circulating, Heating Water
- Pump, Condensate
- Pump, Sump
- Regulator, Temperature
- Tank, Hot Water Storage
- Tower, Cooling
- Unit, Air Handling
- Unit, AC Condensing
- Unit, Freezer Condensing
- Unit, Refrigerator Condensing
- Unit, Fan Coil
- Unit, TAB (Attach Room No. List)
- Unit, VAV (Attach Room No. List)
- Valve, Pressure Reducing
- Valve, Steam Pilot
- Water Heater

**Demolished/Removed Equipment**

Maximo no: \_\_\_\_\_ or Ser no: \_\_\_\_\_

**New Equipment**

Manufacturer: \_\_\_\_\_

Model no: \_\_\_\_\_

Ser no: \_\_\_\_\_

Type: \_\_Elec \_\_Oil \_\_LP Gas \_\_Nat Gas \_\_Steam \_\_Water \_\_Air

Motor Data: HP\_\_\_\_ Volts\_\_\_\_ Phase\_\_\_\_ RLA\_\_\_\_ RPM\_\_\_\_ Frame\_\_\_\_

Tons\_\_\_\_ No. of Motors\_\_\_\_ no. of Belts\_\_\_\_ Belt size(s)\_\_\_\_ CFM\_\_\_\_

KW\_\_\_\_ Refrig type\_\_\_\_ Refrig Qty\_\_\_\_ Filter Size(s)\_\_\_\_\_

## VAV/TAB Room Number List

Employee: \_\_\_\_\_

Phone: \_\_\_\_\_

Bldg: \_\_\_\_\_

Date: \_\_\_\_\_

VAV/TAB Model Number: \_\_\_\_\_

100 <input type="checkbox"/>	130 <input type="checkbox"/>	160 <input type="checkbox"/>	200 <input type="checkbox"/>	230 <input type="checkbox"/>	260 <input type="checkbox"/>	300 <input type="checkbox"/>	330 <input type="checkbox"/>	360 <input type="checkbox"/>
101 <input type="checkbox"/>	131 <input type="checkbox"/>	161 <input type="checkbox"/>	201 <input type="checkbox"/>	231 <input type="checkbox"/>	261 <input type="checkbox"/>	301 <input type="checkbox"/>	331 <input type="checkbox"/>	361 <input type="checkbox"/>
102 <input type="checkbox"/>	132 <input type="checkbox"/>	162 <input type="checkbox"/>	202 <input type="checkbox"/>	232 <input type="checkbox"/>	262 <input type="checkbox"/>	302 <input type="checkbox"/>	332 <input type="checkbox"/>	362 <input type="checkbox"/>
103 <input type="checkbox"/>	133 <input type="checkbox"/>	163 <input type="checkbox"/>	203 <input type="checkbox"/>	233 <input type="checkbox"/>	263 <input type="checkbox"/>	303 <input type="checkbox"/>	333 <input type="checkbox"/>	363 <input type="checkbox"/>
104 <input type="checkbox"/>	134 <input type="checkbox"/>	164 <input type="checkbox"/>	204 <input type="checkbox"/>	234 <input type="checkbox"/>	264 <input type="checkbox"/>	304 <input type="checkbox"/>	334 <input type="checkbox"/>	364 <input type="checkbox"/>
105 <input type="checkbox"/>	135 <input type="checkbox"/>	165 <input type="checkbox"/>	205 <input type="checkbox"/>	235 <input type="checkbox"/>	265 <input type="checkbox"/>	305 <input type="checkbox"/>	335 <input type="checkbox"/>	365 <input type="checkbox"/>
106 <input type="checkbox"/>	136 <input type="checkbox"/>	166 <input type="checkbox"/>	206 <input type="checkbox"/>	236 <input type="checkbox"/>	266 <input type="checkbox"/>	306 <input type="checkbox"/>	336 <input type="checkbox"/>	366 <input type="checkbox"/>
107 <input type="checkbox"/>	137 <input type="checkbox"/>	167 <input type="checkbox"/>	207 <input type="checkbox"/>	237 <input type="checkbox"/>	267 <input type="checkbox"/>	307 <input type="checkbox"/>	337 <input type="checkbox"/>	367 <input type="checkbox"/>
108 <input type="checkbox"/>	138 <input type="checkbox"/>	168 <input type="checkbox"/>	208 <input type="checkbox"/>	238 <input type="checkbox"/>	268 <input type="checkbox"/>	308 <input type="checkbox"/>	338 <input type="checkbox"/>	368 <input type="checkbox"/>
109 <input type="checkbox"/>	139 <input type="checkbox"/>	169 <input type="checkbox"/>	209 <input type="checkbox"/>	239 <input type="checkbox"/>	269 <input type="checkbox"/>	309 <input type="checkbox"/>	339 <input type="checkbox"/>	369 <input type="checkbox"/>
110 <input type="checkbox"/>	140 <input type="checkbox"/>	170 <input type="checkbox"/>	210 <input type="checkbox"/>	240 <input type="checkbox"/>	270 <input type="checkbox"/>	310 <input type="checkbox"/>	340 <input type="checkbox"/>	370 <input type="checkbox"/>
111 <input type="checkbox"/>	141 <input type="checkbox"/>	171 <input type="checkbox"/>	211 <input type="checkbox"/>	241 <input type="checkbox"/>	271 <input type="checkbox"/>	311 <input type="checkbox"/>	341 <input type="checkbox"/>	371 <input type="checkbox"/>
112 <input type="checkbox"/>	142 <input type="checkbox"/>	172 <input type="checkbox"/>	212 <input type="checkbox"/>	242 <input type="checkbox"/>	272 <input type="checkbox"/>	312 <input type="checkbox"/>	342 <input type="checkbox"/>	372 <input type="checkbox"/>
113 <input type="checkbox"/>	143 <input type="checkbox"/>	173 <input type="checkbox"/>	213 <input type="checkbox"/>	243 <input type="checkbox"/>	273 <input type="checkbox"/>	313 <input type="checkbox"/>	343 <input type="checkbox"/>	373 <input type="checkbox"/>
114 <input type="checkbox"/>	144 <input type="checkbox"/>	174 <input type="checkbox"/>	214 <input type="checkbox"/>	244 <input type="checkbox"/>	274 <input type="checkbox"/>	314 <input type="checkbox"/>	344 <input type="checkbox"/>	374 <input type="checkbox"/>
115 <input type="checkbox"/>	145 <input type="checkbox"/>	175 <input type="checkbox"/>	215 <input type="checkbox"/>	245 <input type="checkbox"/>	275 <input type="checkbox"/>	315 <input type="checkbox"/>	345 <input type="checkbox"/>	375 <input type="checkbox"/>
116 <input type="checkbox"/>	146 <input type="checkbox"/>		216 <input type="checkbox"/>	246 <input type="checkbox"/>		316 <input type="checkbox"/>	346 <input type="checkbox"/>	
117 <input type="checkbox"/>	147 <input type="checkbox"/>		217 <input type="checkbox"/>	247 <input type="checkbox"/>		317 <input type="checkbox"/>	347 <input type="checkbox"/>	
118 <input type="checkbox"/>	148 <input type="checkbox"/>		218 <input type="checkbox"/>	248 <input type="checkbox"/>		318 <input type="checkbox"/>	348 <input type="checkbox"/>	
119 <input type="checkbox"/>	149 <input type="checkbox"/>		219 <input type="checkbox"/>	249 <input type="checkbox"/>		319 <input type="checkbox"/>	349 <input type="checkbox"/>	
120 <input type="checkbox"/>	150 <input type="checkbox"/>		220 <input type="checkbox"/>	250 <input type="checkbox"/>		320 <input type="checkbox"/>	350 <input type="checkbox"/>	
121 <input type="checkbox"/>	151 <input type="checkbox"/>		221 <input type="checkbox"/>	251 <input type="checkbox"/>		321 <input type="checkbox"/>	351 <input type="checkbox"/>	
122 <input type="checkbox"/>	152 <input type="checkbox"/>		222 <input type="checkbox"/>	252 <input type="checkbox"/>		322 <input type="checkbox"/>	352 <input type="checkbox"/>	
123 <input type="checkbox"/>	153 <input type="checkbox"/>		223 <input type="checkbox"/>	253 <input type="checkbox"/>		323 <input type="checkbox"/>	353 <input type="checkbox"/>	
124 <input type="checkbox"/>	154 <input type="checkbox"/>		224 <input type="checkbox"/>	254 <input type="checkbox"/>		324 <input type="checkbox"/>	354 <input type="checkbox"/>	
125 <input type="checkbox"/>	155 <input type="checkbox"/>		225 <input type="checkbox"/>	255 <input type="checkbox"/>		325 <input type="checkbox"/>	355 <input type="checkbox"/>	
126 <input type="checkbox"/>	156 <input type="checkbox"/>		226 <input type="checkbox"/>	256 <input type="checkbox"/>		326 <input type="checkbox"/>	356 <input type="checkbox"/>	
127 <input type="checkbox"/>	157 <input type="checkbox"/>		227 <input type="checkbox"/>	257 <input type="checkbox"/>		327 <input type="checkbox"/>	357 <input type="checkbox"/>	
128 <input type="checkbox"/>	158 <input type="checkbox"/>		228 <input type="checkbox"/>	258 <input type="checkbox"/>		328 <input type="checkbox"/>	358 <input type="checkbox"/>	
129 <input type="checkbox"/>	159 <input type="checkbox"/>		229 <input type="checkbox"/>	259 <input type="checkbox"/>		329 <input type="checkbox"/>	359 <input type="checkbox"/>	

**Instructions**

- (1) Confirm room numbers by visual inspection
- (2) Check the box next to each applicable room number

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 (2011) 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 1 2009; Update 2 2011) 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 Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

ASME B16.22 (2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B16.26 (2011) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes

ASME B16.3 (2011) 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 B16.5 (2009) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B16.9	(2007) Standard for Factory-Made Wrought Steel Butt Welding Fittings
ASME B31.3	(2010) Process Piping
ASME B40.100	(2005; R 2010) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IX	(2010) BPVC Section IX-Welding and Brazing Qualifications

## ASTM INTERNATIONAL (ASTM)

ASTM A106/A106M	(2011) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A126	(2004; R 2009) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A197/A197M	(2000; R 2011) Standard Specification for Cupola Malleable Iron
ASTM A234/A234M	(2011a) 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 2011) Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650 degrees F (350 degrees C)
ASTM A307	(2010) 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 A480/A480M	(2011b) Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A563	(2007a) 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 B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B62	(2009) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B88	(2009) Standard Specification for Seamless Copper Water Tube
ASTM C109/C109M	(2011a) 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 D2308	(2007) Standard Specification for Thermoplastic Polyethylene Jacket for Electrical Wire and Cable
ASTM E1	(2007) Standard Specification for ASTM Liquid-in-Glass Thermometers
ASTM E814	(2011a) Standard Test Method for Fire Tests of Through-Penetration Fire Stops
ASTM F104	(2011) Standard Classification System for Nonmetallic Gasket Materials

## FLUID SEALING ASSOCIATION (FSA)

FSA-0017	(1995e6) Standard for Non-Metallic Expansion Joints and Flexible Pipe Connectors Technical Handbook
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## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 515	(2011) Standard for the Testing, Design, Installation, and Maintenance of
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Electrical Resistance Heat Tracing for Industrial Applications

IEEE C2 (2012) 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 (2011) Butterfly Valves

MSS SP-69 (2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

MSS SP-71 (2011) Gray Iron Swing Check Valves, Flanged and Threaded Ends

MSS SP-72 (2010) Ball Valves with Flanged or Butt-Welding Ends for General Service

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2012) 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 (2011; Errata 2 2012) National Electrical Code

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-C-18480 (1982; Rev B; Notice 2 2009) Coating Compound, Bituminous, Solvent, Coal-Tar Base

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	(2003; Reprint Mar 2010) Fire Tests of Through-Penetration Firestops
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## 1.2 GENERAL REQUIREMENTS

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 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.

## 1.3 SUBMITTALS

Submit the following in accordance with Section [01 33 00 SUBMITTAL PROCEDURES](#):

[SD-02 Shop Drawings](#)

Submit the following for pipes, valves and specialties showing conformance with the referenced standards contained within this section.

## Coordination 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-06 Test Reports

Submit test reports on the following tests in accordance with paragraph entitled, "Piping Installation," of this section.

Hydrostatic Tests

System Operation 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 REQUIREMENTS

Furnish motors, controllers, disconnects and contactors with their respective pieces of equipment. Motors, controllers, disconnects and contactors shall conform to and have electrical connections provided under Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted. Controllers and contactors shall have a maximum of 120 volt control circuits, and shall

have auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment. Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

#### 1.7 ELECTRICAL INSTALLATION REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

##### 1.7.1 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.

##### 1.7.2 Modifications to Existing Systems

Where existing mechanical systems and motor-operated equipment require modifications, provide electrical components under Division 26.

##### 1.7.3 High Efficiency Motors

###### 1.7.3.1 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.

###### 1.7.3.2 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.

##### 1.7.4 Three-Phase Motor Protection

Provide controllers for motors rated 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.

## 1.8 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 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.

## 1.9 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 D2308](#).

Provide heater with self-regulating factor of at least 90percent, in order to provide energy conservation and to prevent overheating.

Heater shall operate on line voltages of 120 volts without the use of transformers.

Size Heater according to the following table:

Pipe Size (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

Pipe Size (Inch, Diameter)	Minus 10 degrees F	Minus 20 degrees F
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.

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 CPR, Copper

#### 2.2.2.1 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.

#### 2.2.2.2 Type CPR-U, Copper Under Ground (Domestic Cold Water Only)

Provide Type K seamless copper tube piping, conforming to ASTM B88. Socket-joint fittings shall be wrought copper, conforming to ASME B16.22. Fittings for connection to corporation cocks shall be cast bronze, flared-type, conforming to ASME B16.26. Joints shall be brazed.

#### 2.2.2.3 Type CPR-INS, Copper Under Ground Insulated

Provide insulated Type K seamless copper tube piping conforming to ASTM B88. Socket-joint fittings shall be wrought copper, conforming to ASME B16.22. Joints shall be brazed.

Provide insulation not less than 2 inches thick, suitable for continuous service temperatures of not less than 250 degrees F. Insulation shall be factory-molded, closed-cell polyurethane foam of not less than 2.5 pounds per cubic foot density. Insulation shall be waterproofed with an extruded rigid Type II virgin polyvinylchloride, with minimum wall thickness of 60 mils through 4 inches outside diameter, 85 mils through 6.625 inches and 110 mils through 12.750 inches. Provide fitting covers fabricated from the same materials and thickness as adjacent pipe covering according to the manufacturer's directions.

## 2.3 PIPING SPECIALTIES

### 2.3.1 Air Separator

Commercially constructed separator shall be designed and certified to separate not less than 80 percent of entrained air on the first passage of water and not less than 80 percent of residual on each successive pass. Provide shop drawings detailing all piping connections proposed for this work.

### 2.3.2 Air Vents

Manual air vents shall be 3/8-inch ball 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 or ASTM A480/A480M. 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 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.

### 2.3.4 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.

Fill arches with soft chloroprene.

Joint, single-arch, movement limitations and size-related, pressure characteristics shall conform to FSA-0017.

### 2.3.5 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.

Unit pipe lengths, face-to-face, shall be not less than the following:

<u>INSIDE DIAMETER</u>	<u>UNIT PIPE LENGTH</u>
To 2-1/2 inches, inclusive	12 inches
3 to 4 inches, inclusive	18 inches
5 to 12 inches, inclusive	24 inches
To 3 inches, inclusive	18 inches
4 to 10 inches, inclusive	24 inches
12 inches and larger	36 inches

### 2.3.6 Flexible Metallic Pipe

Flexible pipe shall be the bellows-type with wire braid cover and designed, constructed, and rated in accordance with the applicable requirements of ASME B31.3.

Working pressure minimum rating shall be 100 psi at 300 degrees F.

Minimum burst pressure shall be four times working pressure at 300 degrees F. Bellows material shall be AISI Type 316L corrosion-resistant steel. Braid shall be AISI 300 series corrosion-resistant steel wire.

Welded end connections shall be Schedule 80 carbon steel pipe, 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.

### 2.3.7 Metallic Expansion Joints

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.

Butt weld end preparation of expansion joints shall conform to the same codes and standards requirements as applicable to the piping system materials at the indicated joint location.

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.

#### 2.3.8 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.

### 2.3.9 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.

### 2.3.10 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.

### 2.3.11 Thermometers

Thermometers shall conform to ASTM E1, 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. Thermometer range shall be 0-200. Provide thermometers with nonferrous separable wells. Provide lagging extension to accommodate insulation thickness.

### 2.3.12 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.

Provide manual air vent cocks in cap of each strainer.

### 2.3.13 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 iron conforming to Class 30 [ASTM A278/A278M](#). 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.

#### 2.3.14 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. Screwed 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.

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, 1 piece body 1B, vertically split body 1C, top entry 1D, three piece body 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. 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 lever handle, 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 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 lever-weighted, positive-closure devices and valve ends shall be flanged.

#### 2.4.4 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](#) fitted with 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 setscrews for maintaining a fixed position against a surface.

#### 2.5.5 Flange Gaskets

Compressed non-asbestos sheet, conforming to ASTM F104, coated on both sides with graphite or similar lubricant, with nitrile composition, binder rated to 750 degrees F.

#### 2.5.6 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 minimum

### 2.5.7 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 Beam Clamps

Beam clamps shall be center-loading MSS SP-58 Type 20, 21, 28, 29 or 30.

When it is not possible to use center-loading beam clamps, eccentric-loading beam clamps, MSS SP-58 Type 19,20,25 or27 may be used for

piping sizes 2 inches and less and for piping sizes 2 through 10 inches provided two counterbalancing clamps are used per point of pipe support. Where more than one rod is used per point of pipe support, rod diameter shall be determined in accordance with referenced standards.

#### 2.6.1.3 C-Clamps

Do not use C-clamps.

#### 2.6.1.4 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, 3, or 4 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 44 through 46 or 49 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 be of commercially available, proprietary design, rolled steel.

### 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, Pneumatic Tests, Non-Destructive Electric 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) with gaskets rated for the service.

Make final connections to equipment with unions or flanges 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:

<u>PIPE SIZE</u> <u>INCHES</u>	<u>ROD SIZE</u> <u>INCHES</u>	<u>STEEL PIPE</u> <u>FEET</u>	<u>COPPER PIPE</u> <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
8 to 12	7/8	20	20
14 to 18	1	20	20
20 and over	1-1/4	20	20

Provide vibration isolation supports where needed.

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.

#### 3.5 SLEEVES

Provide sleeves where piping passes through roofs, masonry, concrete walls and floors.

Sleeves passing through steel decks shall be continuously welded 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 E814 and UL 1479.

Exterior wall sleeves shall be calked watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed metal components.

Sleeve height above roof surface shall be a minimum of 12 and a maximum of 18 inches.

### 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 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.

Vertical downspouts; soil, waste, and vent stacks; water risers; and similar work shall be properly supported on approved piers at the base and provided with approved structural supports attached to building construction.

### 3.8 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.

### 3.9 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.

### 3.10 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.

#### 3.10.1 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, design the factory painting system for the temperature service.

### 3.10.2 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.

-- End of Section --



## SECTION 23 05 92

## TESTING/ADJUSTING/BALANCING: SMALL HEATING/VENTILATING/COOLING SYSTEMS

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.

## ASSOCIATED AIR BALANCE COUNCIL (AABC)

**AABC MN-1** 1989 National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems

## NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

**NEBB Procedural Stds** 1991 Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

## SHEET METAL &amp; AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

**SMACNA TAB HVAC Sys** 1993 HVAC Systems - Testing, Adjusting and Balancing

## 1.2 DESCRIPTION OF WORK

The work includes testing, adjusting, and balancing (TAB) of new and existing heating, ventilating, and cooling (HVAC) air and water distribution systems including equipment, ducts, and piping which are located within, on, under, between, and adjacent to buildings.

## 1.2.1 Air Distribution Systems

Systems shall be tested, adjusted, and balanced (TAB'd) in compliance with this section. Obtain Contracting Officer's written approval before applying insulation to exterior of air distribution systems under Section **23 07 00**, "Insulation for Mechanical Systems."

## 1.2.2 Water Distribution Systems

Systems shall be TAB'd in compliance with this section. Obtain Contracting Officer's written approval before applying insulation to water distribution systems under Section **23 07 00**, "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. Piping insulation shall terminate immediately adjacent to each flow control valve, automatic control valve, or device. For chilled water and chilled-hot water piping, the ends of pipe insulation and the space between ends of pipe insulation and piping shall be sealed with waterproof vapor barrier

coating. After completion of work under this section, the flow control valves and devices shall be insulated under Section 23 07 00, "Insulation for Mechanical Systems."

### 1.3 DEFINITIONS

- a. TAB team supervisor: TAB team engineer.
- b. TAB team technician: TAB team assistant.
- c. Field check group: One or more systems of the same basic type; the subgroup of a "field check group" is a "system."
- d. Out-of-tolerance data: Pertains only to field checking of certified DALT or TAB report. The term is defined as a measurement taken during field checking which does not fall within the range of plus 10 to minus 10 percent of the design for a specific parameter.

### 1.4 SUBMITTALS

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

#### SD-06 Test Reports

##### Certified TAB Report

#### 1.4.1 Certified TAB Report

Submit certified TAB report with a certification statement which attests that the procedures executed have been in full compliance with the requirements of NEBB Procedural Stds, AABC MN-1, or SMACNA TAB HVAC Sys. Certifications shall further attest that any/all known deficiencies in operation, performance, or water/air flows are clearly identified herein. The report shall be reported in the specified format including the following data:

- a. Report Format: Submit completed report forms for each of the following; as a minimum, report all data as contained on standard NEBB Procedural Stds, AABC MN-1, OR SMACNA TAB HVAC Sys report forms as contained within the referenced standards:
  - (1) Air Systems
    - (a) Fan report for rooftop units, central air handlers, exhaust fans, fan coil units, heat pumps, packaged terminal units.
  - (2) Water Systems
    - (a) All pumps.
    - (b) All flow control balancing valves, circuit setters, flow orifices, venturis - report size, flow, measured pressure drop, setting, manufacturer, model.
    - (c) Hot water, chilled water coils.
    - (d) Hot water converters, heat exchangers.



(e) Unit heaters, convectors, fan coil units, fin tube radiation.

The report shall be neatly bound with a waterproof cover. It shall contain a table of contents, with each page numbered. All report data shall be typed - handwritten data will not be acceptable.

b. Temperatures: On each TAB report form reporting TAB work accomplished on HVAC thermal energy transfer equipment, include the indoor and outdoor dry bulb temperature range and indoor and outdoor wet bulb temperature range within the TAB data was recorded.

c. Instruments: List the types of instruments actually used to measure the TAB data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

## 1.5 QUALITY ASSURANCE

### 1.5.1 Modifications of References

Accomplish work in accordance with referenced publications of AABC or NEBB except as modified by this section. In the references referred to herein, consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may" wherever they appear. Interpret reference to the "authority having jurisdiction," the "Administrative Authority," the "Owner," or the "Design Engineer" to mean the "Contracting Officer."

## PART 2 PRODUCTS

Not used.

## PART 3 EXECUTION

### 3.1 TAB PROCEDURES

#### 3.1.1 TAB Field Work

Test, adjust, and balance the listed HVAC systems to the state of operation indicated on and specified in the contract design documents. Air systems and water systems shall be proportionately balanced and reported in the certified TAB report. Provide instruments and consumables required to accomplish the TAB work. Conduct TAB work, including sound measurement work, on the listed HVAC systems in conformance with the AABC MN-1, or NEBB Procedural Stds, except as modified by this section:

a. Workmanship: Conduct TAB work on specified HVAC systems until measured parameters are within plus or minus 10 percent of the design values, that is, the values specified or indicated on the contract documents.

#### 3.1.2 Data From TAB Field Work

After all TAB work has been completed, prepare a handwritten certified, pre-final TAB report using all report forms complete as specified for the final certified TAB report. Except as approved otherwise by the

Contracting Officer, in writing, the TAB work and the TAB report shall be considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph titled "Workmanship."

### 3.1.3 Quality Assurance For TAB Field Work

#### 3.1.3.1 Field Check

Verbally notify the Contracting Officer that the field check of the pre-final, handwritten report can commence; give this verbal notice 48 hours in advance of when the field check of the pre-final report can commence. Do not schedule the field check of the pre-final report until the TAB work is accomplished to within the accuracy range specified in the paragraph titled "Workmanship" or written approval of the deviations from the requirements has been received from the Contracting Officer.

- a. Recheck: During field check the Contractor shall recheck, in the presence of the Contracting Officer, random selections of all reported data recorded in the pre-final report.
- b. Areas of Recheck: Points and areas of recheck shall be selected by the Contracting Officer.
- c. Procedures: Measurements and test procedures shall be the same as was used for forming basis of the pre-final report.
- d. Recheck Selections: Selections for recheck will not exceed 25 percent of the total number of reported data entries tabulated in the pre-final report.

#### 3.1.3.2 Retests

If random tests reveal a measured value which is an out-of-tolerance quantity, the report is subject to disapproval at the Contracting Officers' discretion. In the event the report is disapproved, all systems shall be readjusted and tested; new data recorded; a new pre-final report submitted; and a new field check conducted at no additional cost to the Government.

#### 3.1.3.3 Out-of-Tolerance Quantity

Out-of-tolerance quantity pertains to field checking of the pre-final report. The term is defined as measurement taken during field checking which does not fall within the range of plus 10 to minus 10 percent of the design for the specific parameter.

#### 3.1.3.4 Report Acceptance

On completion, and approval, of the pre-final report field check, the Contractor shall prepare, assemble, and submit the final certified TAB report in the required format for final review/approval.

### 3.2 MARKING OF SETTINGS

Permanently mark the settings of HVAC adjustment devices including valves, splitters, and dampers so that adjustment can be restored if disturbed at any time. The permanent markings shall indicate the settings on the adjustment devices which result in the data reported on the submitted certified TAB report.

### 3.3 MARKING OF TEST PORTS

The TAB team shall permanently and legibly mark and identify the location points of the duct test ports. If the ducts have exterior insulation, these markings shall be made on the exterior side of the duct insulation. The location of test ports shall be shown on the as-built mechanical drawings with dimensions given where the test port is covered by exterior insulation.

-- End of Section --



## SECTION 23 07 00

## INSULATION OF MECHANICAL SYSTEMS

03/11

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 240/A 240M	(1996) Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 177	(1985; R 1997) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
ASTM C 195	(1995) Mineral Fiber Thermal Insulating Cement
ASTM C 533	(1995) Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 534	(1994) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 547	(1995) Mineral Fiber Preformed Pipe Insulation
ASTM C 552	(1991) Cellular Glass Thermal Insulation
ASTM C 553	(1992) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 578	(2009e1) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 592	(1980) Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)

ASTM C 612	(1993) Mineral Fiber Block and Board Thermal Insulation
ASTM C 916	(1985; R 1990) Adhesives for Duct Thermal Insulation
ASTM C 1136	(1995) Flexible, Low permeance Vapor Retarders for Thermal Insulation
ASTM D 828	(1993) Tensile Breaking Strength of Paper and Paperboard
ASTM E 84	(2000a) Surface Burning Characteristics of Building Materials
ASTM E 96	(1997; Rev A) Water Vapor Transmission of Materials

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS L-P-535	(Rev. E; Notice 2) Plastic Sheet (Sheeting): Plastic Strip: Poly (Vinyl Chloride) and Poly(Vinyl Chloride-Vinyl Acetate), Rigid
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## U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-3316	(Rev. C; Am. 2) Adhesives, Fire-Resistant, Thermal Insulation
MIL-C-19565	(Rev. C; Am. 1) Coating Compounds, Thermal Insulation, Fire- and Water-Resistant, Vapor Barrier
MIL-C-20079	(Rev. H) Cloth, Glass: Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass
MIL-A-24179	(Rev. A) (Valid Notice 1) Adhesive, Flexible Unicellular-Plastic Thermal Insulation

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 255	(1996) Surface Burning Characteristics of Building Materials
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## UNDERWRITERS LABORATORIES (UL)

UL 723	(1996) Surface Burning Characteristics of Building Materials
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## 1.2 SYSTEM DESCRIPTION

Provide new and modify existing field-applied insulation for heating, ventilating, and cooling (HVAC) air distribution systems and piping systems which are located within, on, under, and adjacent to buildings; and for plumbing piping systems.

### 1.2.1 Air Distribution System

Obtain Contracting Officer's written approval of systems under Section 23 05 92, "Testing/Adjusting/Balancing: Small Heating/Ventilating/Cooling Systems" before applying field-applied insulation to air distribution systems.

### 1.2.2 Piping Systems

Obtain Contracting Officer's written approval of HVAC water distribution systems under Section 23 05 92, "Testing/Adjusting/Balancing: Small Heating/Ventilating/Cooling Systems" before applying field-applied insulation to HVAC water distribution systems. At the Contractor's option and with Contracting Officer's written approval, the piping systems may be insulated before systems are tested, adjusted, and balanced (TAB'd). Piping insulation shall terminate immediately adjacent to each flow control valve, automatic control valve, or device. For chilled water and chilled-hot water piping, the ends of pipe insulation and the space between ends of pipe insulation and piping shall be sealed with waterproof vapor barrier coating. After systems are TAB'd, the control valves and devices shall be insulated.

## 1.3 DEFINITIONS

### 1.3.1 Finished Spaces

Spaces used for habitation or occupancy where rough surfaces are plastered, panelled, or otherwise treated to provide a pleasing appearance.

### 1.3.2 Unfinished Spaces

Spaces used for storage or work areas where appearance is not a factor, such as unexcavated spaces and crawl space.

### 1.3.3 Concealed Spaces

Spaces out of sight. For example, above ceilings; below floors; between double walls; furred-in areas; pipe and duct shafts; and similar spaces.

### 1.3.4 Exposed

Open to view. For example, pipe running through a room and not covered by other construction.

### 1.3.5 Fugitive Treatments

Treatment subject to deterioration due to aging, moisture, high humidity, oxygen, ozone, and heat. Fugitive materials are entrapped materials that can cause deterioration, such as solvents and water vapor.

### 1.3.6 Outside

Open to view up to 5 feet beyond the exterior side of walls, above the roof, and unexcavated or crawl spaces.

### 1.3.7 Conditioned Space

An area, room or space normally occupied and being heated or cooled for

human habitation by any equipment.

#### 1.4 SUBMITTALS

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

##### SD-03 Product Data

Piping insulation

Piping insulation finishes

Accessory materials

Adhesives, sealants, and coating compounds

#### 1.5 QUALITY ASSURANCE

Every package or standard container of insulation, jackets, cements, adhesives, and coatings delivered to the project site shall have the manufacturer's stamp or label attached giving name of manufacturer, brand and description of material. Insulation packages and containers shall be asbestos-free.

#### 1.6 FLAME-SPREAD AND SMOKE-DEVELOPED RATINGS

In accordance with NFPA 255, ASTM E 84 or UL 723, the materials on interior of the building shall have a flame-spread rating of not more than 25 and a smoke-developed rating of not more than 150 interior to the building.

##### 1.6.1 Materials Tests

Test factory-applied materials as assembled. Field-applied materials may be tested individually. Use no fugitive or corrosive treatments to impart flame resistance. UL label or satisfactory certified test report from a testing laboratory will be required to indicate that fire hazard ratings for materials proposed for use do not exceed those specified. Flame-proofing treatments subject to deterioration due to effects of moisture or high humidity are not acceptable.

##### 1.6.2 Materials Exempt From Fire-Resistant Rating

Nylon anchors.

### PART 2 PRODUCTS

#### 2.1 PIPING INSULATION

Piping systems, except buried pipe requiring insulation, types of insulation required, and insulation thickness shall be as listed in Tables I herein. Unless otherwise specified, insulate all fittings, flanges, and valves, except valve stems, hand wheels, and operators. Provide factory premolded, precut, or field-fabricated insulation of the same thickness and conductivity as insulation on adjacent piping. Insulation exterior shall be factory cleanable, grease resistant, non-flaking and non-peeling. Pipe insulation shall conform to the referenced publications.



## 2.1.1 Buried Water Pipe Insulation

## 2.1.2 Flexible Unicellular Insulation

## 2.1.2.1 Recommended Adhesive

ASTM C 534. Provide adhesive as recommended by insulation manufacturer or conforming with MIL-A-24179, Type II, Class 1.

## 2.1.2.2 Polyolefin thermoplastic

Polyolefin thermoplastic meets ASTM C 534, except density.

## 2.1.2.3 Adhesive For Finishing Flexible Unicellular Insulation

MIL-A-3316, Class 1, Grade A.

## 2.1.2.4 Glass Cloth For Finishing Flexible Unicellular Insulation

MIL-C-20079, Type I, Class 1, 3, or 5.

## 2.1.3 Cellular Glass Insulation

ASTM C 552, Type II.

## 2.1.4 Cellular Phenolic Insulation

ASTM C 1136.

## 2.1.5 Mineral Fiber

ASTM C 547, Class I.

## 2.1.6 Calcium Silicate

ASTM C 533, Class I.

## 2.1.7 Cellular Polystyrene

ASTM C 578, Expanded Polystyrene (EPS).

## 2.1.8 Piping Insulation Finishes

## 2.1.8.1 All-Purpose Jacket

Provide a factory applied all-purpose jacket when field applied jacketing is not specified. All purpose jackets shall include integral vapor barrier as required by service. Provide jackets in exposed locations with a white surface suitable for field painting. Allow a maximum water vapor permeance of 0.05 perm in accordance with ASTM E 96, a puncture resistance of not less than 50 Beach units, and a minimum tensile strength of 35 pounds-force per inch of width in accordance with ASTM D 828.

## 2.1.8.2 Vapor-Barrier Material

ASTM C 1136. Resistant to flame, moisture penetration, and mold growth. Provide vapor-barrier material on pipe insulation as required in Table I.

### 2.1.8.3 Metal Jackets

- a. Aluminum Jackets: **ASTM B 209**, Temper H14, minimum thickness of 27 gage (0.016 inch), with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide smooth surface jackets for jacket outside diameters less than 8 inches. Provide corrugated surface jackets for jacket outside diameters 8 inches and larger. Provide stainless steel bands, minimum width of 0.5 inch. Provide factory prefabricated aluminum covers for insulation on fittings, valves and flanges.
- b. Stainless Steel Jackets: **ASTM A 167** or **ASTM A 240/A 240M**; Type 304, minimum thickness of 33 gage (0.010 inch), smooth surface with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide stainless steel bands, minimum width of 0.5 inch. Provide factory prefabricated stainless steel covers for insulation on fittings, valves, and flanges.
- c. Piping, Fittings, Flanges, and Valves in Outside Locations: Finish elbows and curved piping with factory-fabricated metal covers. Finish tees, flanges, and valves with metal covers. Covers shall be same thickness and material as jackets on adjacent piping.

## 2.2 EQUIPMENT

Insulate all equipment and accessories as specified in Table II. In outside locations, provide insulation one inch thicker than specified. Increase the specified insulation thickness for equipment only where necessary to equal the thickness of angles or other structural members to make a smooth, exterior surface. Factory applied insulation shall meet the flame spread and smoke-developed rating of 25/50.

## 2.3 ADHESIVES, SEALANTS, AND COATING COMPOUNDS

### 2.3.1 Insulation and Vapor Barrier Adhesive

Provide **ASTM C 916**, Type I or Type II adhesive for securing insulation to metal surfaces and for vapor barrier lap only in building interior. Provide Type I when an adhesive in which the vehicle is nonflammable in the liquid (wet) state and which will pass the edge-burning test is required. Provide Type II when an adhesive in which the vehicle is nonflammable in the liquid (wet) state and which will not pass the edge-burning test is required.

### 2.3.2 Lagging Adhesive

**MIL-A-3316**, Class 1, for bonding fibrous glass cloth to unfaced fibrous glass insulation; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bounding fibrous glass tape to joints of fibrous glass board; or for bonding lagging cloth to thermal insulation, or Class 2, for attaching fibrous glass insulation to metal surfaces.

### 2.3.3 Mineral Fiber Insulation Cement

**ASTM C 195**, thermal conductivity 0.85 maximum at 200 degrees F mean when tested in accordance with **ASTM C 177**.

#### 2.3.4 Vapor Barrier Coating

MIL-C-19565, Type II, indoor only above surface temperature 60 degrees F, color white.

#### 2.3.5 Weatherproof Coating

For outside applications provide a weatherproof coating recommended by the manufacturer of the insulation and jackets.

#### 2.3.6 Flexible Unicellular Insulation Adhesive

MIL-A-24179, Type II, Class 1 or Type III.

### 2.4 ACCESSORY MATERIALS

#### 2.4.1 Staples

ASTM A 167, Type 304 or 316 stainless steel outside-clinch type.

#### 2.4.2 Insulation Bands

1/2 inch wide; 0.24 gage galvanized steel or 0.26 gage stainless steel or 0.24 gage aluminum.

#### 2.4.3 Bands for Metal Jackets

3/8-inch minimum width; 0.26 gage stainless steel or 0.24 gage aluminum.

#### 2.4.4 Anchor Pins

Provide anchor pins and speed washers recommended by insulation manufacturer.

#### 2.4.5 Glass Cloth and Tape

MIL-C-20079, Type I, Class 1 or Class 3 cloth, and Type II, Class 1 or tape; 20 by 20 maximum size mesh. Tape shall be 4-inch wide rolls. Class 3 tape shall be 4.5 ounces per square yard. In lieu of glass cloth and tape, open weave glass membrane may be provided.

#### 2.4.6 Wire

Soft annealed stainless steel, 0.047-inch nominal diameter.

#### 2.4.7 PVC Pipe Fitting Cover

FS L-P-535, Composition A, Type II, Grade GU, factory premolded, one-piece.

### PART 3 EXECUTION

#### 3.1 PREPARATION

Do not insulate materials until system tests have been completed and surfaces to be insulated have been cleaned of dirt, rust, and scale and dried. Insulate return ducts, outside air intakes and supply ducts to the room outlets, flexible runouts, plenums, casings, mixing boxes, filter boxes, coils, fans, and the portion of air terminals not in the conditioned

spaces. Ensure full range of motion of equipment actuators. Modify insulation to avoid obstruction with valve handles, safety reliefs, and other such items. Allow adequate space for pipe expansion. Install insulation with jackets drawn tight and cement down on longitudinal and end laps. Do not use scrap pieces where a full length section will fit. Insulation shall be continuous through sleeves, wall and ceiling openings, except at fire dampers in duct systems. Extend surface finishes to protect surfaces, ends, and raw edges of insulation. Apply coatings and adhesives at the manufacturer's recommended coverage per gallon. Individually insulate piping and ductwork. Provide a moisture and vapor seal where insulation terminates against metal hangers, anchors and other projections through the insulation on surfaces for which a vapor seal is specified. Keep insulation dry during application of finish. Bevel and seal the edges of exposed insulation. Unless otherwise indicated, do not insulate the following:

- a. Factory preinsulated flexible ductwork;
- b. Vertical portion of interior roof drain pipelines, chrome plated pipes, and fire protection pipes;
- c. Vibration isolating connections;
- d. Adjacent insulation;
- e. ASME stamps;
- f. Fan name plates; and
- g. Access plates in fan housings.

### 3.2 PIPING INSULATION

#### 3.2.1 Mineral Fiber Pipe Insulation

Place sections of insulation around the pipe and joints tightly butted into place. The jacket laps shall be drawn tight and smooth. Secure jacket with fire resistant adhesive factory applied self sealing lap, or stainless steel outward clinching staples spaced not over 4 inches on centers and 1/2 inch minimum from edge of lap. Cover circumferential joints with butt strips, not less than 3 inches wide, of material identical to the jacket material. Overlap longitudinal laps of jacket material not less than 1 1/2 inches. Adhesive used to secure the butt strip shall be the same as used to secure the jacket laps. Apply staples to both edges of the butt strips. Patch damaged jacket material by wrapping a strip of jacket material around the pipe and cementing, stapling, and coating as specified for butt strips. Extend the patch not less than 1 1/2 inches past the break in both directions. At penetrations by pressure gages and thermometers, fill the voids with the vapor barrier coating for outside service. Seal with a brush coat of the same coating. Where penetrating roofs, insulate piping to a point flush with the top of the flashing and seal with the vapor barrier coating. Butt tightly the exterior insulation to the top of the flashing and interior insulation. Extend the exterior metal jacket 2 inches down beyond the end of the insulation. Seal the flashing and counterflashing underneath with the vapor barrier coating.

#### 3.2.2 Flexible Unicellular Insulation

Bond cuts, butt joints, ends, and longitudinal joints with adhesive, miter

90-degree turns and elbows, tees, and valve insulation. Where pipes penetrate fire walls, provide mineral fiber insulation inserts and sheet metal sleeves. Insulate flanges, unions, valves, and fittings in accordance with manufacturer's published instructions. Tape all butt joints with adhesive backed insulation tape. On elastomeric insulation (Rubatex, Armorflex) located outside provide weather covering as follows:

- (1) Coat entire surface of insulation with MIL-A-3316
- (2) While the adhesive is tacky, apply a layer of MIL-C-20079 glass cloth. Stretch tightly and overlap all joints by a minimum of 2-inches. Glass cloth at elbows and fittings shall be mitered.
- (3) Apply a final coat of MIL-A-3316 adhesive.

### 3.2.3 Calcium Silicate Pipe Insulation

Secure insulation with stainless steel metal bands on 12-inch maximum centers. For high temperature piping (above 600 degrees F); unless single layer insulation is recommended by the manufacturer, apply insulation in two layers with the joints tightly butted and staggered a minimum of 3 inches. Secure the inner layer of insulation with 14-gage soft annealed stainless steel wire on 12-inch maximum centers. The outer layer shall be secured with stainless steel metal bands on 12-inch maximum centers. Apply a skim coat of hydraulic setting cement directly to the insulation. When dry, apply a flooding coat of adhesive over the hydraulic setting cement. Press a layer of MIL-C-20079 glass cloth or tape into adhesive and seal laps and edges with adhesive. Coat cloth with adhesive cut at a ratio of one part water to five parts adhesive in color other than white for the purpose of visual inspection to ensure sizing of entire surface.

### 3.2.4 Cellular Glass, Cellular Phenolic, and Polyisocyanurate

Secure outer most layer of insulation with metal bands 12-inch on center. If a factory installed all service jacket is used, the metal bands shall be applied to the outside of the all service jacket. If two or more layers are applied, the inner layers may be secured with fiber reinforced tape. For cold or chilled piping all joints both longitudinal and circumferential shall be sealed. Use the manufacturer's recommended cement or sealant. Apply all-purpose jacket, vapor barrier if required by Table I, and metal jacket if outside. Elbows shall be four piece miter if field fabricated. Pre-manufactured elbows can be held in place with metal bands. All elbows shall be finished as follows: Apply a skim coat of hydraulic setting cement directly to the insulation. When dry, apply a flooding coat of adhesive over the hydraulic setting cement. Press a layer of MIL-C-20079 glass cloth or tape into adhesive and seal laps and edges with adhesive. Coat cloth with adhesive cut at a ratio of one part water to five parts adhesive in color other than white for the purpose of visual inspection to ensure sizing of entire surface. Insulate flexible connection at pumps and other equipment with unicellular plastic insulation, unless otherwise indicated. Factory-fabricated removable and reusable insulated covers shall be provided for all valves, circuit setters, unions and flow control devices. The insulation cover shall be reusable without the need for special material or tools. Insulation shall be two piece molded cellular to fit the valve or device. Flexible unicellular insulation may be used in lieu of molded cellular insulation.

### 3.2.5 Expanded Cellular Polystyrene

Secure outer most layer of insulation with metal bands 9 inch on center. If a factory installed all service jacket is used, the metal bands shall be applied to the outside of the all service jacket. If two or more layers are applied, the inner layers may be secured with fiber reinforced tape. For cold or chilled piping all joints both longitudinal and circumferential shall be sealed. use the manufacturer's recommended cement or sealant. Apply all-purpose jacket, vapor barrier if required by Table 1, and metal jacket if outside. Elbows shall be four piece miter if field fabricated. Pre-manufactured elbows can be held in place with metal bands. All elbows shall be finished according to manufacturer's recommended method. Insulate flexible connection at pumps and other equipment with unicellular plastic insulation, unless otherwise indicated. Factory-fabricated removable and reusable insulated covers shall be provided for all valves, circuit setters, unions and flow control devices. The insulation cover shall be reusable without the need for special material or tools. Insulation shall be two piece molded cellular to fit the valve or device. Flexible unicellular insulation may be used in lieu of molded cellular insulation.

### 3.2.6 Hangers and Anchors

Pipe insulation shall be continuous through pipe hangers. Where pipe is supported by the insulation, provide galvanized steel shields protection saddles. Band and secure insulation protection shields without damaging pipe insulation. Where shields are used on pipes 2 inches and larger, provide insulation inserts at points of hangers and supports. Insulation inserts shall be of calcium silicate, cellular glass (minimum 8 pcf), molded glass fiber (minimum 8 pcf), or other approved material of the same thickness as adjacent insulation. Inserts shall have sufficient compressive strength to adequately support the pipe without compressing the inserts to a thickness less than the adjacent insulation. Insulation inserts shall cover the bottom half of the pipe circumference 180 degrees and be not less in length than the protection shield. Vapor-barrier facing of the insert shall be of the same material as the facing on the adjacent insulation. Seal inserts into the insulation with vapor barrier coating, Type II or for exterior work, manufacturer's recommended weatherproof coating, as applicable. Where protection saddles are used, fill all voids with the same insulation material as used on the adjacent pipe. Where anchors are secured to chilled piping that is to be insulated, insulate the anchors the same as the piping for a distance not less than four times the insulation thickness to prevent condensation. Vapor seal insulation around anchors.

### 3.2.7 Sleeves and Wall Chases

Where penetrating interior walls, extend a metal jacket 2 inches out on either side of the wall and secure on each end with a band. Where penetrating floors, extend a metal jacket from a point below the back-up material to a point 10 inches above the floor with one band at the floor and one not more than one inch from end of metal jacket. Where penetrating exterior walls, extend the metal jackets through the sleeve to a point 2 inches beyond the interior surface of the wall.

### 3.2.8 Flanges, Unions, Valves and Fittings for Hot Piping

Flanges, Unions, Valves, and Fittings Insulation (Except Flexible Unicellular) for Hot Piping: Factory fabricated removable and reusable insulation covers may be used. For inside domestic hot water, heating hot

water, A/C condensate drains, high temperature hot water, steam and condensate return systems; exposed hot water piping and drains in handicap areas, place factory premolded, precut or field-fabricated segmented insulation of the same thickness and conductivity as the adjoining pipe insulation around the flange, union, valve, and fitting abutting the adjoining pipe insulation. If nesting size insulation is used, overlap 2 inches or one pipe diameter, whichever is larger. Use insulating cement to fill voids. Elbows insulated using segments shall have not less than three segments per elbow. Place and joint the segments with manufacturer's recommended water-vapor resistant, fire retardant, and adhesive appropriate for the temperature limit of the service. Upon completion of installation of insulation, apply two coats lagging adhesive with glass tape embedded between coats. Overlap tape seams one inch. Extend adhesive onto adjoining insulation not less than two inches. The total dry film thickness shall be not less than 1/16 inch. Where unions are indicated not to be insulated, taper the insulation to the union at a 45 degree angle. Coat the insulation and all purpose jacket with two coats of lagging adhesive and with glass tape embedded between coats. The total dry film thickness shall be not less than 1/16 inch. At the option of the Contractor, factory premolded one-piece PVC fitting covers may be provided in lieu of two coats of adhesive with tape embedded between coats. Factory premolded field-fabricated segment or blanket insert insulation shall be provided under the fitting covers. Install factory premolded one-piece PVC fitting covers over the insulation and secure by stapling, taping with PVC vapor barrier tape, or with metal or plastic tacks made for securing PVC fitting covers. Do not provide PVC fitting covers where exposed to the weather. Provide PVC fitting covers only in ambient temperatures below 150 degrees F.

### 3.2.9 Piping Exposed to Weather

#### 3.2.9.1 Metal Jackets

Install over the insulation. Metal jackets shall have side and end lap at least 2 inches wide with the cut edge of the side lap turned inside one inch to provide a smooth edge. Overlap the jacket not less than 2 inches at longitudinal and circumferential joints and secure with metal bands at not more than 9-inch centers or with screws at not more than 5-inch centers. Overlap longitudinal joints down to shed water. Seal circumferential joints with a coating recommended by the insulation manufacturer for weatherproofing.

#### 3.2.9.2 Flanges, Unions, Valves, Fittings, and Accessories

Insulate and finish as specified for the applicable service. Apply two coats of an emulsion type weatherproof mastic for hot service and vapor barrier mastic for cold service recommended by the insulation manufacturer. Embed glass tape in the first coat. Overlap tape not less than one inch and the adjoining metal jacket not less than 2 inches. Factory preformed metal jackets may be provided in lieu of the above for hot service.

### 3.3 EQUIPMENT INSULATION

#### 3.3.1 General Procedures

Apply equipment insulation suitable for temperature and service in rigid block or semirigid board or flexible form to fit as closely as possible to equipment. Groove or score insulation where necessary to fit the contours of equipment. Stagger end joints where possible. Bevel the edges of the

insulation for cylindrical surfaces to provide tight joints. Join sections of cellular glass insulation with bedding compound. After the cellular glass insulation is in place on areas to be insulated, except where metal-encased, fill joints, seams, chipped edges, or depressions with bedding compound to form a smooth surface. Fill mineral fiber joints with insulating cement. Bevel insulation around name plates, ASME and access plates. For insulation on equipment that must be opened periodically for inspection, cleaning, or repair, construct insulation to be removable and replaceable without damage. Protect exposed insulation corners with corner angles under wires and bands.

### 3.3.2 Heating Equipment (Except Pumps)

Insulate shell and tube heat exchangers for the temperature of the shell medium indicated on the drawings. Insulation on heads of heat exchangers shall be removable. Fabricate a male-female shiplap type joint for the removable section. Use 16-gage stainless steel or copper wire or 3/4-inch wide 20-gage stainless steel bands spaced on 12-inch centers. Seal joints with bedding compound for cellular glass or for mineral fiber with insulating cement and cover insulation with a smoothing coat of insulating cement. Apply two coats of adhesive with a layer of glass cloth embedded between coats. The dry film thickness of the finish shall be 1/32-inch minimum. On cylindrical equipment a metal jacket may be provided instead of the adhesive and glass cloths on the cylinder, ends must have adhesive and glass cloth.

### 3.3.3 Cold Equipment (Except Pumps)

Secure insulation with 16-gage, galvanized steel or copper clad wire or with 3/4-inch wide 20-gage stainless steel bands spaced on 12-inch centers. Seal joints with joint sealer. Cover non-removable irregular surfaces such as corner angles with a smoothing coat of insulating cement. Provide removable heat exchanger head covers with a male-female shiplap type joint. Apply two coats of vapor barrier coating with a layer of glass cloth embedded between coats. The dry film thickness of the finish shall be 1/32-inch minimum.

### 3.3.4 Pumps

Insulate pumps used for hot service with 2-inch thick rigid mineral fiber insulation and pumps used for chilled water and brine service with 2-inch thick flexible unicellular sheets as follows: Insulate pumps by forming a box around the pump housing, drive shaft, and piping. Apply insulation to inside surfaces of 20-gage galvanized or stainless steel sheet-metal boxes having openings for drive shaft and pipes. Construct the box by forming the bottom and sides using joints which do not leave raw ends of insulation exposed. Band bottom and sides to form a rigid housing that does not rest on the pump. Between top cover and sides, fit joints tightly forming a female shiplap joint on the side pieces and a male joint on the top cover to make the top cover removable. Secure insulation to the box with adhesive. Allow clearance for draining and adjustment of pump shaft seal.

## 3.4 PAINTING AND IDENTIFICATION

Paint in accordance with Section 09 90 00, "Paints and Coatings." Piping identification shall be as specified in other sections.



3.5 REPLACEMENT OF EXISTING ASBESTOS INSULATION

When existing asbestos insulation is to be replaced, provide new asbestos-free insulation. Label or stencil new insulation "Asbestos-Free" after final finishing and painting.

3.6 FIELD INSPECTION

Visually inspect to ensure that materials provided conform to specifications. Inspect installations progressively for compliance with requirements.

TABLE IPiping Insulation Wall Thickness

<u>Service</u>	<u>Material</u>	<u>Tube And Pipe Size (Inches)</u>						<u>Vapor Barrier Required</u>
		<u>1/4-1 1/4</u>	<u>1 1/2-3</u>	<u>3 1/2-5</u>	<u>6-&amp; Larger</u>			
Brine Systems	Cellular Glass	2.5 (3.5)	3.0 (4)	3 (4)	3.5 (4.5)		Yes	
Cryogenics (Minus 30 to Zero Degrees F)	Polyisocyanurate Flexible	1.5 (2.0) 2 (3.0)	1.5 (2) 2 (3)	N.P. (2) 2 (3)	N.P. (2.5) 2.5 (3.5)		Yes Yes	
	Unicellular Polystyrene	2 (3)	2 (3)	2 (3)	2.5 (3.5)		Yes	
Brine Systems, Cryogenics (Zero to 34 Degrees F)	Cellular Glass	2 (3.0)	2 (3.0)	2.5 (3.0)	2.5 (3.0)		Yes	
	Polyisocyanurate Flexible	1.5 (1.5) 1.75 (2.5)	1.5 (2.0) 2 (2.5)	1.5 (2.0) 2 (2.5)	1.5 (2.0) 2 (2.5)	1.5 (2.0) 2 (2.5)	Yes Yes	
	Unicellular Polystyrene	1.75 (2.5)	2 (2.5)	2 (2.5)	2 (2.5)	2 (2.5)	Yes	
Chilled Water & Dual Temperature & Refrigerant Suction Pipe	Cellular Glass	1.5 (2.0)	1.5 (2.0)	2.0 (2.5)	2.0 (2.5)		Yes	
	Polyisocyanurate Flexible	1 (1) 3/4 (1.5)	1 (1.0) 3/4 (1.5)	1.5 (2.0) 1.5 (2.0)	1.5 (2.0) 1.5 (2.0)		Yes Yes	
	Unicellular Polystyrene	1 (1.5)	1 (1.5)	1.5 (2)	1.5 (2)		Yes	
Domestic Cold Water, Drains and Horizontal Roof Drains	Polyisocyanurate	1	1	1	1		Yes	
	Cellular Glass	1.5	1.5	1.5	1.5		Yes	
	Cellular Phenolic Flexible	1 3/4	1	1	1		Yes Yes	
	Unicellular Polystyrene	1	1	1	1		Yes	
Domestic Hot Water	Polyisocyanurate	1	1	1.5	1.5		No	
	Calcium Silicate	1.5	1.5	1.5	1.5		No	
	Mineral Fiber	1	1	1.5	1.5		No	
	Cellular Glass	1.5	1.5	1.5	1.5		No	
	Cellular Phenolic Flexible Uni- cellular	1 1	1	1	1		No No	
	Polystyrene	1	1	1.5	1.5		No Yes	
Heating Hot Water & Pipes (150 to 200 Degrees F)	Polyisocyanurate	1 (1.5)	1 (1.5)	1.5 (2.0)	1.5 (2.0)		No	
	Calcium Silicate	1.5 (2.5)	2 (2.5)	2 (2.5)	2.5 (3.0)		No	
	Mineral Fiber	1.5 (2.0)	1.5 (2.5)	2 (2.5)	2 (2.5)		No	
	Cellular Glass	1.5 (2.5)	1.5 (2.5)	2 (2.5)	2.5 (3.0)		No	
	Cellular Phenolic	1 (1.25)	1 (1.25)	1 (1.25)	1.5 (1.5)		No	
Compressed Air Discharge, Steam, and Condensate (201 to 250 Degrees F)	Calcium Silicate	1.5 (2.5)	2 (2.5)	2 (2.5)	2.5 (3.0)		No	
	Mineral Fiber	1.5 (2.0)	1.5 (2.0)	2 (2.5)	2.5 (3.0)		No	
	Cellular Glass	1.5 (2.5)	2 (2.5)	2 (2.5)	2.5 (3.0)		No	
	Polyisocyanurate	1 (1.5)	1.5 (1.5)	1.5 (2.0)	1.5 (2.0)		No	

TABLE I

Piping Insulation Wall Thickness

<u>Service</u>	<u>Material</u>	<u>Tube And Pipe Size (Inches)</u>							
		<u>1/4-1 1/4</u>	<u>1 1/2-3</u>	<u>3 1/2-5</u>	<u>6-&amp; Larger</u>	<u>Vapor Barrier Required</u>			
High Temp- erature Hot Water and Steam (251 to 350 Degrees F)	Calcium Silicate	2 (3.0)	2.5 (3.5)	2.5 (3.5)	3 (4.0)	4 (5.0)	No		
	Mineral Fiber	2 (3.0)	2.5 (3.5)	2.5 (3.5)	3 (4.0)	4 (5.0)	No		
	Cellular Glass	2.5 (3.5)	3 (4.0)	3 (4.0)	4 (5.0)	4 (5.0)	No		
High Temp- erature Water & Steam (351 to 500 Degrees F)	Calcium Silicate	3 (4.0)	4 (5.0)	4 (5.0)	4 (5.0)	5 (6.0)	No		
	Mineral Fiber	3 (4.0)	4 (5.0)	4 (5.0)	4 (5.0)	5 (6.0)	No		
	Cellular Glass	4 (5.0)	5 (6.0)	5 (6.0)	5 (6.0)	5 (6.0)	No		

NOTE: Thickness in parenthesis are for:

- (1) Cold piping - crawl spaces, mechanical rooms, and outside locations
- (2) Hot Piping - outside locations, not including tunnels and crawl spaces.
- (3) NP - Not permitted.

=====

TABLE IIInsulation For Equipment

<u>Material</u>	<u>Spec</u>	<u>Type</u>	<u>Class</u>	<u>Vapor Barrier Required</u>
Flexible Mineral Fiber,	ASTM C 553	I	B-3	Yes*/No
Rigid Mineral Fiber,	ASTM C 612		2	Yes*/No
or Cellular Glass	ASTM C 552	I		No

\*Yes for chilled water and brine service and no for other services.

<u>Equipment</u>	<u>Recommended Wall Thickness</u>	<u>Vapor Barrier Required</u>
Heat Exchangers Systems	2"	For Chilled Water and Brine
Expansion Tanks Systems	2"	For Chilled Water and Brine
Air Separators Systems	2"	For Chilled Water and Brine
All Pumps Systems	2"	For Chilled Water and Brine
Hot Water Storage Tanks	2"	No
Hot Water Heat Exchangers or Steam to Hot Water Convector		
Up to 249	2"	No
250 to 400oF	3-1/2"	No
401 to 600oF	6"	No
Hot Water Duct Mounted Coils	2"	No
Drain Pans	2"	For Chilled Water Systems
Pneumatic Water Tanks	2"	For Chilled Water Systems
Water Boxes and Headers	2"	For Chilled Water Systems

\*Exact insulation thickness may be determined by proposed condition of use.

TABLE III

<u>Service And Surface</u> <u>Temperature Range</u> <u>Degrees F)</u>	<u>Material</u>	<u>Insulation Wall Thickness (Inches)</u>				
		<u>Outside Diameter (Inches)</u>				
		<u>1/4-1-1/4</u>	<u>1-1/2-3</u>	<u>3-1/2-5</u>	<u>6-10</u>	<u>11-36</u>
Boiler Breech and Stack (Up to 400 Degrees F)	Mineral Fiber ASTM C 553 Class B-3, ASTM C 547 Class 1, or ASTM C 612 Class 1	NA	NA	2	2	2
	Calcium Silicate ASTM C 533 Type 1	NA	NA	2	2	2
Boiler Breech and Stack (401 to 600 Degrees F)	Mineral Fiber ASTM C 547, Class 2, ASTM C 592 Class 1, or ASTM C 612 Class 3	NA	NA	3	3	3
	Calcium Silicate ASTM C 533 Type I	NA	NA	3	3	4
Boiler Breech and Stack (601 to 800 Degrees F)	Mineral Fiber ASTM C 547 Class 3,\ ASTM C 592 Class 1, or ASTM C 612 Class 3	NA	NA	4	4	4
	Calcium Silicate ASTM C 533 Type I	NA	NA	4	4	4
Diesel Engine Exhaust	Calcium Silicate ASTM C 533 Type I	6	6	6	6	6

-- End of Section --



## SECTION 23 09 23.13

## BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC

04/12

## PART 1 GENERAL

## 1.1 REFERENCES

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

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

ASHRAE 135 (2008; Addenda q Errata 2009, Addenda l, o, r, s, v 2009; Addenda j Errata 2010; Addenda h, k, n, t, u, w, x, y 2010; Errata 2010) BACnet—A Data Communication Protocol for Building Automation and Control Networks

ASME INTERNATIONAL (ASME)

ASME B16.5 (2009) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B31.1 (2010) Power Piping

ASTM INTERNATIONAL (ASTM)

ASTM A 126 (2004; R 2009) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM B 117 (2009) 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/IEC 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 (2011; Errata 2 2012) National Electrical Code

## UNDERWRITERS LABORATORIES (UL)

UL 1449 (2006; R thru 2009) Surge Protective Devices

UL 506 (2008; R 2010) Specialty Transformers

UL 508A (2001; R thru 2010) Industrial Control Panels

UL 916 (2007; R 2009) 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 Applicaiton 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 Building Controller (SBC)

The Supervisory Building 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. The SBC shall communicate with other controllers and equipment through a BACnet MS/TP bus. Depending on approvals and capabilities, the SBC may be used as a point of connection between the Camp Lejeune EMCS network (IP) and the building level control network (BACnet MS/TP).

#### 1.2.19 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 Camp Lejeune is an enterprise system that actively receives energy and building condition information from multiple sources and provides load shedding, electric metering, alarming, trending, scheduling, set point adjustment and device status of all supervisory building controllers for maintenance personnel. The EMCS receives real time electrical utility pricing data and automatically manages to Camp Lejeune's energy target. The existing Camp Lejeune EMCS is manufactured by Johnson Controls and incorporates both the Metasys extended architecture system (for use with Johnson Controls NAE & NCE) and the Facilities Explorer (FX) network architecture (for use with an MS/TP to IP Router). Both of the systems communicate over the MRAN and either may be used to fulfill the requirements of this specification.

#### 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

#### 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/IEC 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. If a router is connected directly to the MRAN, it must be listed on the approved DITSCAP or DIACAP equipment list and must be Marine Corps DADMS listed and approved.

#### 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 Camp Lejeune.

#### 1.2.52 Supervisory Building Controller (SBC)

The Supervisory Building Controller is the upper level controller on the building's MS/TP bus. It provides building wide points, scheduling, and interface with programming tools. The SBC may be used as the point of connection between the Camp Lejeune EMCS network (IP) and the building level control network (MS/TP). Since the EMCS network uses the Marine Air Ground Task Force Regional Network (MRAN) Ethernet network using TCP/IP, if the SBC is used as a point of connection, it must be listed on the approved DITSCAP or DIACAP equipment list and must be Marine Corps DADMS listed and approved.

### 1.3 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC DESCRIPTION

- a. Provide new BACnet, modify existing merge with existing non-BACnet, and merge with existing BACnet, DDC systems including associated equipment and accessories.
- b. Provide a networked DDC system for standalone control in compliance with the latest revision of the ASHRAE 135 BACnet standard. Include all

programming, objects, and service required to meet the sequence of control. Provide BACnet communication between the DDC system and the native BACnet devices furnished with HVAC equipment, and plant equipment including boilers, chillers, and variable frequency drives. Devices provided shall be BACnet Testing Laboratories (BTL) product listing certified. Provide a Supervisory Building Controller (SBC) that communicates with the field DDC controllers via the MS/TP bus using BACnet. Provide one of the two means listing in this guide specification to connect the building control system to the EMCS via the Marine Air-Ground Task Force Regional Area Network (MRAN) Ethernet network using TCP/IP. Provide 40 hours of assistance to the government to facilitate interfacing the building control system with the existing EMCS.

- c. Authority to Operate/Authority to Connect: Prior approval to communicate on the base MRAN is a requirement on this project. Supervisory Building Controllers (SBC) and any other device communicating on the MRAN without being DADMS listed and approved and approval from the Designated Approving Authority based on DITSCAP or DIACAP efforts will not be permitted.
- d. Only technicians authorized by the Camp Lejeune utilities department are approved to add, manage, or revise data in the EMCS. Authorization shall require a unique username and password managed by the Utilities Department.

### 1.3.1 Design Requirements

#### 1.3.1.1 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.

#### 1.3.1.2 List of I/O Points

Also known as a Point Schedule, provide for each input and output point physically connected to a digital controller: point name, point description, point type (Analog Output (AO), Analog Input (AI), Binary Output (BO), Binary Input (BI)), point sensor range, point actuator range, point address, BACnet object, associated BIBBS (where applicable), and point connection terminal number. Typical schedules for multiple identical equipment are allowed unless otherwise requested in design or contract criteria. All points shall adhere to the Camp Lejeune standard naming conventions.

#### 1.3.1.3 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.

#### 1.3.1.4 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

#### 1.3.1.5 HVAC Equipment Electrical Ladder Diagrams

Provide HVAC equipment electrical ladder diagrams. Indicate required electrical interlocks.

#### 1.3.1.6 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.

#### 1.3.1.7 Terminal Strip Diagrams

Provide a diagram of each terminal strip. Indicate the terminal strip location, termination numbers, and associated point names.

#### 1.3.1.8 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.

### 1.4 SUBMITTALS

Submit detailed and annotated manufacturer's data, drawings, and specification sheets for each item listed, that clearly show compliance with the project specifications.

Submit the following according to 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).

Sensors and Input Hardware

Output Hardware

Surge and transient protection

#### 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

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

Training documentation

#### 1.5 QUALITY ASSURANCE

##### 1.5.1 Standard Products

Provide material and equipment that are standard manufacturer's products currently in production and supported by a local service organization.

##### 1.5.2 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.

##### 1.5.3 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.

##### 1.5.4 Finish of New Equipment

New equipment finishing shall be factory provided. Manufacturer's standard factory finishing shall be proven to withstand 125 hours in a salt-spray fog test. Equipment located outdoors shall be proven to withstand 500 hours in a salt-spray fog test.

Salt-spray fog test shall be according to [ASTM B 117](#), 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.

##### 1.5.5 Verification of Dimensions

The contractor shall verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing work.

##### 1.5.6 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.

##### 1.5.7 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.

### 1.5.8 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". 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.
- 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 Point of Connection to EMCS

The existing centralized Camp Lejeune DDC system is comprised of two separate systems. One utilizes the Johnson controls Metasys system to communicate with a central server and the other utilizes a BACnet MS/TP to IP router to communicate with a central server. Both of the systems

communicate over the basewide Marine Air-Ground Task Force Regional Area Network (MRAN). These systems provide two different means to connect the building control system to the base wide energy management and control system (EMCS) and either system is acceptable for use. Each system requires a different component to connect to the EMCS; furthermore, any component that is directly connected to the MRAN must be approved and listed through the Department of Defense Information Assurance Certification and Accreditation Process (DIACAP) and must be Department of Navy Application and Database Management System (DADMS) listed and approved. Currently there are two products that are approved for use on Camp Lejeune: a Johnson Controls Metasys NAE or NCE and a LOYTEC LIP-ME201 BACnet IP Router. A Johnson Controls NAE & NCE serves as the building supervisory controller and connects directly to the MRAN, while the LOYTEC Router forms a direct connection between the building's BACnet MS/TP backbone and the MRAN. With the use of the LOYTEC Router, any manufacturer's supervisory building controller may be used, even if it is not listed through DIACAP because in this instance the supervisory building controller does not connect directly to the MRAN. Other routers that connect directly to the MRAN and supervisory building controllers that connect directly to the MRAN may be used if they are approved and listed through the above mentioned process. All IP addresses and network drops shall be furnished by base telephone. One of the two means to connect the building control system to the EMCS shall be provided.

#### 2.1.2 Supervisory Building Controller (SBC)

Each building has an existing to remain SBC that communicates between the DDC system and the Camp Lejeune EMCS server in one of two ways:

- 1) The SBC connects directly to the MRAN
- 2) It communicates via a BACnet IP router over the MRAN

Provide all necessary hardware, drivers, software, material and equipment which shall allow communication and control between the **existing to remain** SBC and the field DDC controllers using BACnet on the MS/TP bus. Relevant supervisory controller information shall transfer back to the EMCS system via the Ethernet TCP/IP level 1 network. When the supervisory controller is disconnected from the enterprise system for maintenance, access to the supervisor controller shall be via a laptop computer. The laptop computer shall be provided with any required propriety licensed software and license keys.

#### 2.1.3 Direct Digital Controllers

Direct digital controllers shall be **UL 916** rated.

##### 2.1.3.1 I/O Point Limitation

The total number of I/O hardware points used by a single stand-alone digital controller, including I/O expansion units, shall not exceed 64. Place I/O expansion units in the same cabinet as the digital controller.

##### 2.1.3.2 Environmental Limits

Controllers shall be suitable for, or placed in protective enclosures suitable for the environment (temperature, humidity, dust, and vibration) where they are located.

#### 2.1.3.3 Stand-Alone Control

Provide stand-alone digital controllers capable of meeting the complete sequence of operation with and without network connectivity (being connected to the EMCS).

#### 2.1.3.4 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.

#### 2.1.3.5 Memory

Provide sufficient memory for each controller to support the required control, communication, trends, alarms, and messages. Protect programs residing in memory with EEPROM, flash memory, or by an uninterruptible power source (battery or uninterruptible power supply). The backup power source shall have capacity to maintain the memory during a 72-hour continuous power outage. Rechargeable power sources shall be constantly charged while the controller is operating under normal line power. Batteries shall be replaceable without soldering. Trend and alarm history collected during normal operation shall not be lost during power outages less than 72 hours long.

#### 2.1.3.6 Immunity to Power Fluctuations

Controllers shall operate at 90 percent to 110 percent nominal voltage rating.

#### 2.1.3.7 Transformer

The controller power supply shall be fused or current limiting and rated at 125 percent power consumption.

#### 2.1.3.8 Wiring Terminations

Use screw terminal wiring terminations for all field-installed controllers. Provide field-removable modular terminal strip or a termination card connected by a ribbon cable for all controllers other than terminal units.

#### 2.1.3.9 Input and Output Interface

Provide hard-wired input and output interface for all controllers as follows:

- a. Protection: Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with sources up to 24 volts AC or DC for any duration shall cause no controller damage.
- b. Binary Inputs: Binary inputs shall monitor 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.

#### 2.1.3.10 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 (INCLUDING NEW STEAM BOILER ROOMS) ARE CONSIDERED DAMP ENVIRONMENTS.** Outdoor control panels and controllers must be able to withstand extreme ambient conditions, without malfunction or failure, whether or not the controlled equipment is running. If necessary, provide a thermostatically controlled panel heater in freezing locations, and an internal ventilating fan in locations exposed to direct sunlight. Cabinets shall have a hinged lockable door and an offset removable metal back plate, except controllers integral with terminal units, like those mounted on VAV boxes. Provide like-keyed locks for all hinged panels provided and a set of two keys at each panel, with one key inserted in the lock.

#### 2.1.3.11 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.

#### 2.1.3.12 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.

#### 2.1.3.13 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 Use gateway interoperability schedules shown on design drawings or other project documents, 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.

#### 2.1.4 DDC Software

##### 2.1.4.1 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 Base, Camp Lejeune Complex for unrestricted use on Camp Lejeune Complex and reproduction for use on Camp Lejeune Complex. Software keys and "dongles" are not permitted. Provide 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.

#### 2.1.4.2 Parameter Modification

All writeable object properties, and all other programming parameters needed to comply with the project specification shall be adjustable for devices at any network level, including those accessible with web-browser communication, and regardless of programming methods used to create the applications.

#### 2.1.4.3 Short Cycling Prevention

Provide setpoint differentials and minimum on/off times to prevent equipment short cycling.

#### 2.1.4.4 Equipment Status Delay

Provide an adjustable delay from when equipment is commanded on or off and when the control program looks to the status input for confirmation.

#### 2.1.4.5 Run Time Accumulation

Use the Elapsed Time Property to provide re-settable run time accumulation for each Binary Output Object connected to mechanical loads greater than 1 HP, electrical loads greater than 10 KW, or wherever else specified.

#### 2.1.4.6 Timed Local Override

Provide a non-cumulative adjustable override time for the push of a local override button.

#### 2.1.4.7 Time Synchronization

Provide time synchronization, including adjustments for leap years, daylight saving time, and operator time adjustments.

#### 2.1.4.8 Scheduling

Provide operating schedules as indicated, with equipment assigned to groups. Changing the schedule of a group shall change the operating schedule of all equipment in the group. Groups shall be capable of operator creation, modification, and deletion. Provide capability to view and modify schedules in a seven-day week format. Provide capability to enter holiday and override schedules one full year at a time.

#### 2.1.4.9 Object Property Override

Allow writeable object property values to accept overrides to any valid value. Where specified or required for the sequence of control, the Out Of Service property of Objects shall be modifiable using BACnet's write property service. When documented, exceptions to these requirement are



allowed for life, machine, and process safeties.

#### 2.1.4.10 Alarms and Events

Alarms and events shall be capable of having programmed time delays and high-low limits. All alarms/events shall report to the EMCS server. Alarms/events shall be stored within the Supervisory 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.

#### 2.1.4.11 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.

#### 2.1.4.12 Device Diagnostics

Each controller shall have diagnostic LEDs for power, communication, and device fault condition. The DDC system shall recognize and report a non-responsive controller.

#### 2.1.4.13 Power Loss

Upon restoration of power, the DDC system shall perform an orderly restart and restoration of control.

#### 2.1.4.14 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.

#### 2.1.4.15 Configuration Tool

Provide the software with the manufacturer's installation CDs and licenses. Licenses shall allow unrestricted use and reproduction for use

at the Camp Lejeune 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.

## 2.2 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 Pneumatic to Electric Transducers

Pneumatic to electronic transducers shall convert a 0 to 20 psig signal to a proportional 4 to 20 mA or 0 to 10 VDC signal (operator scaleable). Supply voltage shall be 24 VDC. Accuracy and linearity shall be 1.0 percent or better.

##### 2.2.5 Air Quality Sensors

Provide power supply for each sensor.

#### 2.2.5.1 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.

#### 2.2.6 Input Switches

##### 2.2.6.1 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.

### 2.3 OUTPUT HARDWARE

#### 2.3.1 Control Valves

##### 2.3.1.1 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 A 126 Class B or C.

##### 2.3.1.2 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.

##### 2.3.1.3 Two-Way Valves

Two-way modulating valves shall have an equal percentage characteristic.

##### 2.3.1.4 Three-Way Valves

Three-way valves shall have an equal percentage characteristic.

##### 2.3.1.5 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.

#### 2.3.1.6 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 Actuators

Provide direct-drive electric actuators for all control applications, except where indicated otherwise.

##### 2.3.2.1 Electric Actuators

Each actuator shall deliver the torque required for continuous uniform motion and shall have internal end switches to limit the travel, or be capable of withstanding continuous stalling without damage. Actuators shall function properly within 85 to 110 percent of rated line voltage. Provide actuators with hardened steel running shafts and gears of steel or copper alloy. Fiber or reinforced nylon gears may be used for torques less than 16 inch-pounds. Provide two-position actuators of single direction, spring return, or reversing type. Provide modulating actuators capable of stopping at any point in the cycle, and starting in either direction from any point. Actuators shall be equipped with a switch for reversing direction, and a button to disengage the clutch to allow manual adjustments. Provide the actuator with a hand crank for manual adjustments, as applicable. Actuators without spring-return may only be

used on terminal fan coil units, terminal VAV units, convectors, and unit heaters. Spring return actuators shall be provided on all control dampers and all control valves except terminal fan coil units, terminal VAV units, convectors, and unit heaters; unless indicated otherwise. Each actuator shall have distinct markings indicating the full-open and full-closed position, and the points in-between.

### 2.3.3 Output Signal Conversion

#### 2.3.3.1 Electronic-to-Pneumatic Transducers

Electronic to pneumatic transducers shall convert a 4 to 20 mA or 0 to 10 VDC digital controller output signal to a proportional 0 to 20 psig pressure signal (operator scaleable). Accuracy and linearity shall be 1.0 percent or better. Transducers shall have feedback circuit that converts the pneumatic signal to a proportional 4 to 20 mA or 0 to 10 VDC signal.

### 2.3.4 Output Switches

#### 2.3.4.1 Control Relays

Field installed and DDC panel relays shall be double pole, double throw, UL listed, with contacts rated for the intended application, indicator light, and dust proof enclosure. The indicator light shall be lit when the coil is energized and off when coil is not energized. Relays shall be the socket type, plug into a fixed base, and replaceable without tools or removing wiring. Encapsulated "PAM" type relays may be used for terminal control applications.

## 2.4 ELECTRICAL POWER AND DISTRIBUTION

### 2.4.1 Transformers

Transformers shall conform to [UL 506](#). For control power other than terminal level equipment, provide a fuse or circuit breaker on the secondary side of each transformer.

### 2.4.2 [Surge and Transient Protection](#)

Provide each digital controller with surge and transient power protection. Surge and transient protection shall consist of the following devices, installed externally to the controllers.

#### 2.4.2.1 Power Line Surge Protection

Provide surge suppressors on the incoming power at each controller or grouped terminal controllers. Surge suppressors shall be rated in accordance with [UL 1449](#), have a fault indicating light, and conform to the following:

- a. The device shall be a transient voltage surge suppressor, hard-wire type individual equipment protector for 120 VAC/1 phase/2 wire plus ground.
- b. The device shall react within 5 nanoseconds and automatically reset.
- c. The voltage protection threshold, line to neutral, shall be no more than 211 volts.

- d. The device shall have an independent secondary stage equal to or greater than the primary stage joule rating.
- e. The primary suppression system components shall be pure silicon avalanche diodes.
- f. The secondary suppression system components shall be silicon avalanche diodes or metal oxide varistors.
- g. The device shall have an indication light to indicate the protection components are functioning.
- h. All system functions of the transient suppression system shall be individually fused and not short circuit the AC power line at any time.
- i. The device shall have an EMI/RFI noise filter with a minimum attenuation of 13 dB at 10 kHz to 300 MHz.
- j. The device shall comply with [IEEE C62.41.1](#) and [IEEE C62.41.2](#), Class "B" requirements and be tested according to [IEEE C62.45](#).
- k. The device shall be capable of operating between minus 20 degrees F and plus 122 degrees F.

#### 2.4.3 Wiring

Provide complete electrical wiring for the DDC System, including wiring to transformer primaries. Unless indicated otherwise, provide all normally visible or otherwise exposed wiring in conduit. Where conduit is required, control circuit wiring shall not run in the same conduit as power wiring over 100 volts. Circuits operating at more than 100 volts shall be in accordance with Section [26 20 00](#), INTERIOR DISTRIBUTION SYSTEM. Run all circuits over 100 volts in conduit, metallic tubing, covered metal raceways, or armored cable. Use plenum-rated cable for circuits under 100 volts in concealed accessible spaces. Examples of these spaces include HVAC plenums, within walls, above suspended ceilings, in attics, and within ductwork. All wiring in mechanical rooms and mezzanines shall be run in conduit.

##### 2.4.3.1 Power Wiring

The following requirements are for field-installed wiring:

- a. Wiring for 24 V circuits shall be insulated copper 18 AWG minimum and rated for 300 VAC service.
- b. Wiring for 120 V circuits shall be insulated copper 14 AWG minimum and rated for 600 VAC service.

##### 2.4.3.2 Analog Signal Wiring

Field-installed analog signal wiring shall be in accordance with manufacturer's installation instructions. Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.

## 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 Camp Lejeune unique instance number and all Supervisory Building Controllers shall have a Camp Lejeune unique name.

## 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 1 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.

Instance numbers are to be obtained from Camp Lejeune Operations to ensure duplicates do not occur. Point of contact:

Bill Schrader  
Public Works Division/EMCS  
1005 Michael Road / Building 1005  
MCB, Camp Lejeune, NC 28547  
(910) 450-7846

d. Point Name. Each object on the Camp Lejeune EMCS has a unique point name, which is made up of the object or short name stored in the controller and the equipment identifier, which is stored in the supervisory building controller (SBC). The long point name combines this object name with the name stored in the SBC that describes the controller or location of the object. The point name follows the general convention:

Area.Building.location.Equipment.Object Name.

Example: Hadnot Point.HP512.Second Floor.AHU-3.ASTATIC-SP. See Attachments one through four for equipment names, object names, object groupings, and area names.



- e. Object Name. The object name identifies the specific point. Only object names on the approved Camp Lejeune list shall be used. From the example above, the point name is: "ASTATIC-SP." See Attachment for the approved Camp Lejeune list.
- f. Object description. The controller shall also store an alpha numeric description of the object name. The controller shall support a minimum of 30 printable characters. From the example above the object description is: "Actual Static Pressure Setpoint."
- g. List of Attachments
  - Attachment 1 - Equipment Names
  - Attachment 2 - Object Names
  - Attachment 3 - Object Grouping
  - Attachment 4 - Area Names

### 3.1.2 Minimum BACnet Object Requirements

- a. Use of Standard BACnet Objects in accordance with existing Camp Lejeune standards

For the following points and parameters, use standard BACnet objects, where all relevant object properties can be read using BACnet's Read Property Service, and all relevant object properties can be modified using BACnet's Write Property Service:

all device physical inputs and outputs, all set points, all PID tuning parameters, all calculated pressures, flow rates, and consumption values, all alarms, all trends, all schedules, and all equipment and lighting circuit operating status.

- b. BACnet Object Description Property

The Object Description property shall support 30 minimum printable characters. For each object, complete the description property field using a brief, narrative, plain English description specific to the object and project application. For example: "HW Pump 1 Proof." Document compliance, length restrictions, and whether the description is writeable in the device PICS.

- c. Analog Input, Output, and Value Objects

Support and provide Description and/or Device\_Type text strings matching signal type and engineering units shown on the points list.

- d. Binary Input, Output, and Value Objects

Support and provide Inactive\_Text and Active\_Text property descriptions matching conditions shown on the points list.

- e. Calendar Object

For devices with scheduling capability, provide at least one Calendar Object with ten-entry capacity. All operators may view Calendar Objects; authorized operators may make modifications from a workstation. Enable the writeable Date List property and support all calendar entry data types.

- f. Schedule Object

Use Schedule Objects for all building system scheduling. All operators may view schedule entries; authorized operators may modify schedules from a workstation.

g. Loop Object or Equal

Use Loop Objects or equivalent BACnet objects in each applicable field device for PID control. Regardless of program method or object used, allow authorized operators to adjust the Update Interval, Setpoint, Proportional Constant, Integral Constant, and Derivative Constant using BACnet read/write services.

3.1.3 Minimum BACnet Service Requirements

a. Command Priorities

Use commandable BACnet objects to control machinery and systems, providing the priority levels listed below. If the sequence of operation requires a different priority, obtain approval from the Contracting Officer.

<u>Priority Level</u>	<u>Application</u>
1	Manual-Life Safety
2	Automatic-Life Safety
3	(User Defined)
4	(User Defined)
5	Critical Equipment Control
6	Minimum On/Off
7	(User Defined)
8	Manual Operator
9	(User Defined)
10	(User Defined)
11	Load Shedding
12	(User Defined)
13	(User Defined)
14	(User Defined)
15	(User Defined)
16	(User Defined)

b. Alarming

- (1) Alarm Priorities - Coordinate alarm and event notification with the BAS Owner.
- (2) Notification Class - Enable writeable Priority, Ack Required, and Recipient List properties of Notification Class objects.
- (3) Event Notification Message Texts - Use condition specific narrative text and numerical references for alarm and event notification.

c. Updating Displayed Property Values

Allow workstations to display property values at discrete polled intervals, or based on receipt of confirmed and unconfirmed Change of Value notifications. The COV increment shall be adjustable by an operator using BACnet services, and polled intervals shall be

adjustable at the operator workstation.

#### 3.1.4 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 Office at least 60 days advance notice of need. Provide one inch conduit and Cat 5 cable from the point of connection of the building control system to the point of connection to the network (most likely in the telephone equipment room).

### 3.2 INTERFACE WITH EXISTING EMCS

Interface the new DDC system with Camp Lejeune'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. The servers are located in Building 24: workstations are located at Buildings 1005, 1023, and 1202. Complete installation and programming includes scheduling, alarming, trending, and verification that relevant building points can be read at and written from the EMCS server via the MRAN.

### 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 92 TESTING/ADJUSTING/BALANCING: SMALL HEATING/VENTILATING/COOLING SYSTEMS. 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 shall 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 MECHANICAL. Locate cabinets adjacent to DDC control panels where applicable. Have each cabinet's proposed installation site approved in advance by the Contracting Officer and the BAS Owner. Prominently label each cabinet with the wording "OPERATION AND MAINTENANCE MANUALS." 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.
- 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 points are accessible through the MRAN.

### 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. Provide 40 hours of assistance to the Government to facilitate interfacing the building control system with the existing EMCS. Testing includes the following:

- a. Reading of Any Property: Demonstrate the ability to read and display any used readable object property of any device on the network.
- b. Setpoint and Parameter Modifications: Show the ability to modify all setpoints and tuning parameters in the sequence of control or listed on project schedules.
- c. 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.
- d. 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.).
- e. Schedule Lists: Show that schedules are configured for start/stop, mode change, occupant overrides, and night setback as defined in the sequence of operations.
- f. 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 or notebook by an operator with sufficient privilege.
- g. Modification of Trend Log Object Parameters: Show that an operator with sufficient privilege can change the logged data points, sampling rate, and trend duration.

h. 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 --

**EQUIPMENT NAMES**

<b>DESCRIPTION</b>	<b>EQUIPMENT NAME</b>
air handler 1, air handling unit 1	AH1
Building	BLDG
Boiler 1	BLR1
Chiller 1	CHR1
Condenser 1	COND1
Cooling tower 1	CT1
Cooling tower 1 fan	CT1F
Cooling tower 1 pump	CT1P
condenser water	CW
condenser water pump 1	CWP1
exhaust fan 1	EF1
Evaporator 1	EVAP1
heat exchanger 1	HEX1
high pressure steam	HPS
low pressure steam	LPS
make up air fan 1	MAF1
medium pressure steam	MPS
primary chilled water	PCHW
primary chilled water pump 1	PCHWP1
primary hot water	PHW
primary hot water pump 1	PHWP1
return fan 1	RF1
secondary chilled water	SCHW
secondary chilled water pump 1	SCHWP1
secondary hot water	SHW
secondary hot water pump 1	SHWP1
System	SYS
terminal air blender 1, fan powered	TAB1
tertiary chilled water	TCHW
tertiary chilled water pump 1	TCHWP1
tertiary hot water	THW
tertiary hot water pump 1	THWP1
variable air volume box 1	VAV1
occupied zone 1 thru 999	ZN1
Common zone	ZNT





## OBJECT NAMES

Point Name	Description	BACnet Command
ACHWS-SP	Actual CHW Temperature Setpoint	Read/Write
ACLG-SP	Actual Cooling Setpoint	Read/Write
ADA-SP	Actual Discharge Setpoint	Read/Write
AHTG-SP	Actual Heating Sepoint	Read/Write
AHWS-SP	Actual HW Supply Temperature Setpoint	Read/Write
ASA-SP	Actual Supply Air Setpoint	Read/Write
ASTATIC-SP	Actual Static Pressure Setpoint	Read/Write
AUTOCAL-C	Autocalibrate Command	Read/Write
AUTOCAL-STATE	Autocalibration Status	Read
AVEMA-T	Average Mixed Air Temperature	Read
AVEZN-T	Average Zone Temperature	Read
AZN-SP	Actual Zone Setpoint	Read/Write
BLDG-P	Building Static Pressure	Read
BLR1-A	Boiler 1 Alarm	Read
BLR1-EN	Boiler 1 Enable	Read/Write
BLR1EW-T	Boiler 1 Entering Water Temperature	Read
BLR1-FS	Boiler 1 Flow Switch	Read
BLR1LW-T	Boiler 1 Leaving Water Temperature	Read
BLR1-S	Boiler 1 Status	Read
BLR1SP-O	Boiler 1 Setpoint Output	Read/Write
BLR2-A	Boiler 2 Alarm	Read
BLR2EW-T	Boiler 2 Entering Water Temperature	Read
BLR2-FS	Boiler 2 Flow Switch	Read
BLR2LW-T	Boiler 2 Leaving Water Temperature	Read
BLR2-S	Boiler 2 Status	Read
BLR3-A	Boiler 3 Alarm	Read
BLR3EW-T	Boiler 3 Entering Water Temperature	Read
BLR3-FS	Boiler 3 Flow Switch	Read
BLR3LW-T	Boiler 3 Leaving Water Temperature	Read
BLR3-S	Boiler 3 Status	Read
BLR4-A	Boiler 4 Alarm	Read
BLR4EW-T	Boiler 4 Entering Water Temperature	Read
BLR4-FS	Boiler 4 Flow Switch	Read
BLR4LW-T	Boiler 4 Leaving Water Temperature	Read
BLR4-S	Boiler 4 Status	Read
BLR-SP	Boiler Setpoint	Read/Write
BLR-SP-O	Boiler Setpoint Output	Read/Write
BOX-LOAD	Box Terminal Load	Read
BOXMODE	Box Mode	Read
BP1-C	Boiler Pump 1 Command	Read/Write
BP1-S	Boiler Pump 1 Status	Read
BYPDMP-O	Bypass Damper Output	Read/Write
CC-T	Cooling Coil Temperature	Read
CD-P	Cold Deck Pressure	Read
CSDS-A	Cold Deck Smoke Detector Alarm	Read
CD-T	Cold Deck Temperature	Read
CH1-A	Chiller 1 Alarm	Read
CH1-C	Chiller 1 Command	Read/Write
CH1CHWE-T	Chiller 1 CHW Entering Temperature	Read
CH1CHWL-T	Chiller 1 CHW Leaving Temperature	Read
CH1CL-O	Chiller 1 Current Limit Output	Read

## OBJECT NAMES

CH1CWE-T	Chiller 1 CW Entering Temperature	Read
CH1CWL-T	Chiller 1 CW Leaving Temperature	Read
CH1-E	Chiller 1 Enable	Read/Write
CH1-S	Chiller 1 Status	Read
CH1SP-O	Chiller 1 Setpoint Output	Read/Write
CH1-UNL	Chiller 1 Unloader	Read
CH2-A	Chiller 2 Alarm	Read
CH2-C	Chiller 2 Command	Read
CH2-S	Chiller 2 Status	Read
CH2-UNL	Chiller 2 Unloader	Read
CH-C	Chiller Command	Read
CH-E	Chiller Enable	Read/Write
CHNGOVER-DIFF	Changeover Differential	Read
CHNGOVER-DLY	Changeover Delay	Read
CH-S	Chiller Status	Read
CH-SP	Chiller Setpoint	Read/Write
CHW-DP	Chilled Water Differential Pressure	Read
CHWDP-SP	Chilled Water Differential Pressure Setpoint	Read/Write
CHWDT-SP	CHW Differential Temperature Setpoint	Read
CHWGPM-F	Chilled Water GPM Flow	Read
CHWGPM-SP	Chilled Water GPM Setpoint	Read/Write
CHWP-C	Chilled Water Pump Command	Read/Write
CHWP-S	Chilled Water Pump Status	Read
CHWR-T	Chilled Water Return Temperature	Read
CHWS-SP	Chilled Water Supply Temperature Setpoint	Read/Write
CHWS-T	Chilled Water Supply Temperature	Read
CHWV-O	Chilled Water Valve Output	Read/Write
CLG1-C	Cooling Stage 1 Comand	Read/Write
CLGDA-SP	Cooling Discharge Air Temperature Setpoint	Read
CLG-O	Cooling Valve Output	Read/Write
CLG-O	Cooling Output	Read/Write
CLGOCC-SP	Occupied Cooling Setpoint	Read/Write
CLGUNOCC-SP	Unoccupied Cooling Setpoint	Read/Write
CMP1-A	Commpressor 1 Alarm	Read
CMP1-C	Commpressor 1 Command	Read/Write
CMP1EVAP-P	Commpressor 1 Evaporation Pressure	Read
CMP2-A	Commpressor 2 Alarm	Read
CMP2-C	Commpressor 2 Command	Read/Write
CMP2EVAP-P	Commpressor 2 Evaporation Pressure	Read
COMMON-SP	Common Setpoint	Read/Write
COND-T	Condensate Temperature	Read
CT1-C	Cooling Tower 1 Command	Read/Write
CTIISOV-C	Cooling Tower 1 Isolation Valve Command	Read/Write
CT1-S	Cooling Tower 1 Status	Read
CTV-O	Cooling Tower Valve Output	Read/Write
CWP1-C	Condenser Water Pump 1 Command	Read/Write
CWP1-S	Condenser Water Pump 1 Status	Read
CWR-T	Condenser Water Return Temperature	Read
CW-SP	Condenser Water Setpoint	Read/Write
CWS-T	Condenser Water Supply Temperature	Read
DA1-P	Discharge Air Static Pressure 1	Read
DADEHUM-SP	Discharge Air Dehumidification Setpoint	Read/Write

## OBJECT NAMES

DA-F	Discharge Air Flow	Read
DA-H	Discharge Air Humidity	Read
DAMPER-O	Damper Output	Read/Write
DA-P	Discharge Air Static Pressure	Read
DAPHI-A	Discharge Air High Duct Pressure	Read
DAP-SP	Duct Static Pressure Setpoint	Read/Write
DA-SD	Discharge Air Smoke Detector	Read
DA-SP	Discharge Air Setpoint	Read/Write
DA-SP-HL	Discharge Air Setpoint High Limit	Read/Write
DA-SP-LL	Discharge Air Setpoint Low Limit	Read/Write
DA-STATIC-SP	Discharge Air Static Pressure Setpoint	Read/Write
DA-T	Discharge Air Temperature	Read
DATCLGUNOCC-SP	Unoccupied Cooling Setpoint	Read/Write
DATHTGUNOCC-SP	Unoccupied Heating Setpoint	Read/Write
DA-VP	Discharge Air Velocity Pressure	Read
DCPL-F	Decouple Loop Flow	Read
DCPL-S	Decouple Loop Direction	Read
DCPL-T	Decouple Loop Temperature	Read
DEHUM-SP	Dehumidification Setpoint	Read/Write
DPR-C	Damper Command	Read/Write
DPR-O	Damper Output	Read/Write
DTC-T	Dual Temp Coil Temperature	Read
DTP-C	Dual Temp Pump Command	Read/Write
DTP-S	Dual Temp Pump Status	Read
DTR-T	Dual Temp Return Temperature	Read
DTS-T	Dual Temp Supply Temperature	Read
DTV-O	Dual Temp Valve Output	Read/Write
EAFILTER_S	Exhaust Air Filter Status	Read
ECON-C	Economizer Command	Read/Write
ECON-S	Economizer Status	Read
EF1-C	Exhaust Fan 1 Command	Read/Write
EF1-S	Exhaust Fan 1 Status	Read
EF2-C	Exhaust Fan 2 Command	Read/Write
EF2-S	Exhaust Fan 2 Status	Read
EF3-C	Exhaust Fan 3 Command	Read/Write
EF3-S	Exhaust Fan 3 Status	Read
EF4-C	Exhaust Fan 4 Command	Read/Write
EF4-S	Exhaust Fan 4 Status	Read
EF-C	Exhaust Fan Command	Read/Write
EF-S	Exhaust Fan Status	Read
EFFCLG-SP	Effective Cooling Setpoint	Read/Write
EFFHTG-SP	Effective Heating Setpoint	Read/Write
EF-S	Exhaust Fan Status	Read
EMER-RST	Emergency Reset Switch	Read/Write
ERU-E	Energy Recovery Unit Enable	Read/Write
E-STOP	Emergency Stop Switch	Read/Write
FAN-C	Fan Command	Read/Write
FA-SD	Fire Alarm Shutdown	Read/Write
FFILTER-A	Final Filter Alarm	Read
FFILTER-DP	Final Filter Differential Pressure	Read
FILTER-S	Filter Status	Read
FLOERR	Average Flow Error	Read

## OBJECT NAMES

FLOWPID-C	Flow PID Command	Read/Write
FLOW-S	Flow Switch Status	Read
FLOW-SP	Flow Setpoint	Read/Write
FSD1-S	Fire Smoke Damper 1 Status	Read
FSD2-S	Fire Smoke Damper 2 Status	Read
FSD3-S	Fire Smoke Damper 3 Status	Read
FSD-S	Fire Smoke Damper Status	Read
GAS-MTR	Gas Meter Accumulator	Read
HD-P	Hot Deck Pressure	Read
HDS-D-A	Hot Deck Smoke Detector Alarm	Read
HD-T	Hot Deck Temperature	Read
HIDAP-A	High Discharge Air pressure Alarm	Read
HRW-C	Heat Recovery Wheel Command	Read/Write
HRW-S	Heat Recovery Wheel Status	Read
HT-A	High Temperature Alarm	Read
HTG1-C	Heating Stage 1 Command	Read/Write
HTG2-C	Heating Stage 2 Command	Read/Write
HTGCLG-S	AHU Heating/Cooling Status	Read
HTGDA-SP	Heating Discharge Air Temperature Setpoint	Read/Write
HTG-O	Heating Output	Read/Write
HUMSEN-A	Humidity Sensor Failure	Read
HUM-SP	Humidifier Setpoint	Read/Write
HUMV-O	Humidifier Valve Output	Read/Write
HWB-T	Heating Water Bridge Temperature	Read
HW-DP	Hot Water Differential Pressure	Read
HW-DTS-HL	Hot Water Dual Temp Supply High Limit	Read/Write
HW-DTS-LL	Hot Water Dual Temp Supply Low Limit	Read/Write
HW-OA-HL	Hot Water Outdoor Air Reset High Limit	Read/Write
HW-OA-LL	Hot Water Outdoor Air Reset Low Limit	Read/Write
HWP-C	Hot Water Pump Command	Read/Write
HWP-O	Hot Water Valve Output	Read/Write
HWP-S	Hot Water Pump Status	Read
HWP-S	Hot Water Pump Status	Read
HWR-T	Hot Water Return Temperature	Read
HWS-BTU-h	Hot Water System BTU/h	Read
HWS-HI	Hot Water Supply High (Reset)	Read/Write
HWS-kW-h	Hot Water System kW/h	Read
HWS-LO	Hot Water Supply Low (Reset)	Read/Write
HW-SP-HL	Hot Water Setpoint High Limit	Read/Write
HW-SP-LL	Hot Water Setpoint Low Limit	Read/Write
HWS-SP	Hot Water Supply Setpoint	Read/Write
HWS-T	Hot Water Supply Temperature	Read
HWS-W-h	Hot Water System Watt per Hour	Read
HX-EN	Heat Exchanger Enable	Read/Write
HXMV-O	Heat Exchanger Mixing Valve Output	Read/Write
HXV-O	Heat Exchanger Valve Output	Read/Write
IV-O	Inlet Vane Output	Read/Write
LIFT-STA_AIR-A	Lift Station Air Pressure Alarm	Read
LIFT-STA_LEVEL-A	Lift Station Level Alarm	Read
LIFT-STA_P1-A	Lift Station Pump 1 Alarm	Read
LIFT-STA_P1-S	Lift Station Pump 1 Status	Read
LIFT-STA_POWER-A	Lift Station Power Alarm	Read

## OBJECT NAMES

LOWVOLTA	Low Voltage Alarm	Read
LL-A	low Limit Alarm	Read
LT-A	Low Temperature Alarm	Read
MAD-O	Mixed Air Damper Output	Read
MANUALOVERRIDE	Manual Override	Read
MA-P	Mixed Air Static Pressure	Read
MA-STATIC-SP	Mixed Air Static Pressure Setpoint	Read/Write
MA-T	Mixed Air Temperature	Read
MINOAD-SP	Minimum Outdoor Air Damper Setpoint	Read/Write
MIX-O	Mixing Valve Output	Read/Write
MOAD-O	Minimum Outdoor Air Damper Output	Read/Write
MOTOROVRD	Motor Overload	Read
MR-T	Mechanical Room Temperature	Read
OA-CFM	Outdoor Air Cubic Feet per Minute	Read
OACFM-SP	Outdoor Air Cubic Feet per Minute Setpoint	Read/Write
OACHNGOVER-SP	Outdoor Air Changeover Setpoint	Read/Write
OACLG-LL	Outdoor Air Cooling Low Limit	Read
OAD-C	Outdoor Air Damper Command	Read/Write
OAD-O	Outdoor Air Damper Output	Read/Write
OAD-S	Outdoor Air Damper Status	Read
OA-F	Outdoor Air Flow	Read
OAFILTER-S	Outdoor Air Filter Status	Read
OAF-SP	Outdoor Air Flow Setpoint	Read/Write
OA-H	Outdoor Air Humidity	Read
OA-MIN	Outdoor Air Minimum Cubic Feet per Minute	Read/Write
OA-P	Outdoor Air Static Pressure	Read
OA-Q	Outdoor Air Quality	Read
OA-SP-HL	Outdoor Air Setpoint High Limit	Read/Write
OA-SP-LL	Outdoor Air Setpoint Low Limit	Read/Write
OA-T	Outdoor Air Temperature	Read
OAT-HI	Outdoor Air Temperature High (Reset)	Read/Write
OA-T-LL	Outdoor Air Temperature Low Limit	Read/Write
OA-T-LL-S	Outdoor Air Temperature Low Limit Status (Enabled)	Read/Write
OAT-LO	Outdoor Air Temperature Low (Reset)	Read/Write
OA-VP	Outdoor Air Velocity Pressure	Read
OCC-C	Occupied Command	Read/Write
OCCCLGBIAS	Occupied Cooling Bias	Read
OCCHTGBIAS	Occupied Heating Bias	Read
OCCHTG-SP	Occupied Heating Setpoint	Read/Write
OCC-OVERRIDE	Occupancy Override	Read/Write
OCC-S	Occupancy Status	Read
OCC-SCHEDULE	Occupancy Schedule	Read
OCLG-SP	Occupied Cooling Setpoint	Read/Write
OHTG-SP	Occupied Heating Setpoint	Read/Write
OVER-TMR	Override Timer	Read
PCHWP1-C	Primary Chilled Water Pump 1 Command	Read/Write
PFILTER-A	Pre-filter Alarm	Read
PFILTER-DP	Pre-filter Differential Pressure	Read
PH-O	Preheat Valve Output	Read/Write
PH-SP	Preheat Setpoint	Read/Write
PH-T	Preheat Temperature	Read
PHWP1-C	Primary Hot Water Pump 1 Command	Read/Write

## OBJECT NAMES

PHWP1-S	Primary Hot Water Pump 1 Status	Read
PHWP2-S	Primary Hot Water Pump 2 Status	Read
PHWP3-S	Primary Hot Water Pump 3 Status	Read
PHWP4-S	Primary Hot Water Pump 4 Status	Read
PHWP-C	Primary Hot Water Pump Command	Read/Write
PHWP-S	Primary Hot Water Pump Status	Read
PHWR-T	Primary Hot Water Return Temperature	Read
PHWS-T	Primary Hot Water Supply Temperature	Read
Power Fail	Power Failure	Read
RAD-O	Return Air Damper Output	Read/Write
RA-F	Return Airflow Rate	Read
RA-H	Return Air Humidity	Read
RA-P	Return Air Static Pressure	Read
RAPHI-A	Relief Air High Duct Pressure	Read
RAPLO-A	Return Air Low Duct Pressure	Read
RASD-A	Return Air Smoke Detector Alarm	Read
RA-T	Return Air Temperature	Read
RAT-HI-A	High Temperature Alarm	Read
RAT-LO-A	Low Temperature Alarm	Read
RA-VP	Return Air Velocity Pressure	Read
RF-C	Return Fan Command	Read/Write
RF-O	Return Fan Output	Read/Write
RF-S	Return Fan Status	Read
RH-O	Reheat Output	Read/Write
RTU1-C	Rooftop Unit 1 Command	Read/Write
RTU1-S	Rooftop Unit 1 Status	Read
RTU2-C	Rooftop Unit 2 Command	Read/Write
RTU2-S	Rooftop Unit 2 Status	Read
RTU3-C	Rooftop Unit 3 Command	Read/Write
RTU3-S	Rooftop Unit 3 Status	Read
SA-F	Supply Airflow Rate	Read
SAFLOW-SP	Supply Flow Setpoint	Read/Write
SA-P	Supply Air Static Pressure	Read
SASD-A	Supply Air Smoke Detector	Read
SA-T	Supply Air Temperature	Read
SCHW-F	Secondary Chilled Water Flow	Read
SCHWP1-C	Secondary Chilled Water Pump 1 Command	Read/Write
SCHWP1-O	Secondary Chilled Water Pump 1 Output	Read/Write
SCHWP1-S	Secondary Chilled Water Pump 1 Status	Read
SCHWP1-S	Secondary Hot Water Pump 1 Status	Read
SCHWR-T	Secondary CHW Return Temperature	Read
SCHWS-T	Secondary CHW Supply Temperature	Read
SCLG-SP	Standby Cooling Setpoint	Read/Write
SDES-S	Supply Air Damper End Switch Status	Read
SDWN-C	Shutdown Command	Read/Write
SF-A	Supply Fan Alarm	Read
SF-C	Supply Fan Command	Read/Write
SF-FAULT	Supply Fan Fault Cycle	Read
SF-HZ	Supply Fan Output Frequency	Read
SF-KWH	Supply Fan Kilowatt Hours	Read
SF-O	Supply Fan Output	Read/Write
SF-RPM	Supply Fan Motor Speed	Read

## OBJECT NAMES

SF-S	Supply Fan Status	Read
SHTG-SP	Standby Heating Setpoint	Read/Write
SHUTDOWN	Shutdown	Read/Write
SHUTDOWN-S	Shutdown Status	Read
SHW-F	Secondary Hot Water Flow	Read
SHWP1-C	Secondary Hot Water Pump 1 Command	Read/Write
SHWP1-O	Secondary Hot Water Pump 1 Output	Read/Write
SHWP1-S	Secondary Hot Water Pump 1 Status	Read
SHWP2-C	Secondary Hot Water Pump 2 Command	Read/Write
SHWP2-O	Secondary Hot Water Pump 2 Output	Read/Write
SHWP2-S	Secondary Hot Water Pump 2 Status	Read
SHWP-ROT	Secondary Hot Water Pump Rotate	Read/Write
SHWR-T	Secondary Hot Water Return Temperature	Read
SHWS-T	Secondary Hot Water Supply Temperature	Read
SMKNEG-A	Smoke Negative Alarm	Read
SMKPOS-A	Smoke Positive Alarm	Read





## OBJECT GROUPING

AHU		
SYSTEM-E	System Enable	R/W
OCC-C	Occupied Command	R/W
DA-T	Discharge Air Temperature	R
ADA-SP	Actual Discharge Air Setpoint	R/W
RA-T	Return Air Temperature	R
SF-C	Supply Fan Command	R/W
SF-S	Supply Fan Status	R
SF-O	Supply Fan Output	R/W
SF-HZ	Supply Fan Output Frequency	R
SF-RPM	Supply Fan Motor Speed	R
SF-KWH	Supply Fan Kilowatt Hours	R
SF-FAULT	Supply Fan Fault Code	R
DA-P	Discharge Air Static Pressure	R
ASTATIC-SP	Actual Static Pressure Setpoint	R/W
DTV-O	Dual Temperature Valve Output	R/W
SUMDA-SP	Summer Discharge Air Setpoint	R/W
SUMRA-SP-HL	Summer Return Air Setpoint High Limit	
SUMSTATIC-SP-HL	Summer Static Setpoint High Limit	
SUMRA-SP-LL	Summer Return Air Setpoint Low Limit	
SUMSTATIC-SP-LL	Summer Static Setpoint Low Limit	
WINSTATIC-SP	Winter Static Pressure Setpoint	
WINRA-SP-HL	Winter Return Air Setpoint High Limit	
WINDA-SP-LL	Winter Discharge Air Setpoint Low Limit	
WINRA-SP-LL	Winter Return Air Setpoint Low Limit	
WINDA-SP-HL	Winter Discharge Air Setpoint High Limit	
LL-A	Low Limit Alarm	
HIDAP-A	High Discharge Air Pressure Alarm	
SUMWIN-C	Summer/Winter Command	
OA-T	Outdoor Air Temperature	

AHU-VAV	
SYSTEM-E	System Enable
SYSTEM-M	System Mode
OCC-C	Occupied Command
DPR-O	Damper Output
SA-F	Supply Air Flow
FLOW-SP	Flow Setpoint

## OBJECT GROUPING

### VAV

SYSTEM-E	System Enable
SYSTEM-M	System Mode
OCC-C	Occupied Command
ZN-T	Zone Temperature
WC-ADJ	Warm/Cool Adjust
SF-C	Supply Fan Command
ACLG-SP	Actual Cooling Setpoint
OCLG-SP	Occupied Cooling Setpoint
AHTG-SP	Actual Heating Setpoint
OHTG-SP	Occupied Heating Setpoint
SA-F	Supply Air Flow
FLOW-SP	Flow Setpoint
DPR-O	Supply Air Damper Output
SUMWIN-C	Summer/Winter Command
FLOWPID-C	Flow PID Command

### ERU

SYSTEM-E	System Enable
OCC-C	Occupied Command
DA-T	Discharge Air Temperature
ADA-SP	Actual Discharge Air Setpoint
ERU-E	Energy Recovery Unit Enable
SF-S	Supply Fan Status
EF-S	Exhaust Fan Status
WHEEL-S	Wheel Status
DTV-O	Dual Temperature Valve Output
SUMDA-SP	Summer Discharge Air Setpoint
WINDA-SP	Winter Discharge Air Setpoint
OACLG-LL	Outdoor Air Cooling Low Limit
LL-A	Low Limit Alarm
OAFILTER-S	Outdoor Air Filter Status
EAFILTER-S	Exhaust Air Filter Status
SUMWIN-C	Summer/Winter Command
OA-T	Outdoor Air Temperature

## OBJECT GROUPING

### DTWS

SYSTEM-E	System Enable
OA-T	Outdoor Air Temperature
SUM-SW	Summer Switch
WIN-SW	Winter Switch
SUMWIN-S	Summer/Winter Status
DTS-T	Dual Temp Supply Temperature
DTR-T	Dual Temp Return Temperature
DTP-C	Dual Temperature Pump Command
DTP-S	Dual Temperature Pump Status
CH-E	Chiller Enable
CHWP-C	Chiller Water Pump Command
CHWP-S	Chilled Water Pump Status
HWP-C	Hot Water Pump Command
HWP-S	Hot Water Pump Status
HWS-T	Hot Water Supply Temperature
STMVLV-O	Steam Valve Output
AHWS-SP	Actual HW Supply Temperature Setpoint
OA-SP-LL	Outdoor Air Setpoint Low Limit
HW-SP-HL	Hot Water Setpoint High Limit
OA-SP-HL	Outdoor Air Setpoint High Limit
HW-SP-LL	Hot Water Setpoint Low Limit
CHNGOVER-DLY	Change Over Delay

### ENERGY MANAGEMENT POINTS

EMTR	Electric Meter
GMTR	Gas Meter



## AREA NAMES

Lejeune Memorial Park  
Knox Trailer Park  
Camp Geiger  
Camp Johnson  
Tarawa Terrace  
Naval Hospital Midway Park  
MCASNR (Marine Corps Air Station New River)  
Training Area B  
Training Area C  
Piney Green Gate  
Berkeley Manor  
Paradise Point  
Training Area R  
Training Area D  
Watkins Village  
Piney Green  
Camp Devil Dog  
Training Area M  
Training Area K  
Wallace Creek North  
Wallace Creek South  
Training Area Q  
Training Area F  
Hospital Point  
Hadnot Point  
Cogdels Creek  
MOUT  
Frence Creek  
Triangle Outpost Gate  
Ammo Supply Point  
G-10 Impact Area  
Training Area L  
K-2 Impact Area  
Greater Sandy Run  
Rifle Range  
Training Area J  
Amphibian Base  
Courthouse Bay  
Training Area H  
Training Area G  
N1/BT-3 Impact Area  
AIWW  
Training Area E-1  
Training Area I  
Onslow Beach  
Mile Hammock Bay  
Training Area E  
Rawls Parcel-Greater Sandy Run



## SECTION 23 24 00

## HYDRONIC PIPE CLEANING AND FLUSHING PROCEDURES

08/10

## PART 1 GENERAL

## 1.1 PERFORMANCE REQUIREMENTS

Cleaning and flushing shall remove organic soil, hydrocarbons, flux, pipe mill varnish, pipe compounds, iron oxide, and like deleterious substances. Removal of tightly adherent mill scale is not required.

## 1.2 DELIVERY, STORAGE, AND HANDLING

Handle and store detergent to protect equipment, environment and persons. Store detergent according to manufacturer's recommendations.

## 1.3 ENVIRONMENTAL REQUIREMENTS

All chemicals shall be acceptable for discharge into sanitary sewer.

## PART 2 PRODUCTS

## 2.1 MATERIALS

The cleaning compound/detergent shall be an alkaline phosphate or non-phosphate detergent/surfactant/specific to remove organic soil, hydrocarbons, flux, pipe mill varnish, pipe compounds, iron oxide, and like deleterious substances, with or without inhibitor, suitable for system wetted metals without deleterious effects.

## PART 3 EXECUTION

## 3.1 PROTECTION

Do not exceed service factor amperage on pump motor.

## 3.1.1 Special Techniques

- a. If hydronic system does not have operating heating system, install temporary heating system to maintain a water temperature of 120F.
- b. Close terminal unit service valves and open bypass valve. Flushing bypass should connect upstream of the terminal unit supply service valve and downstream of the return service valve. If necessary, provide temporary piping or hose to bypass terminal unit. Remove any component which may be damaged.
- c. Fill system with water and detergent solution to manufacturer's specified water/detergent concentration, heat to 120F.
- d. Operate pump(s) and circulate solution for a minimum of 48 hrs, while maintaining 120 F. From bottom of air/solids separator continuously bleed water while filling system thru standard fill station ensuring to maintain the manufacturer's specified

water/detergent concentration. Modulate drain to maintain system pressure. Do not exceed service factor amperage on pump motor. Throttle discharge valve as necessary. The pump start up strainer shall remain in place. Periodically clean the pump strainer.

- e. Open terminal device service valves and close bypass valves. Flush each terminal device at the device. Ensure to clean all strainers before opening terminal device service valves. Repeat "Step Four" for the terminal devices for a minimum of 48 hour.
- f. Drain system and thoroughly flush with fresh water.
- g. Clean all strainers. Remove pump startup strainer.
- h. Add maintenance chemicals.

-- End of Section --



## SECTION 23 52 43.00 20

## LOW PRESSURE WATER HEATING BOILERS (UNDER 800,000 BTU/HR OUTPUT)

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.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.13/CSA 4.9 (2010; Addenda A 2010) Gas-Fired Low Pressure Steam and Hot Water Boilers

ANSI Z83.3 (1971; R 1995) Gas Utilization Equipment in Large Boilers

## ASME INTERNATIONAL (ASME)

ASME BPVC SEC IV (2010) BPVC Section IV-Rules for Construction of Heating Boilers

ASME CSD-1 (2009) Control and Safety Devices for Automatically Fired Boilers

## ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M (2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2012) Motors and Generators

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

MIL-B-18897 (Rev F; CANC Notice 1) Boilers, Steam and Hot Water, Watertube (Straight Bare and Finned Tube), Cast Iron and Firebox, Packaged Type (40,000 to 35,000,000 BTU/HR Thermal Output Capacity)

## U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

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

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS F-B-2910 (Basic) Burners, Single Oil, Gas, and Gas-Oil Combination for Packaged Boilers (320,001 to 125,000,000 BTU/HR Thermal

Output Capacity)

UNDERWRITERS LABORATORIES (UL)

UL 726 (1995; Reprint Apr 2011) Oil-Fired Boiler Assemblies

UL 795 (2011) Standard for Commercial-Industrial Gas Heating Equipment

## 1.2 RELATED REQUIREMENTS

Section 23 03 00 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section, with the additions and modifications specified herein.

## 1.3 DESIGN REQUIREMENTS

Boiler shall be suitable for installation in the space shown with ample room for service. Boiler shall have an output as indicated on plans with an efficiency not less than 90% at design conditions and equal to or greater than 94% based on the Hydronics Institute BTS-2000 Rev. 06.07 conditions. Boiler shall be designed, tested, and installed in accordance with ASME BPVC SEC IV and ASME CSD-1.

### 1.3.1 Detail Drawings

Submit fuel train and wiring diagram

### 1.3.2 Water Analysis

Provide test reports of water analysis.

## 1.4 SAFETY STANDARDS

Hot water boilers, burners and supplementary control devices, safety interlocks, or limit controls required under this specification, shall meet requirements of the following standards as applicable:

- a. Oil-Fired Units: UL 726.
- b. Gas-Fired Units: ANSI Z83.3, ANSI Z21.13/CSA 4.9 or UL 795.
- c. Combination Gas- and Oil-Fired Units: UL 726, ANSI Z83.3, ANSI Z21.13/CSA 4.9 or UL 795.
- d. All Units: ASME BPVC SEC IV and ASME CSD-1.

Controls not covered by the above shall have a UL label, UL listing mark, or shall be listed in the Factory Mutual Approval Guide.

## 1.5 SUBMITTALS

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

SD-02 Shop Drawings

Fuel train

Wiring diagram

SD-03 Product Data

Boilers: power output, thermal efficiency, ASME certification, allowable working pressure, model number, documentation for Energy Star qualifications or meeting FEMP requirements

Boiler trim and control equipment

Burners and control equipment

Documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project.

SD-06 Test Reports

Operational tests

Water analysis

SD-07 Certificates

Boilers

Burners and control equipment

Boiler trim and control equipment

Boilers

Boiler trim and control equipment

Burners and control equipment

Boiler manufacturer's certificate of boiler performance including evidence that the burners provided shall be a make, model, and type certified and approved by the manufacturer of the boiler being provided.

SD-08 Manufacturer's Instructions

Boilers

SD-10 Operation and Maintenance Data

Boilers, Data Package 4

SD-11 Closeout Submittals

Posted operating instructions for heating water boilers

## PART 2 PRODUCTS

## 2.1 BOILERS

**MIL-B-18897.** Provide hot water heating boiler complete with firing equipment, combustion chamber, insulation with steel jacket, safety and operating controls, integral electrical wiring and other appurtenances, to make the boiler a complete, self-contained, fully-automatic unit, ready for service upon completion of utility connections. Gas fired boilers greater than 300,000 Btuh output shall have a steady state combustion efficiency of at least 94percent when fired at the maximum and minimum capacities which are provided and allowed by the controls based on the Hydronics Institute BTS-2000, Rev. 06.07 conditions. Cast aluminum boilers are acceptable.

## 2.2 BURNERS AND CONTROL EQUIPMENT

## 2.2.1 Gas-Fired Power Burner

Gas-fired power burner (over 400,000 BTU/hr input). **FS F-B-2910.** Interrupted pilot type ignition system, and pilot shall be the spark orelectrode-ignited natural gas type. Design burner and combustion control equipment for firing natural gas having a specific gravity of 0.6 and a heating value of approximately 1000 BTU per cubic foot and be an integral part of the boiler. Burner controls and safety equipment shall conform to applicable requirements of **FS F-B-2910.** Mount controls; including operating switches, indicating lights, gages, alarms, motor starters, fuses, and circuit elements of control systems on a single control panel or cabinet designed for separate mounting not on the burner in accordance with **FS F-B-2910.** The combustion control system shall be the modulating type. Gas pressure available: 10 inches of water gage. Minimum turn down ratio of 5:1. Provide boiler with gas regulator as required to meet manufacturer's inlet pressure and flow requirements.

## 2.3 BOILER TRIM AND CONTROL EQUIPMENT

Provide in accordance with **MIL-B-18897** and additional requirements specified below.

## 2.3.1 Emergency Disconnect Switch

Provide and locate on wall outside boiler room entrance or just inside door, when boiler room door is on building exterior to allow rapid and complete shutdown of the boiler in the event of an emergency. Emergency switch shall be a 15-amp. fuse-type safety switch. Switch shall be red and furnished with a label indicating function of switch.

## 2.3.2 Relief Valves

Provide relieving capacity for the full output of boiler installed. Relief-valve piping shall conform to **ASTM A53/A53M**, schedule 40 steel pipe and be piped full-size to a floor drain to 6 inches above floor.

## 2.3.3 Thermometer

Provide thermometer with a scale equivalent to 1.5 times outlet water temperature. Provide one located on supply water piping and one on return water piping.

#### 2.3.4 Drain Tapping

Provide drain valve and piping to 6 inches above floor.

#### 2.3.5 Make-up Water Station

##### 2.3.5.1 Pressure Reducing Station

Provide a water pressure-reducing valve and relief valve, or a combination of the two in the makeup water line to the boiler to maintain a water pressure of 12 psig in the hot water system. Provide a 3/4 inch globe valve by-pass around this valve.

##### 2.3.5.2 Backflow Preventers

Section 22 00 00 PLUMBING, GENERAL PURPOSE. Locate upstream of by-pass.

#### 2.3.6 Air Vent Valve

Provide with screwed connection, stainless steel disk, and stainless steel seats to vent entrapped air.

#### 2.3.7 High Temperature Limit Switch

Provide immersible aquastat type with a temperature setting above that of the combustion regulator and below that of the lowest relief valve setting. Aquastat shall function to cause a safety shutdown by closing fuel valves, and shutting down burner equipment , activating a red indicating light, and sounding an alarm in the event that boiler water temperature rises to the high temperature limit setting. A safety shutdown due to high temperature shall require manual reset before operation can resume and prevent recycling of burner equipment.

#### 2.3.8 Low Water Pressure Control

Provide mercury switch type. Control shall have a main scale, adjusting screws at the top of the case, and have an internal or external bellows. Control shall be the type which will open an electric circuit on a drop in pressure below a set minimum. Control shall be set and installed to cause a safety shutdown by closing fuel valves, and shutting down burner equipment , activating a red indicating light, and sounding an alarm in the event that water pressure in the system drops below 12 psig . A safety shutdown due to low water pressure shall require manual reset before operation can resume and prevent recycling of burner equipment.

#### 2.3.9 Low Water Level Cutoff Switch

Provide float actuated type. Low water level cutoff shall cause a safety shutdown by closing fuel valves, and shutting down burner equipment , activating a red indicating light, and sounding an alarm in the event that water level drops below the lowest safe permissible water level established by the boiler manufacturer and ASME BPVC SEC IV. A safety shutdown due to low water shall require manual reset before operation can resume and prevent recycling of burner equipment.

#### 2.3.10 Boiler Safety Control Circuits

Provide boiler safety control circuits, including control circuits for burner , shall be single-phase, two-wire one-side grounded, and not over

120 volts. Provide safety control switching in ungrounded conductors. Provide overcurrent protection. In addition to circuit grounds, ground metal parts which do not carry current to a grounding conductor.

#### 2.3.11 Draft

Comply with boiler manufacturer's recommendations.

### 2.4 ELECTRIC MOTORS

Electric motors shall meet requirements of NEMA MG 1. Motors less than 1 hp shall meet NEMA High Efficiency requirements. Motors 1 hp and larger shall meet NEMA Premium Efficiency requirements. Motors which are an integral part of the packaged boiler system shall be the highest efficiency available by the manufacturer of the packaged boiler. Motors shall be variable speed.

## PART 3 EXECUTION

### 3.1 EQUIPMENT INSTALLATION

Install equipment in accordance with manufacturer's installation instructions. Grout equipment mounted on concrete foundations before installing piping. Install piping in such a manner as not to place a strain on equipment. Do not bolt flanged joints tight unless they match. Grade, anchor, guide, and support piping without low pockets.

### 3.2 EQUIPMENT FOUNDATIONS

Locate equipment foundations as indicated, designed, and made of sufficient size and weight to preclude shifting of equipment under operating conditions or under abnormal conditions that could be imposed upon the equipment. Foundations shall meet requirements of the equipment manufacturer. Concrete and grout shall conform to Section 03 30 00 CAST-IN-PLACE CONCRETE.

### 3.3 BOILER CLEANING

Follow manufacturer's instructions.

### 3.4 FIELD QUALITY CONTROL

Perform and furnish everything required for inspections and tests as specified herein to demonstrate that boiler and auxiliary equipment, as installed, are in compliance with contract requirements. Start-up and operate the system. During this time, clean strainers until no further accumulation of foreign material occurs. Exercise care to minimize loss of water when strainers are cleaned. Adjust safety and automatic control instruments as necessary to place them in proper operation and sequence. Test instrumentation shall be calibrated and have full scale readings from 1.5 to 2 times test values.

#### 3.4.1 Operational Tests

Operate each boiler and appurtenances prior to final testing and insure that necessary adjustments have been made. Provide testing equipment required to perform tests. During this testing period, provide operating instructions and training to persons tasked with operation of the boiler. Tests shall be accomplished with both fuels on dual fuel units and include

the following:

3.4.1.1 Preliminary Operational Test

Operate the boilers continuously for a period of at least 8 hours to demonstrate proper operability of the combustion control, flame safeguard control, and safety interlocks.

3.5 WASTE MANAGEMENT

Separate waste in accordance with the Waste Management Plan. Close and seal tightly all partly used adhesives and solvents; store protected in a well-ventilated, fire-safe area at moderate temperature.

-- End of Section --





## SECTION 23 73 33

## HEATING, VENTILATING, AND COOLING SYSTEM

01/07

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 210 (1999) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.22 (1999; 2001) Relief Valves for Hot Water Supply Systems

## ASME INTERNATIONAL (ASME)

ASME B16.3 (2011) Malleable Iron Threaded Fittings, Classes 150 and 300

ASME B16.5 (2009) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B16.9 (2007) Standard for Factory-Made Wrought Steel Butt Welding Fittings

ASME B16.11 (2011) Forged Fittings, Socket-Welding and Threaded

ASME B16.18 (2012) Cast Copper Alloy Solder Joint Pressure Fittings

ASME/ANSI B16.22 (1995) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B16.23 (2011) Cast Copper Alloy Solder Joint Drainage Fittings - DWV

ASME/ANSI B16.39 (1998) Malleable Iron Threaded Pipe Unions

ASME B31.1 (2010) Power Piping

ASME/ANSI B31.5 (2001) Refrigeration Piping and Heat Transfer Components

## AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003 (2009) Performance Requirements for Water

Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI approved 2010)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A 53/A 53M (1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- ASTM A 106 (1999e1) Seamless Carbon Steel Pipe for High-Temperature Service
- ASTM A 193/A 193M (2001b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
- ASTM A 194/A 194M (2001a) Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
- ASTM B 32 (2008) Standard Specification for Solder Metal
- ASTM B 42 (1998) Seamless Copper Pipe, Standard Sizes
- ASTM B 88 (2009) Standard Specification for Seamless Copper Water Tube
- ASTM B 306 (1999) Copper Drainage Tube (DWV)

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

- FCCCHR-USC (2002) List of Approved Backflow Prevention Assemblies

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

- MSS SP-58 (2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
- MSS SP-67 (2011) Butterfly Valves
- MSS SP-69 (2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)
- MSS SP-70 (2011) Gray Iron Gate Valves, Flanged and Threaded Ends
- MSS SP-71 (2011) Gray Iron Swing Check Valves, Flanged and Threaded Ends
- MSS SP-80 (2008) Bronze Gate, Globe, Angle and Check Valves
- MSS SP-85 (2011) Gray Iron Globe & Angle Valves

Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70

(2011; Errata 2 2012) National Electrical Code

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA R&W Manual

(2001, 5th Ed) NRCA Roofing and Waterproofing Manual

1.2 SYSTEM DESCRIPTION

Provide new and modify existing heating, ventilating, and cooling (HVAC) systems complete and ready for operation. HVAC systems include equipment, ducts, and piping which is located within, on, under, and adjacent to buildings.

1.3 SUBMITTALS

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

SD-02 Shop Drawings

Temperature control systems

Automatic Flow Control Valves (AFCV)

Unit heaters

Pumps, including performance curves for each impeller size

Exhaust fans

Expansion tanks

Air separators

Pipe hangers and supports

Flexible pipe connectors

Valves

Pipe and fittings

SD-08 Manufacturer's Instructions

Installation manual

SD-10 Operation and Maintenance Data

Unit heaters, Data Package 2

Pumps, Data Package 2

Exhaust fans, Data Package 2

### 1.3.1 Temperature Control Systems

Drawings shall include point-to-point electrical wiring diagrams.

### 1.3.2 Automatic Flow Control Valves (AFCV)

Submit drawings showing location and model of each AFCV. Show HVAC equipment and requirements, piping, and pressure drops across the AFCV. Show gpm, size and spring ranges of AFCV.

### 1.3.3 Equipment layout drawings

Submit drawings showing equipment layout including foot print, piping, conduit, control cabinets, door swings, and power disconnects.

### 1.3.4 Installation Manual

Provide for each item of equipment.

### 1.3.5 Certification of Welders' Qualifications

Submit copy of Welder Qualification Tests (Form QW-482) prior to site welding.

## PART 2 PRODUCTS

### 2.1 EQUIPMENT

Dehydrate, purge, and charge refrigerant circuit with refrigerant and oil at factory. Factory oil and refrigerant charge shall be full amount required for operation, if within limits permitted by the Department of Transportation; otherwise, a holding charge shall be furnished. Field charging, where only a holding charge is shipped, shall be accomplished without breaking permanent refrigerant connections. Equipment using R-11, R-12, R-13, R-113, R-114, R-115, R-500, or R-502 as a refrigerant will not be permitted. Refrigerants shall have an Ozone Depletion Factor (ODF) of 0.05 or less. The ODF shall be in accordance with the "Montreal Protocol On Substances That Deplete The Ozone Layer," September 1987, sponsored by the United Nations Environment Program. Refrigerants that operate anywhere in the cycle below 20 psia will not be permitted. Efficiency of equipment shall meet the minimum's of Table 15701-1.

#### 2.1.1 Unit Heaters

Provide factory-assembled, propeller or blower type fan unit heaters arranged for horizontal or vertical air discharge as indicated. Each unit shall include hot water coil, fan, electric motor, housing, and air discharge vanes or diffusers. Horizontal discharge type units shall have adjustable deflectors for control of horizontal and vertical airflow. Rotating air deflector assemblies on vertical units where indicated shall be gear driven by separate electric motor and shall rotate when the fan runs. Each unit shall be provided with threaded mounting holes for attaching threaded hanger rods. Fan motor shall be controlled by wall-mounted adjustable thermostat with higher end of scale range factory set at 75 degrees F. Controls shall be automatic of the on-off type. Provide fan selector switches to provide AUTOMATIC-ON-OFF positions.

### 2.1.2 Pumps

- a. In-Line pumps: Provide pumps constructed of manufacturer's standard materials suitable for chilled water and hot water heating systems. Pumps shall have mechanical seals and drip-proof electric motors.
- b. End suction water pumps: Pumps shall be single stage centrifugal, with mechanical seals and drip-proof electric motors. Impeller shall be bronze. Other pump parts shall be manufacturer's standard materials provided with bronze impeller pump. Provide threaded suction and discharge pressure gage tapping with square-head plugs. Provide flexible coupling with steel cover guard on base-mounted pumps. 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.
- c. Pump suction diffuser: Casing shall include an angle type body of cast iron. Unit shall have internal straightening vanes, strainer with minimum 0.25-inch openings, and 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. Blowdown port and plug shall be provided on unit casing. Provide a magnetic insert to remove debris from system.

### 2.1.3 Exhaust Fans

AMCA 210 with AMCA seal. Provide centrifugal type exhaust fans with aluminum housing, fan wheel, and bird screen. Motors shall be completely shielded from the airstream. Provide exhaust opening and gravity closing type automatic backdraft dampers. Provide NRCA R&W Manual roof curb for roof mounted exhaust fans as recommended by fan manufacturer.

## 2.2 ELECTRICAL

### 2.2.1 Electrical Motors, Controllers, Contactors, and Disconnects

Furnish with respective pieces of equipment. Motors, controllers, contactors, and disconnects shall conform to Section 26 20 00, "Interior Wiring Systems." Provide electrical connections under Section, 26 20 00, "Interior Wiring Systems." Provide controllers and contactors with maximum of 120-volt control circuits, and auxiliary contacts for use with controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of providing additional electrical service and related work shall be included under this section.

### 2.2.2 Electrical Work

Provide control wiring under this section in accordance with NFPA 70.

## 2.3 PIPING SYSTEMS

Provide the following [pipe and fittings](#). Provide dielectric fittings, unions or flanges between steel piping and copper tubing for all piping sizes; except that copper alloy valves and strainers may be used without dielectric fittings, unions or flanges. Water piping sizes 4 inches and smaller shall be copper tubing. Water piping sizes larger than 4 inches shall be copper tubing or steel piping. If steel piping is provided, provide a solids-from-water separator.

### 2.3.1 Soldered Joint Copper Tubing

Provide [ASTM B 88](#), Type L for aboveground piping, Type K for buried piping, with [ASME B16.18](#) or [ASME/ANSI B16.22](#) solder joint fittings, unions, and flanges; provide adapters as required. Provide [ASTM B 42](#) copper pipe nipples with threaded end connections. Provide [ASTM B 32](#), 95-5 tin-antimony solder, or provide Plumbing Code approved lead-free solder.

### 2.3.2 Copper Tubing Piping Systems

Provide copper tubing for the following piping systems, except water piping sizes larger than 4 inches shall be copper tubing or steel piping.

- a. Chilled water, chilled-hot water, and hot water piping.
- b. Cold drain piping from drain pans.

### 2.3.3 Copper Cold Drain Piping

Provide copper tubing in accordance with paragraph entitled "Copper Tubing" for piping sizes one inch and smaller. Provide [ASTM B 306](#) copper tubing and [ASME B16.23](#) solder joint fittings for piping sizes larger than one inch. In lieu of copper tubing, 1.25 inch Schedule 40 polyvinyl chloride (PVC) plastic pipe, fittings, and solvent cement may be provided.

### 2.3.4 Buried Preinsulated Water Piping

Provide buried preinsulated water piping in conduit complete and ready for operation. Install in accordance with fabricator's published literature. Provide copper tubing for carrier piping; carrier piping sizes larger than 4 inches may be steel piping. Minimum depth of cover shall be 2 feet.

- a. Factory-applied insulation: Provide polyurethane or polyisocyanate insulation, rated for not less than 250 degrees F service, completely filling the space between carrier pipe and conduit.
- b. Factory-applied conduit: Provide each section of carrier pipe with insulation and conduit complete with waterproof conduit caps at both ends. Mark each section of conduit with fabricator's name, product identification, and publications to which the items conform. Provide same type of insulation and conduit material over field-insulated joints and fittings; provide waterproof shrink sleeves over field-insulated joints to overlap not less than 6 inches of each conduit section.
- c. Bedding: Accurately grade trench bedding with minimum of 6 inches

of sand. Backfill sand to minimum of 6 inches above and below conduit. Lay bedding to firmly support conduit along entire length.

- d. Buried utility warning tape: Provide detectable tape for warning of buried piping.

#### 2.3.5 Steel Piping Systems

Provide steel piping for the following piping systems.

- a. Gas piping.

##### 2.3.5.1 Steel Pipe

Provide [ASTM A 53/A 53M](#) Type E or Type S, or [ASTM A 106](#) steel pipe; except [ASTM A 53/A 53M](#), Type F steel pipe may be provided for water pipe sizes larger than 4 inches and for steam pipe less than 100 psig. Provide Weight Class STD or Schedule No. 40 black steel pipe for welding end connections. Provide Weight Class XS or Schedule No. 80 black steel pipe for threaded end connections and for condensate piping.

##### 2.3.5.2 Steel Pipe Fittings

Provide [ASME B16.3](#) or [ASME B16.11](#) threaded fittings, and [ASME/ANSI B16.39](#) threaded unions. Provide [ASME B16.9](#) buttwelding fittings of the same material and weight as the piping in which fittings are installed; provide backing rings compatible with piping materials being buttwelded. Provide [ASME B16.11](#) socket welding fittings.

##### 2.3.5.3 Steel Pipe Unions

Provide [ASME/ANSI B16.39](#), Class 150, unions with threaded end connections on one side of threaded valve in steel piping systems.

##### 2.3.5.4 Steel Pipe Flanges

Provide [ASME B16.5](#), Class 150 welding neck flanges. Extend bolts no less than two full threads beyond the nut with the bolts tightened to the required torque.

- a. Gaskets: Provide one piece factory cut gaskets suitable for the intended service. Provide full-face gaskets for flat-face flanged joints, and ring gaskets for raised-face flanged joints.
- b. Bolts: Provide [ASTM A 193/A 193M](#), Grade B7 bolts.
- c. Nuts: [ASTM A 194/A 194M](#), Grade 7.
- d. Washers: Provide steel flat circular washers under bolt heads and nuts.

##### 2.3.6 Valves

Valves shall have flanged end connections, except valves smaller than 2.5 inches may have threaded end connections with a union on one side of the valve. Solder end connections may be used for connections between copper alloy valves and copper tubing.

#### 2.3.6.1 Gate Valves

MSS SP-80, Class 125, except sizes 2.5 inches and larger shall conform to MSS SP-70, Class 125.

#### 2.3.6.2 Globe and Angle Valves

MSS SP-80, Class 125, except sizes 2.5 inches and larger shall conform to MSS SP-85, Class 125.

#### 2.3.6.3 Check Valves

MSS SP-80, Class 125, swing check; except sizes 2.5 inches and larger shall conform to MSS SP-71, Class 125.

#### 2.3.6.4 Butterfly Valves

MSS SP-67, except sizes 2.5 inches and larger shall have lugged or wafer body designed for installation between ASME Class 150 flanges. Valves shall have two-position lever handles, except when infinite position lever handles are indicated.

#### 2.3.6.5 Ball Valves

Full port design, copper alloy body, except sizes 2.5 inches and larger shall be cast-iron body. Valves shall have two-position lever handles. Ball valves may be provided in lieu of gate valves.

#### 2.3.6.6 Square Head Cocks

Provide copper alloy or cast-iron body with copper alloy plugs, suitable for 125 psig water working pressure.

#### 2.3.6.7 Air Venting Valves

Provide copper alloy body valves with automatic or manual air vent as indicated.

#### 2.3.6.8 Combination Pressure and Temperature Relief Valves

ANSI Z21.22, copper alloy body, automatic reseating, test lever, and discharge capacity based on AGA temperature steam rating.

#### 2.3.6.9 Water Pressure Reducing Valves

ASSE 1003, copper alloy body, automatic reseating, with test lever.

#### 2.3.6.10 Water Temperature Regulating Valves

Provide copper alloy body, direct acting, pilot operated, for the intended service.

#### 2.3.6.11 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 tappings 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.

#### 2.3.6.12 Automatic Flow Control Valves

Valve shall be tamperproof, factory calibrated, direct acting, automatic pressure compensating valve which limits flow rates to within range of plus or minus 10 percent accuracy, regardless of system pressure fluctuations. Select each valve for mid-range control of indicated capacity. Flow control mechanism includes self-cleaning spring loaded cut with open chambers and unobstructed flow passages. Valves shall be furnished by same manufacturer. Valve body shall have flow direction arrow. Provide strainer and union connection on inlet to valve. Copper alloy or cast-iron body, copper alloy or stainless internal working parts. Valves shall be suitable for 125 psig at 190 degrees F hot water. 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.

#### 2.3.6.13 Backflow Prevention Assemblies

Provide reduced pressure principle type backflow prevention assemblies which are approved by and has a current "Certificate of Approval" from the [FCCCHR-USC](#). Listing of the particular make, model/design, and size in the current [FCCCHR-USC](#) will be acceptable as the required proof.

### 2.4 PIPING ACCESSORIES

#### 2.4.1 Pipe Hangers and Supports

Provide [MSS SP-58](#) and [MSS SP-69](#), Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

#### 2.4.2 Strainers

Pressure and temperature range shall be for the intended service. Provide blowoff outlet with pipe nipple, gate valve, and discharge pipe nipple. Provide stainless steel strainer element with perforations of 0.047 inch for water, 0.031 inch for steam mixed with condensate, and 0.016 inch for steam. Provide copper alloy or cast-iron body strainers in steam and condensate systems up to 100 psig. Provide steel body strainers in steam and condensate systems 100 psig and greater.

#### 2.4.3 Pressure Gages

Provide single style pressure gage with 4.5-inch dial, brass or aluminum case, bronze tube, gage cock, pressure snubber, and syphon. Provide scale range for intended service.

#### 2.4.4 Thermometers

Provide bi-metal dial type thermometers with stainless steel case, stem, and fixed thread connection; 3 inch diameter dial with glass face gasketed within the case; and accuracy within 2 percent of scale range. Provide scale range for intended service.

#### 2.4.5 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors. Provide one-inch minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, seal both ends of sleeves or core-drilled holes with UL listed fill, void, or cavity material.

##### 2.4.5.1 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.

##### 2.4.5.2 Sleeves not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

#### 2.4.6 Flexible Pipe Connectors

Provide flexible bronze or stainless steel piping connectors with single braid where indicated. Connectors shall be suitable for the intended service.

#### 2.4.7 Expansion Tanks

Construct of steel for minimum working pressure of 125 psig. Tank shall have polypropylene or butyl lined diaphragm which keeps the air charge separated from the water.

#### 2.4.8 Air Separators

Provide tangential inlet and outlet connections, blowdown connections, and internal perforated stainless steel air collector tube to direct released air to automatic air vent. Construct of steel for minimum working pressure of 125 psig. 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. Unit shall be for minimum working pressure of 125 psig.

2.4.9 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

2.5 HEAT TAPE FOR FREEZE PROTECTION OF PIPING

Provide parallel conduction type that is composed of two copper conductors separated by conductive material and all encased in an insulating jacket. The heat tape shall be self-regulating that decreases heat output as temperature increases at each point along the length of tape. Provide voltage as indicated. Provide heat tape complete with fittings, adapters, and fittings, adapters, and other devices to connect tape to standard rigid steel conduit junction boxes, switches, or other devices as indicated. Provide tape sealants and jumper connectors up to 5-inches in length for connecting multiple runs. Provide a thermostat that activates the heat tape on drop of outside air temperature at 38 F. Thermostat shall have maximum tolerance of plus or minus 5 degrees F and maximum operating differential of 6 degrees F within temperature operating range. Wattage per foot of pipe at 50 F shall be as follows. This wattage may be achieved by spiraling the tape around the pipe.

Pipe Diameter (Inches)	1/2	3/4	1	1.25	1.5	2	3	4	6	8
Watt/Foot	2	2	2.5	2.5	3	3.5	4	6	7	8

2.5.1 Pressure/Temperature Test Ports (Plugs)

Provide solid bras test plugs where indicated. Test plug shall be capable of receiving a pressure or temperature probe 1/8-inch o.d. Dual seal core shall be rated zero leakage from vacuum to 200 psig and 0 F to 220 F. Each plug shall be extended through pipe insulation and be capped.

2.6 CHEMICAL FEED TANK

Construct of steel for minimum working pressure of 125 psig. Provide chemical pipe, fittings, and valves as specified for water piping. Add borate-nitrite corrosion inhibitors to initial fill water for heating and cooling water systems in concentrations of one-half ounce per gallon of system water.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 HVAC System

Installation of HVAC system including equipment, materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with ASME B31.1, ASME/ANSI B31.5, NFPA 70, and in accordance with the manufacturer's recommendations.

3.1.2 Connections to Existing Systems

Notify the Contracting Officer in writing at least 15 calendar days prior to the date the connections are required. Obtain approval before interrupting service. Furnish materials required to make connections into existing systems and perform excavating, backfilling, compacting, and other incidental labor as required. Furnish labor and tools for making actual connections to existing systems.

3.2 PIPING

Test, inspect, and approve piping before burying, covering, or concealing. Provide fittings for changes in direction of piping and for connections. Make changes in piping sizes through tapered reducing fittings; bushings will not be permitted. Install valves with stems horizontal or above. Provide flanges or unions at valves, traps, strainers, and connections to equipment; unions are not required in copper tubing piping systems.

- a. Threaded connections: Provide Teflon pipe thread paste on male threads. Do not thread metal pipe into plastic piping.
- b. Pipe hangers and supports: Provide additional pipe hangers and supports at in-line water pumps and flanged valves.
- c. Piping to receive insulation: Provide temporary wood spacers between the pipe hangers and supports, and the pipe in order to properly slope the piping and establish final elevations. Provide temporary wood spacers of same thickness as insulation to be provided under Section 23 07 00, "Insulation For Mechanical Systems." Support plastic piping every 4 feet. Support metal piping as follows.

MAXIMUM SPACING (FEET)

Nominal Pipe Size (inches)	One and under	1.25	1.5	2	2.5	3	3.5	4	5	6
Copper Tubing	6	7	8	8	9	10	11	12	13	14
Steel Pipe	7	8	9	10	11	12	13	14	16	17

- d. Cleaning of piping: Keep interior and ends of new piping and existing piping affected by Contractor's operations, cleaned of water and foreign matter during installation by using plugs or other approved methods. When work is not in progress, securely close open ends of pipe and fittings to prevent entry of water and foreign matter. Inspect piping before placing into position.
- e. Demolition: Remove materials so as not to damage materials which are to remain. Replace existing work damaged by Contractor's operations with new work of same construction.
- f. Tee Joints: Extracted tee joints may be made in copper tube. Make joint with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, provide dimpled depth stops. Notch the branch tube for proper penetration into fitting to assure a free flow

joint. Braze extracted joints using a copper phosphorous classification brazing filler metal. Soldered joints shall not be permitted.

### 3.3 ADJUSTMENTS

Adjust controls and equipment so as to give satisfactory operation. Adjust entire water temperature control system and place in operation so that water quantities circulated are as indicated. Air duct systems shall be adjusted and balanced so that air quantities at outlets are as indicated and so that distribution from supply outlets is free from drafts and has uniform velocity over the face of each outlet.

### 3.4 PUMPS

After testing, adjusting, and balancing, trim the impellers on all pumps 10 hp and greater to actual flow conditions plus 10 percent discharge head. Readjust throttling device to correct flow rate.

### 3.5 INSTRUCTING OPERATING PERSONNEL

Upon completion of work and at time designated by Contracting Officer, provide services of competent technician for period of not less than one 8-hour working day for instruction of Government operating personnel in proper operation and maintenance of equipment.

### 3.6 FIELD QUALITY CONTROL

Upon completion and before final acceptance of work, test each system in service to demonstrate compliance with the contract requirements. Adjust controls and balance systems prior to final acceptance of completed systems. Test controls through every cycle of operation. Test safety controls to demonstrate performance of required function. Correct defects in work provided by Contractor and repeat tests. Furnish steam, fuel, water, electricity, instruments, connecting devices, and personnel for tests. Flush and clean piping and boiler before placing in operation. Clean equipment, piping, strainers, ducts, and filters.

#### 3.6.1 Piping Systems Except for Refrigerant Piping

Before insulating, hydrostatically test each new piping system at not less than 188 psig. Maintain pressure for 2 hours with no leakage or reduction in gage pressure. Obtain approval before applying insulation.

#### 3.6.2 Equipment

##### 3.6.2.1 Field Testing

Test each item of equipment in operation for continuous period of not less than 24 hours under every condition of operation in accordance with each equipment manufacturer's recommendation. Verify that the equipment operating parameters are within limits recommended by the manufacturer.

##### 3.6.2.2 Equipment Requiring Field Test Reports:

- a. Equipment Items for Reports: Equipment requiring field test reports are listed in paragraph "SD-12, Field Test Reports."
- b. Manufacturer's Recommended Test: Conduct the manufacturer's

recommend field testing in compliance with the approved test plan. Furnish a factory trained field representative authorized by and to represent the equipment manufacturer at the complete execution of the field testing.

- c. Operational Test: Conduct a continuous 24 hour operational test for each item of equipment. Equipment shutdown before the test period is completed shall result in the test period being started again and run for the required duration. For the duration of the test period, compile an operational log of each item of equipment. Log required entries every two hours. Use the test report forms for logging the operational variables.
- d. Notice of Tests: Conduct the manufacturer's recommended tests and the operational tests; record the required data using the approved reporting forms. Notify the Contracting Officer in writing at least 15 calendar days prior to the testing. Within 30 calendar days after acceptable completion of testing, submit each test report for review and approval.
- e. Report Forms: Type all data entries and writing on the test report forms. Completed test report forms for each item of equipment shall be reviewed, approved, and signed by the Contractor's test director and the QC Manager. The manufacturer's field test representative shall review, approve, and sign the report of the manufacturer's recommended test. Signatures shall be accompanied by the person's name typed.
- f. Deficiency Resolution: The test requirements acceptably met; deficiencies identified during the tests shall be corrected in compliance with the manufacturer's recommendations and corrections retested in order to verify compliance.

### 3.6.3 Boiler

Hydrostatically test at pressure of not less than 60 psig or as provided for in manufacturer's literature before being placed in operation. Notify Contracting Officer in writing when boiler is ready for testing and before boiler is operated. Government boiler inspector shall be notified by the Contracting Officer and shall witness boiler tests and approve before boiler units are placed in operation or accepted.

### 3.6.4 Additional Field Testing

Provide testing, adjusting, and balancing (TAB) of ducts, piping, and equipment under Section 23 05 92, "Testing/Adjusting/Balancing: Heating/Ventilating/Cooling Systems."

### 3.6.5 Testing and Balancing

Balance airflow in accordance with SMACNA and flows indicated. Submit written certificate to report the following:

- a. Air-handling unit and condensing unit nameplate data, and actual voltage and ampere consumption.
- b. Supply and return terminal airflow, and equipment used to measure airflow.

- c. Air-handling unit in and out cfm and temperatures, rpm of fan if belt driven.
- d. Ambient outside air temperature, date, and person testing, balancing, and reporting.

3.6.6 Testing EMCS Equipment

- a. All EMCS equipment shall be given an operation test.
- b. Items not operating properly shall be repaired or replaced and retested.

TABLE 15701-1  
EQUIPMENT MINIMUM EFFICIENCY REQUIREMENTS  
Equipment must meet each rating listed

<u>Equipment Type</u>	<u>Efficiency</u>	<u>Rating Condition</u>
Natural Gas Fired Heating Boiler		
Water	92% Et	

-- End of Section --





## SECTION 26 00 00

## BASIC ELECTRICAL MATERIALS AND METHODS

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 D 709 (2000) Laminated Thermosetting Materials

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

29 CFR 1910.147 Control of Hazardous Energy (Lock Out/Tag Out)

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 100 (1996) Dictionary of Electrical and Electronics Terms (IEEE)

IEEE C2 (2012) National Electrical Safety Code

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA C57.12.28 (1999) Pad-Mounted Equipment - Enclosure Integrity (Revision of ANSI C57.12.28-88)

NEMA ICS 6 (1993; R 2001) Industrial Control and Systems Enclosures

NEMA MG 1 (2012) 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 (2011; Errata 2 2012) National Electrical Code

## 1.2 RELATED REQUIREMENTS

This section applies to certain sections of Division 23, "Mechanical".

This section applies to all sections of Division 26, "Electrical," of this project specification unless specified otherwise in the individual sections.

### 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 Std 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 12.47 kV primary, three phase, four wire, 60 Hz, and 208 volts secondary, three phase, four wire. Final connections to the power distribution system at the building shall be made by the Contractor as directed by the Contracting Officer.

### 1.5 SUBMITTALS

Submittals required in the sections which refer to this section shall conform to the requirements of Section **01 33 00**, "Submittal Procedures" and to the following additional requirements. Submittals shall include the manufacturer's name, trade name, place of manufacture, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and technical paragraph reference. Submittals shall also include applicable federal, military, industry, and technical society publication references, and years of satisfactory service, and other information necessary to establish contract compliance of each item to be provided. Photographs of existing installations are unacceptable and will be returned without approval.

#### 1.5.1 Manufacturer's Catalog Data

Submittals for each manufactured item shall be current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts. Handwritten and typed modifications and other notations not part of the manufacturer's preprinted data will result in the rejection of the submittal. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified for certificates of compliance.

#### 1.5.2 Drawings

Submit drawings a minimum of **14 by 20 inches** in size using a minimum scale of **1/8 inch per foot**, except as specified otherwise. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and

indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

#### 1.5.3 Instructions

Where installation procedures or part of the installation procedures are required to be in accordance with manufacturer's instructions, submit printed copies of those instructions prior to installation. Installation of the item shall not proceed until manufacturer's instructions are received. Failure to submit manufacturer's instructions shall be cause for rejection of the equipment or material.

#### 1.5.4 Certificates

Submit manufacturer's certifications as required for products, materials, finishes, and equipment as specified in the technical sections. Certificates from material suppliers are not acceptable. Preprinted certifications and copies of previously submitted documents will not be acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials and the publication specified as controlling the quality of that item. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; "achieve the same end use and results as materials formulated in accordance with the referenced publications"; or "equal or exceed the service and performance of the specified material." Certifications shall simply state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance.

##### 1.5.4.1 Reference Standard Compliance

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), American Society for Testing and Materials (ASTM), National Electrical Manufacturers 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.

##### 1.5.4.2 Independent Testing Organization Certificate

In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

#### 1.5.5 Operation and Maintenance Manuals

Comply with the requirements of the technical sections.

##### 1.5.5.1 Operating Instructions

Submit text of posted operating instructions for each system and principal item of equipment as specified in the technical sections.

## 1.6 QUALITY ASSURANCE

### 1.6.1 Material and Equipment Qualifications

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 Regulatory Requirements

Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of [NFPA 70](#).

### 1.6.3 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.

### 1.6.4 Service Support

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

### 1.6.5 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.

### 1.6.6 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.

### 1.6.7 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 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.

#### 1.8 NAMEPLATES

**ASTM D 709**. Provide laminated plastic nameplates for each panelboard, 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. Provide red laminated plastic label with white center core where indicated. 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.

#### 1.9 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 **NEMA C57.12.28**, such as for pad-mounted transformers, provide self-adhesive warning signs on the outside of the high voltage compartment door(s). Sign shall be a decal and shall have nominal dimensions of 7 by 10 inches with the legend "DANGER HIGH VOLTAGE" printed in two lines of nominal 2 inch high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background. Decal shall be Panduit No. PPS0710D72 or approved equal.

#### 1.10 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to **IEEE C2**, **NFPA 70**, and requirements specified herein.

### 1.10.1 Motors and Equipment

Provide electrical components of mechanical equipment, such as motors, motor starters, control or push-button stations, float or pressure switches, solenoid valves, and other devices functioning to control mechanical equipment, including 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 16.

Provide motors, controllers, integral disconnects, and contactors with their respective pieces of equipment. Motors, controllers, integral disconnects, and contactors shall conform to Section 26 20 00, "Interior Distribution System". Extended voltage range motors shall not be permitted. Control voltage for controllers and contactors shall not exceed 120 volts nominal. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment. Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated. As an exception to these requirements, provide disconnect switches, contactors, and controllers for existing motor-operated equipment under Section 26 20 00, "Interior Distribution System."

### 1.10.2 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment, and motor control equipment forming part of motor control centers or switchgear assemblies, the conduit and wiring connecting such centers, assemblies, or other power sources to equipment under Section 26 20 00, "Interior Distribution System." Power wiring and conduit shall conform to Section 26 20 00, "Interior Distribution System." Control wiring and conduit shall be provided under, and conform to the requirements of the section specifying the associated equipment.

### 1.10.3 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 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 16, except internal wiring for components of packaged 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.

### 1.10.4 Modifications to Existing Systems

Where existing mechanical systems and motor-operated equipment require

modifications, provide electrical components under Division 16.

#### 1.10.5 High Efficiency Motors

##### 1.10.5.1 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](#).

##### 1.10.5.2 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 12-10 of [NEMA MG 1](#).

#### 1.10.6 Three-Phase Motor Protection

Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

#### 1.11 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.

#### 1.12 LOCKOUT REQUIREMENTS

Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with [29 CFR 1910.147](#). Mechanical isolation of machines and other equipment shall be in accordance with requirements of Division 15, "Mechanical."

#### 1.13 EQUIPMENT INVENTORY UPDATE

Submit information for each piece of equipment removed and supplied for use of Camp Lejeune to update the Maximo equipment inventory. For the purposes of this paragraph, inventoried equipment is defined as equipment listed on the Maximo Equipment Inventory Update form.

##### 1.13.1 Requirements

The contractor shall prepare and submit one Maximo Equipment Inventory Update form for each individual item of inventoried equipment that is demolished, removed, replaced, or installed. (ex: three new condensing units would require the submission of three Equipment Inventory Update

forms. The replacement of two existing air handling units with two new air handling units would require the submission of two Equipment Inventory Update forms). The contractor shall prepare and submit a VAV/TAB Room Number List for each VAV/Tab model installed in a single building. Only one Maximo Equipment Inventory Update form is required for each model of VAV or TAB in a single building.

#### 1.13.1.1 Demolition of all equipment in a structure or facility

When all the inventoried equipment in a building or structure is demolished or removed, and not replaced, an Equipment Inventory Update form is not required.

#### 1.13.1.2 Standards

The contractor shall provide accurate, complete, and legible information on all required forms. All required forms shall be completed and delivered to the Contracting Officer on or before the Beneficial Occupancy Date. All information on Equipment Inventory Update forms shall be obtained by visual inspection of equipment data plate(s).

#### 1.13.1.3 Form Preparation

Each required Maximo Equipment Inventory Update form shall contain the following information:

- (1) The name and telephone number of an individual who can be contacted for clarification or additional information pertaining to the data on the form.
- (2) The date of data collection
- (3) The building or structure identification number and the specific location of the equipment within the structure (ex: 3d deck mech room)
- (4) A check adjacent to the description of the new or replacement item, and a check adjacent to the supplemental description if applicable (ex: circulating pump and HVAC or steam)
- (5) The Maximo number or serial number of the demolished or removed item, if applicable
- (6) All applicable data from the equipment data plate

Each Room Number List form shall contain the following information:

- (1) The name and telephone number of the individual providing the information
- (2) The date the form was completed
- (3) The building or structure identification number
- (4) A check in the box adjacent to each applicable room number

## PART 2 PRODUCTS

Not used.



PART 3 EXECUTION

3.1 PAINTING OF EQUIPMENT

3.1.1 Factory Applied

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the technical sections.

3.1.2 Field Applied

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 the section specifying the associated electrical equipment.

3.2 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.

3.4 CABLE TAG INSTALLATIONMAXIMO EQUIPMENT INVENTORY UPDATE

Employee: \_\_\_\_\_ Phone: \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

Bldg: \_\_\_\_\_ Specific Location: \_\_\_\_\_

- AC, Computer Room
- AC, Package
- AC, Package Terminal
- Assembly, Trap line
- Backflow Preventer
- Boiler
- Chiller, Air Cooled Recip
- Chiller, Air Cooled Screw
- Chiller, Air Cooled Scroll
- Chiller, Water Cooled Recip
- Chiller, Water Cooled Screw
- Compressor, Control Air
- Compressor, Industrial Air
- Dryer, Refrigerated Air
- Exchanger, Heat
- Evaporator, Freezer
- Evaporator, Refrigerator
- Fan, Exhaust
- Generator
- Heater, Space
- Heater, Unit
- Heat Pump, Geo-Thermal
- Heat Pump, Indoor Unit
- Heat Pump, Outdoor Unit
- Heat Pump, Package
- Heat Pump, Package Terminal
- Pump, Circulating, Chilled Water
- Pump, Circulating, Domestic Water
- Pump, Circulating, Dual Temp Water
- Pump, Circulating, Heating Water
- Pump, Condensate
- Pump, Sump
- Regulator, Temperature
- Tank, Hot Water Storage
- Tower, Cooling
- Unit, Air Handling
- Unit, AC Condensing
- Unit, Freezer Condensing
- Unit, Refrigerator Condensing
- Unit, Fan Coil
- Unit, TAB (Attach Room No. List)
- Unit, VAV (Attach Room No. List)
- Valve, Pressure Reducing
- Valve, Steam Pilot
- Water Heater

**Demolished/Removed Equipment**

Maximo no: \_\_\_\_\_ or Ser no: \_\_\_\_\_

**New Equipment**

Manufacturer: \_\_\_\_\_

Model no: \_\_\_\_\_

Ser no: \_\_\_\_\_

Type:  Elec  Oil  LP Gas  Nat Gas  Steam  Water  Air

Motor Data: HP \_\_\_\_\_ Volts \_\_\_\_\_ Phase \_\_\_\_\_ RLA \_\_\_\_\_ RPM \_\_\_\_\_ Frame \_\_\_\_\_

Tons \_\_\_\_\_ No. of Motors \_\_\_\_\_ no. of Belts \_\_\_\_\_ Belt size(s) \_\_\_\_\_ CFM \_\_\_\_\_

KW \_\_\_\_\_ Refrig type \_\_\_\_\_ Refrig Qty \_\_\_\_\_ Filter Size(s) \_\_\_\_\_

## VAV/TAB Room Number List

Employee: \_\_\_\_\_

Phone: \_\_\_\_\_

Bldg: \_\_\_\_\_

Date: \_\_\_\_\_

VAV/TAB Model Number: \_\_\_\_\_

100 <input type="checkbox"/>	130 <input type="checkbox"/>	160 <input type="checkbox"/>	200 <input type="checkbox"/>	230 <input type="checkbox"/>	260 <input type="checkbox"/>	300 <input type="checkbox"/>	330 <input type="checkbox"/>	360 <input type="checkbox"/>
101 <input type="checkbox"/>	131 <input type="checkbox"/>	161 <input type="checkbox"/>	201 <input type="checkbox"/>	231 <input type="checkbox"/>	261 <input type="checkbox"/>	301 <input type="checkbox"/>	331 <input type="checkbox"/>	361 <input type="checkbox"/>
102 <input type="checkbox"/>	132 <input type="checkbox"/>	162 <input type="checkbox"/>	202 <input type="checkbox"/>	232 <input type="checkbox"/>	262 <input type="checkbox"/>	302 <input type="checkbox"/>	332 <input type="checkbox"/>	362 <input type="checkbox"/>
103 <input type="checkbox"/>	133 <input type="checkbox"/>	163 <input type="checkbox"/>	203 <input type="checkbox"/>	233 <input type="checkbox"/>	263 <input type="checkbox"/>	303 <input type="checkbox"/>	333 <input type="checkbox"/>	363 <input type="checkbox"/>
104 <input type="checkbox"/>	134 <input type="checkbox"/>	164 <input type="checkbox"/>	204 <input type="checkbox"/>	234 <input type="checkbox"/>	264 <input type="checkbox"/>	304 <input type="checkbox"/>	334 <input type="checkbox"/>	364 <input type="checkbox"/>
105 <input type="checkbox"/>	135 <input type="checkbox"/>	165 <input type="checkbox"/>	205 <input type="checkbox"/>	235 <input type="checkbox"/>	265 <input type="checkbox"/>	305 <input type="checkbox"/>	335 <input type="checkbox"/>	365 <input type="checkbox"/>
106 <input type="checkbox"/>	136 <input type="checkbox"/>	166 <input type="checkbox"/>	206 <input type="checkbox"/>	236 <input type="checkbox"/>	266 <input type="checkbox"/>	306 <input type="checkbox"/>	336 <input type="checkbox"/>	366 <input type="checkbox"/>
107 <input type="checkbox"/>	137 <input type="checkbox"/>	167 <input type="checkbox"/>	207 <input type="checkbox"/>	237 <input type="checkbox"/>	267 <input type="checkbox"/>	307 <input type="checkbox"/>	337 <input type="checkbox"/>	367 <input type="checkbox"/>
108 <input type="checkbox"/>	138 <input type="checkbox"/>	168 <input type="checkbox"/>	208 <input type="checkbox"/>	238 <input type="checkbox"/>	268 <input type="checkbox"/>	308 <input type="checkbox"/>	338 <input type="checkbox"/>	368 <input type="checkbox"/>
109 <input type="checkbox"/>	139 <input type="checkbox"/>	169 <input type="checkbox"/>	209 <input type="checkbox"/>	239 <input type="checkbox"/>	269 <input type="checkbox"/>	309 <input type="checkbox"/>	339 <input type="checkbox"/>	369 <input type="checkbox"/>
110 <input type="checkbox"/>	140 <input type="checkbox"/>	170 <input type="checkbox"/>	210 <input type="checkbox"/>	240 <input type="checkbox"/>	270 <input type="checkbox"/>	310 <input type="checkbox"/>	340 <input type="checkbox"/>	370 <input type="checkbox"/>
111 <input type="checkbox"/>	141 <input type="checkbox"/>	171 <input type="checkbox"/>	211 <input type="checkbox"/>	241 <input type="checkbox"/>	271 <input type="checkbox"/>	311 <input type="checkbox"/>	341 <input type="checkbox"/>	371 <input type="checkbox"/>
112 <input type="checkbox"/>	142 <input type="checkbox"/>	172 <input type="checkbox"/>	212 <input type="checkbox"/>	242 <input type="checkbox"/>	272 <input type="checkbox"/>	312 <input type="checkbox"/>	342 <input type="checkbox"/>	372 <input type="checkbox"/>
113 <input type="checkbox"/>	143 <input type="checkbox"/>	173 <input type="checkbox"/>	213 <input type="checkbox"/>	243 <input type="checkbox"/>	273 <input type="checkbox"/>	313 <input type="checkbox"/>	343 <input type="checkbox"/>	373 <input type="checkbox"/>
114 <input type="checkbox"/>	144 <input type="checkbox"/>	174 <input type="checkbox"/>	214 <input type="checkbox"/>	244 <input type="checkbox"/>	274 <input type="checkbox"/>	314 <input type="checkbox"/>	344 <input type="checkbox"/>	374 <input type="checkbox"/>
115 <input type="checkbox"/>	145 <input type="checkbox"/>	175 <input type="checkbox"/>	215 <input type="checkbox"/>	245 <input type="checkbox"/>	275 <input type="checkbox"/>	315 <input type="checkbox"/>	345 <input type="checkbox"/>	375 <input type="checkbox"/>
116 <input type="checkbox"/>	146 <input type="checkbox"/>		216 <input type="checkbox"/>	246 <input type="checkbox"/>		316 <input type="checkbox"/>	346 <input type="checkbox"/>	
117 <input type="checkbox"/>	147 <input type="checkbox"/>		217 <input type="checkbox"/>	247 <input type="checkbox"/>		317 <input type="checkbox"/>	347 <input type="checkbox"/>	
118 <input type="checkbox"/>	148 <input type="checkbox"/>		218 <input type="checkbox"/>	248 <input type="checkbox"/>		318 <input type="checkbox"/>	348 <input type="checkbox"/>	
119 <input type="checkbox"/>	149 <input type="checkbox"/>		219 <input type="checkbox"/>	249 <input type="checkbox"/>		319 <input type="checkbox"/>	349 <input type="checkbox"/>	
120 <input type="checkbox"/>	150 <input type="checkbox"/>		220 <input type="checkbox"/>	250 <input type="checkbox"/>		320 <input type="checkbox"/>	350 <input type="checkbox"/>	
121 <input type="checkbox"/>	151 <input type="checkbox"/>		221 <input type="checkbox"/>	251 <input type="checkbox"/>		321 <input type="checkbox"/>	351 <input type="checkbox"/>	
122 <input type="checkbox"/>	152 <input type="checkbox"/>		222 <input type="checkbox"/>	252 <input type="checkbox"/>		322 <input type="checkbox"/>	352 <input type="checkbox"/>	
123 <input type="checkbox"/>	153 <input type="checkbox"/>		223 <input type="checkbox"/>	253 <input type="checkbox"/>		323 <input type="checkbox"/>	353 <input type="checkbox"/>	
124 <input type="checkbox"/>	154 <input type="checkbox"/>		224 <input type="checkbox"/>	254 <input type="checkbox"/>		324 <input type="checkbox"/>	354 <input type="checkbox"/>	
125 <input type="checkbox"/>	155 <input type="checkbox"/>		225 <input type="checkbox"/>	255 <input type="checkbox"/>		325 <input type="checkbox"/>	355 <input type="checkbox"/>	
126 <input type="checkbox"/>	156 <input type="checkbox"/>		226 <input type="checkbox"/>	256 <input type="checkbox"/>		326 <input type="checkbox"/>	356 <input type="checkbox"/>	
127 <input type="checkbox"/>	157 <input type="checkbox"/>		227 <input type="checkbox"/>	257 <input type="checkbox"/>		327 <input type="checkbox"/>	357 <input type="checkbox"/>	
128 <input type="checkbox"/>	158 <input type="checkbox"/>		228 <input type="checkbox"/>	258 <input type="checkbox"/>		328 <input type="checkbox"/>	358 <input type="checkbox"/>	
129 <input type="checkbox"/>	159 <input type="checkbox"/>		229 <input type="checkbox"/>	259 <input type="checkbox"/>		329 <input type="checkbox"/>	359 <input type="checkbox"/>	

**Instructions**

- (1) Confirm room numbers by visual inspection
- (2) Check the box next to each applicable room number

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 NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C80.5 (1994) Aluminum Rigid Conduit-(ARC)

## 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 1 (2000; R 2005; R 2008) Standard for Industrial Control and Systems: General Requirements

NEMA ICS 2 (2000) Industrial Control and Systems Controllers, Contactors, and Overload Relays, Rated 600 Volts

NEMA ICS 4 (2000) Industrial Automation Control Products and Systems Section Terminal Blocks

NEMA ICS 6 (1993; R 2001) Industrial Control and Systems Enclosures

NEMA KS 1 (2001) Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

NEMA MG 1 (2012) 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
NEMA RN 1	(1998) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
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	(2011; Errata 2 2012) National Electrical Code
UNDERWRITERS LABORATORIES (UL)	
UL 1	(2000) Flexible Metal Conduit
UL 1242	(2000; R 2001, Bul. 2002) Intermediate Metal Conduit
UL 1569	(1999; R 2001, Bul. 2001, 2002) Metal-Clad Cables
UL 1660	(2000; R 2002, Bul. 2002) Liquid-Tight Flexible Nonmetallic 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 44	(1999; R 2002, Bul. 2002) Thermoset-Insulated Wires and Cables

UL 467	(1993; R 2001) Grounding and Bonding Equipment
UL 486A	(1997; R 2001, Bul. 2002, 2003) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486C	(2000; R 2002) Splicing Wire Connectors
UL 489	(2009; Reprint Jun 2011) 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 506	(2008; R 2010) Specialty Transformers
UL 508	(1999; R 2002, Bul. 2003) Industrial Control Equipment
UL 510	(1994; R 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 514B	(1997; R 2002, Bul. 2002) Fittings for Cable and Conduit
UL 6	(2000; Bul. 2001, 2002) Rigid Metal Conduit- Steel
UL 651	(1995; R 2002) Schedule 40 and 80 Rigid PVC Conduit
UL 67	(1993; R 2002) Panelboards
UL 6A	(2000; Bul. 2002) Electrical Rigid Metal Conduit - Aluminum, Bronze, and Stainless Steel
UL 797	(2000; Bul. 2002) Electrical Metallic Tubing
UL 83	(1998; R 2001, Bul. 2002) Thermoplastic-Insulated Wires and Cables
UL 869A	(1998; Bul. 2002) Reference Standard for Service Equipment
UL 870	(1995; R 1999, Bul. 2002) Wireways, Auxiliary Gutters, and Associated Fittings
UL 943	(1993; R 2002, Bul. 2002) Ground-Fault Circuit-Interrupters
UL 984	(1996; Bul. 2001) Hermetic Refrigerant

Motor-Compressors

1.2 RELATED REQUIREMENTS

Section 26 00 00, "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

Wireways

Load centers for housing units

SD-03 Product Data

Receptacles

Circuit breakers

Switches

Enclosed circuit breakers

Motor controllers

Manual motor starters

CATV outlets

Grounding Block

SD-06 Test Reports

600-volt wiring test

Grounding system test

Ground-fault receptacle test

SD-07 Certificates

Fuses

SD-10 Operation and Maintenance Data

Electrical Systems, Data Package 5

1.4 QUALITY ASSURANCE

1.4.1 Fuses

Submit coordination data as specified in article entitled, "FUSES" of this



section.

## 1.5 MAINTENANCE

### 1.5.1 Electrical Systems

Submit operation and maintenance manuals for electrical systems that provide basic data relating to the design, operation, and maintenance of the electrical distribution system for the building. This shall include:

- a. Single line diagram of the "as-built" building electrical system.
- b. Schematic diagram of electrical control system (other than HVAC, covered elsewhere).
- c. Manufacturers' operating and maintenance manuals on active electrical equipment.

## 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.

##### 2.2.1.2 Rigid Aluminum Conduit

ANSI C80.5, UL 6A.

#### 2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40, and EPC-80 in accordance with NEMA TC 2, UL 651, or fiberglass conduit, in accordance with NEMA TC 14.

#### 2.2.3 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

#### 2.2.4 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, NEMA C80.3.

#### 2.2.5 Plastic-Coated Rigid Steel and IMC Conduit

NEMA RN 1, Type 40 (40 mils thick).

## 2.2.6 Flexible Metal Conduit

UL 1.

### 2.2.6.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

## 2.2.7 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.

### 2.2.7.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

### 2.2.7.2 Fittings for EMT

Die cast compression type.

## 2.2.8 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3, UL 514B.

## 2.2.9 Liquid-Tight Flexible Nonmetallic Conduit

UL 1660.

## 2.3 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

## 2.4 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.

### 2.4.1 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.

#### 2.4.1.1 Equipment Manufacturer Requirements

#### 2.4.1.2 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.

#### 2.4.2 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
- d. On three-phase, four-wire delta system, high leg shall be orange, as required by [NFPA 70](#).

#### 2.4.3 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](#) conforming to [UL 44](#), 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.

#### 2.4.4 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.

#### 2.4.5 Metal-Clad Cable

[UL 1569](#); [NFPA 70](#), Type MC cable.

#### 2.5 SPLICES AND TERMINATION COMPONENTS

[UL 486A](#) for wire connectors and [UL 510](#) for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with [UL 486A](#) or [UL 486C](#) (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

## 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 white thermoplastic. 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 3R, enclosure per NEMA ICS 6.

### 2.7.3 Breakers Used as Switches

For 120- and 277-Volt fluorescent fixtures, mark breakers "SWD" in accordance with UL 489.

## 2.8 RECEPTACLES

UL 498, hard use, heavy-duty, grounding-type. Ratings and configurations shall be as indicated. Bodies shall be of white as per NEMA WD 1. 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 Switched Duplex Receptacles

Provide separate terminals for each ungrounded pole. Top receptacle shall be switched when installed.

### 2.8.2 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."

### 2.8.3 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.

### 2.8.4 Plugs

Provide heavy-duty, rubber-covered three-, four-, or five-wire cord of required size, install plugs thereon, and attach to equipment. Plugs shall be UL listed with receptacles, complete with grounding blades. Where equipment is not available, turn over plugs and cord assemblies to the Government.

## 2.9 PANELBOARDS

UL 67 and UL 50 having a short-circuit current rating of 10,000 amperes symmetrical minimum. Panelboards for use as service disconnecting means shall additionally conform to UL 869A. Panelboards shall be circuit breaker-equipped. 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" 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.

### 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.

### 2.9.2 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 LOAD CENTERS

### 2.10.1 RLC 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 groundable 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.

### 2.10.2 Circuit Breakers

UL 489, thermal magnetic-type with interrupting capacity of 10,000 minimum amperes rms symmetrical. Breaker terminals shall be UL listed as suitable for the type of conductor provided.

#### 2.10.2.1 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 two adjacent breaker poles are connected to alternate phases in sequence.

#### 2.10.2.2 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.

## 2.11 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.

## 2.12 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.

### 2.12.1 Cartridge Fuses, Current Limiting Type (Class R)

UL 198E, Class RK-5. Associated fuseholders shall be Class R only.

### 2.12.2 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.

### 2.12.3 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.

## 2.13 MOTORS

NEMA MG 1 ; hermetic-type sealed motor compressors shall also comply with UL 984. Provide the size in terms of HP, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Motors for operation on 208-volt, 3-phase circuits shall have terminal voltage rating of 200 volts, and those for operation on 480-volt, 3-phase circuits shall have terminal voltage rating of 460 volts. Motors shall be designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating.

### 2.13.1 High Efficiency Single-Phase Motors

Single-phase fractional-horsepower alternating-current motors shall be high efficiency types corresponding to the applications listed in NEMA MG 11.

### 2.13.2 High Efficiency Polyphase Motors

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 12-10 of NEMA MG 1.

### 2.13.3 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided.

## 2.14 MOTOR CONTROLLERS

UL 508, NEMA ICS 1, and NEMA ICS 2. Controllers shall have thermal overload protection in each phase and shall have one spare normally open and one spare normally closed auxiliary contact. Magnetic-type motor controllers shall have undervoltage protection when used with momentary-contact pushbutton stations or switches and shall have undervoltage release when used with maintained-contact pushbutton stations or switches. When used with pressure, float, or similar automatic-type or

maintained-contact switch, controller shall have hand/off/automatic selector switch. Connections to selector switch shall be such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices, shall be connected in motor control circuit in "hand" and "automatic" positions. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device shall be made in accordance with indicated or manufacturer's approved wiring diagram. Selector switch shall have means for locking in any position. For each motor not in sight of controller or where controller disconnecting means is not in sight of motor location and driven machinery location, controller disconnecting means shall be capable of being locked in open position. As an alternative, provide a manually operated, lockable, nonfused switch which disconnects motor from supply source within sight of motor. Overload protective devices shall provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case. Cover of combination motor controller and manual switch or circuit breaker shall be interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position. Minimum short circuit withstand rating of combination motor controller shall be 10,000 rms symmetrical amperes..

#### 2.14.1 Control Circuits

Control circuits shall have maximum voltage of 120 volts derived from control transformer in same enclosure. Transformers shall conform to [UL 506](#), as applicable. Transformers, other than transformers in bridge circuits, shall have primaries wound for voltage available and secondaries wound for correct control circuit voltage. Size transformers so that 80 percent of rated capacity equals connected load. Provide disconnect switch on primary side. One secondary lead shall be fused; other shall be grounded.

#### 2.14.2 Enclosures for Motor Controllers

[NEMA ICS 6](#).

#### 2.14.3 Multiple-Speed Motor Controllers and Reversible Motor Controllers

Across-the-line-type, electrically and mechanically interlocked. Multiple-speed controllers shall have compelling relays and shall be multiple-button, station-type with pilot lights for each speed.

#### 2.14.4 Pushbutton Stations

Provide with "start/stop" momentary contacts having one normally open and one normally closed set of contacts, and red lights to indicate when motor is running. Stations shall be heavy duty, oil-tight design.

#### 2.14.5 Pilot and Indicating Lights

Provide LED cluster lamps.

#### 2.14.6 Terminal Blocks

[NEMA ICS 4](#).



## 2.15 MANUAL MOTOR STARTERS (MOTOR RATED SWITCHES)

Single Double pole designed for surface mounting with overload protection .

## 2.16 TELEPHONE SYSTEM

### 2.16.1 Outlet Boxes for Telephone System

Standard type, as specified herein, 2 by 1/2 in. Mount flush in finished walls at height indicated. Outlet boxes for wall-mounted telephones shall be 2 by 4 by 2 1/8 in deep; mounted at height 60 in above finished floor. Outlet boxes for handicapped telephone station shall be 2 by 4 by 2 1/8 in deep and mounted at height 48 in above finished floor.

### 2.16.2 Cover Plates

Modular telephone type with same finish specified for receptacle and switch cover plates.

### 2.16.3 Conduit Sizing

Conduit for single outlets shall be minimum of 1 in and for multiple outlets minimum of one inch. Size conduits for telephone risers to telephone cabinets, junction boxes, distribution centers, and telephone service, as indicated.

## 2.17 GROUNDING AND BONDING EQUIPMENT

UL 467. Ground rods shall be copper-clad steel, with minimum diameter of 3/4 in and minimum length of 10 ft.

## 2.18 NAMEPLATES

Provide as specified in Section 26 00 00, "Basic Electrical Materials and Methods."

## 2.19 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations.

## 2.20 WIREWAYS

UL 870. Material shall be steel galvanized 16 gage for heights and depths up to 6 by 6 in, and 14 gage for heights and depths up to 12 by 12 in. Provide in length required for the application with screw- cover NEMA 3R enclosure per NEMA ICS 6.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Electrical installations shall conform to requirements of NFPA 70 and to requirements specified herein.

#### 3.1.1 Service Entrance Identification

##### 3.1.1.1 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.

### 3.1.2 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Shared neutral, or multi-wire branch circuits, are not permitted with arc-fault circuit interrupters. Minimum conduit size 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.

#### 3.1.2.1 Restrictions Applicable to Aluminum Conduit

Do not install underground or encase in concrete or masonry. Do not use brass or bronze fittings.

#### 3.1.2.2 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.

#### 3.1.2.3 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.

#### 3.1.2.4 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph entitled "Flexible Connections."

#### 3.1.2.5 Underground Conduit Other Than Service Entrance

Plastic-coated rigid steel; plastic-coated steel IMC; PVC, Type EPC-40; or fiberglass. Convert nonmetallic conduit, other than PVC Schedule 40 or 80, to plastic-coated rigid, or IMC, steel conduit before rising through floor slab. Plastic coating shall extend minimum 6 in above floor.

#### 3.1.2.6 Conduit in Floor Slabs

#### 3.1.2.7 Metal Clad Cable

Install in accordance with NFPA 70, Type MC cable.

#### 3.1.3 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. Run conduits in crawl space under floor slab as if exposed.

##### 3.1.3.1 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.

##### 3.1.3.2 Conduit Through Floor Slabs

Where conduits rise through floor slabs, curved portion of bends shall not be visible above finished slab.

##### 3.1.3.3 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 watertight 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.

#### 3.1.3.4 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.

#### 3.1.3.5 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.

#### 3.1.3.6 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. 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.

#### 3.1.3.7 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.

#### 3.1.3.8 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.

#### 3.1.3.9 Flexible Connections

Provide flexible steel conduit between 3 and 6 ft in length for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size 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.

#### 3.1.4 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. 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.

##### 3.1.4.1 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.

##### 3.1.4.2 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 Mounting Heights

Mount panelboards, enclosed circuit breakers, motor controller 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, and other devices. Measure mounting heights of wiring devices and outlets to center of device or outlet.

### 3.1.6 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. Identify control circuit terminations in accordance with manufacturer's recommendations.

### 3.1.7 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.

### 3.1.8 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.

### 3.1.9 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings.

### 3.1.10 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. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

#### 3.1.10.1 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.

### 3.1.11 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.

### 3.1.12 Repair of Existing Work

Repair of existing work, demolition, and modification of existing electrical distribution systems shall be performed as follows:

#### 3.1.12.1 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.

#### 3.1.12.2 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.

#### 3.1.12.3 Continuation of Service

Maintain continuity of existing circuits of equipment to remain. Existing circuits of equipment shall remain energized. Circuits which are to remain but were disturbed during demolition shall have circuits wiring and power restored back to original condition.

## 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 each test.

### 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.

#### 3.2.5 Watthour Metera. Electrical tests

- (1) Determine accuracy of meter.
- (2) Calibrate watthour meters to one-half percent.
- (3) Verify that correct multiplier has been placed on face of meter, where applicable.

-- End of Section --



## SECTION 26 29 23

## VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS

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.

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE 519 (1992; R 1993; Errata 2004) Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
- IEEE C62.41.1 (2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
- IEEE C62.41.2 (2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- NEMA 250 (2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
- NEMA ICS 1 (2000; R 2005; R 2008) Standard for Industrial Control and Systems: General Requirements
- NEMA ICS 3.1 (2009) Guide for the Application, Handling, Storage, Installation and Maintenance of Medium-Voltage AC Contactors, Controllers and Control Centers
- NEMA ICS 6 (1993; R 2001) Industrial Control and Systems Enclosures
- NEMA ICS 7 (2006) Adjustable-Speed Drives

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2011; Errata 2 2012) National Electrical Code

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

- MIL-STD-461 (2007; Rev F) Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment

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

47 CFR 15 Radio Frequency Devices

## UNDERWRITERS LABORATORIES (UL)

UL 489 (2009; Reprint Jun 2011) Molded-Case  
Circuit Breakers, Molded-Case Switches,  
and Circuit-Breaker Enclosures

UL 508C (2002; Reprint Nov 2010) Power Conversion  
Equipment

## 1.2 RELATED REQUIREMENTS

Section 26 00 00 BASIC ELECTRICAL MATERIALS AND METHODS, and Section  
26 20 00 INTERIOR DISTRIBUTION SYSTEM apply to this section with additions  
and modifications specified herein.

## 1.3 SYSTEM DESCRIPTION

## 1.3.1 Performance Requirements

## 1.3.1.1 Electromagnetic Interference Suppression

Computing devices, as defined by 47 CFR 15, MIL-STD-461 rules and  
regulations, shall be certified to comply with the requirements for class A  
computing devices and labeled as set forth in part 15.

## 1.3.1.2 Electromechanical and Electrical Components

Electrical and electromechanical components of the Variable Frequency Drive  
(VFD) shall not cause electromagnetic interference to adjacent electrical  
or electromechanical equipment while in operation.

## 1.3.2 Electrical Requirements

## 1.3.2.1 Power Line Surge Protection

IEEE C62.41.1 and IEEE C62.41.2, IEEE 519 Control panel shall have surge  
protection, included within the panel to protect the unit from damaging  
transient voltage surges. Surge arrestor shall be mounted near the  
incoming power source and properly wired to all three phases and ground.  
Fuses shall not be used for surge protection.

## 1.3.2.2 Sensor and Control Wiring Surge Protection

I/O functions as specified shall be protected against surges induced on  
control and sensor wiring installed outdoors and as shown. The inputs and  
outputs shall be tested in both normal mode and common mode using the  
following two waveforms:

- 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.

## 1.4 SUBMITTALS

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

## SD-02 Shop Drawings

Schematic diagrams

Installation drawings

Submit drawings for government approval prior to equipment construction or integration. Modifications to original drawings made during installation shall be immediately recorded for inclusion into the as-built drawings.

## SD-03 Product Data

Variable frequency drives

Wires and cables

Equipment schedule

Include data indicating compatibility with motors being driven.

## SD-06 Test Reports

VFD Test

Performance Verification Tests

Endurance Test

## SD-08 Manufacturer's Instructions

Installation instructions

## SD-09 Manufacturer's Field Reports

VFD Factory Test Plan

Factory test results

## SD-10 Operation and Maintenance Data

Variable frequency drives, Data Package 4

Provide service and maintenance information including preventive maintenance, assembly, and disassembly procedures. Include electrical drawings from electrical general sections. Submit additional information necessary to provide complete operation, repair, and maintenance information, detailed to the smallest replaceable unit. Include copies of as-built submittals. Provide routine preventative maintenance instructions, and equipment required. Provide instructions on how to modify program settings, and modify the control program. Provide instructions on drive adjustment, trouble-shooting, and configuration. Provide instructions on process tuning and system calibration.

## 1.5 QUALITY ASSURANCE

### 1.5.1 Schematic Diagrams

Show circuits and device elements for each replaceable module. Schematic diagrams of printed circuit boards are permitted to group functional assemblies as devices, provided that sufficient information is provided for government maintenance personnel to verify proper operation of the functional assemblies.

### 1.5.2 Interconnecting Diagrams

Show interconnections between equipment assemblies, and external interfaces, including power and signal conductors. Include for enclosures and external devices.

### 1.5.3 Installation Drawings

Show floor plan of each site, with V.F.D.'s and motors indicated. Indicate ventilation requirements, adequate clearances, and cable routes.

### 1.5.4 Equipment Schedule

Provide schedule of equipment supplied. Schedule shall provide a cross reference between manufacturer data and identifiers indicated in shop drawings. Schedule shall include the total quantity of each item of equipment supplied. For complete assemblies, such as VFD's, provide the serial numbers of each assembly, and a sub-schedule of components within the assembly. Provide recommended spare parts listing for each assembly or component.

### 1.5.5 Installation instructions

Provide installation instructions issued by the manufacturer of the equipment, including notes and recommendations, prior to shipment to the site. Provide operation instructions prior to acceptance testing.

### 1.5.6 Factory Test Results

Document test results and submit to government within 7 working days after completion of test.

## 1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

## 1.7 WARRANTY

The complete system shall be warranted by the manufacturer for a period of one year, or the contracted period of any extended warrantee agreed upon by the contractor and the Government, after successful completion of the acceptance test. Any component failing to perform its function as specified and documented shall be repaired or replaced by the contractor at no additional cost to the Government. Items repaired or replaced shall be warranted for an additional period of at least one year from the date that it becomes functional again, as specified in the FAR CLAUSE 52.246-21.

## 1.8 MAINTENANCE

### 1.8.1 Spare Parts

Manufacturers provide spare parts in accordance with recommended spare parts list.

### 1.8.2 Maintenance Support

During the warranty period, the Contractor shall provide on-site, on-call maintenance services by Contractor's personnel on the following basis: The service shall be on a per-call basis with 36 hour response. Contractor shall support the maintenance of all hardware and software of the system. Various personnel of different expertise shall be sent on-site depending on the nature of the maintenance service required. Costs shall include travel, local transportation, living expenses, and labor rates of the service personnel while responding to the service request. The provisions of this Section are not in lieu of, nor relieve the Contractor of, warranty responsibilities covered in this specification. Should the result of the service request be the uncovering of a system defect covered under the warranty provisions, all costs for the call, including the labor necessary to identify the defect, shall be borne by the Contractor.

## PART 2 PRODUCTS

### 2.1 VARIABLE FREQUENCY DRIVES (VFD)

Provide frequency drive to control the speed of induction motor(s). The VFD shall include the following minimum functions, features and ratings.

- a. Input circuit breaker per **UL 489** with a minimum of 20,000 amps symmetrical interrupting capacity and door interlocked external operator.
- b. A converter stage per **UL 508C** shall change fixed voltage, fixed frequency, ac line power to a fixed dc voltage. The converter shall utilize a full wave bridge design incorporating diode rectifiers. Silicon Controlled Rectifiers (SCR) are not acceptable. The converter shall be insensitive to three phase rotation of the ac line and shall not cause displacement power factor of less than .95 lagging under any speed and load condition.
- c. An inverter stage shall change fixed dc voltage to variable frequency, variable voltage, ac for application to a standard NEMA design B squirrel cage motor. The inverter shall be switched in a manner to produce a sine coded pulse width modulated (PWM) output waveform.
- d. The VFD shall be capable of supplying 120 percent of rated full load current for one minute at maximum ambient temperature.
- e. The VFD shall be designed to operate from a 208 volt, plus or minus 10 percent, three phase, 60 Hz supply, and control motors with a corresponding voltage rating.
- f. Acceleration and deceleration time shall be independently adjustable from one second to 60 seconds.
- g. Adjustable full-time current limiting shall limit the current to a

- preset value which shall not exceed 120 percent of the controller rated current. The current limiting action shall maintain the V/Hz ratio constant so that variable torque can be maintained. Short time starting override shall allow starting current to reach 175 percent of controller rated current to maximum starting torque.
- h. The controllers shall be capable of producing an output frequency over the range of 3 Hz to 60 Hz (20 to one speed range), without low speed cogging. Over frequency protection shall be included such that a failure in the controller electronic circuitry shall not cause frequency to exceed 110 percent of the maximum controller output frequency selected.
  - i. Minimum and maximum output frequency shall be adjustable over the following ranges: 1) Minimum frequency 3 Hz to 50 percent of maximum selected frequency; 2) Maximum frequency 40 Hz to 60 Hz.
  - j. The controller efficiency at any speed shall not be less than 96 percent.
  - k. The controllers shall be capable of being restarted into a motor coasting in the forward direction without tripping.
  - l. Protection of power semiconductor components shall be accomplished without the use of fast acting semiconductor output fuses. Subjecting the controllers to any of the following conditions shall not result in component failure or the need for fuse replacement:
    - 1. Short circuit at controller output
    - 2. Ground fault at controller output
    - 3. Open circuit at controller output
    - 4. Input undervoltage
    - 5. Input overvoltage
    - 6. Loss of input phase
    - 7. AC line switching transients
    - 8. Instantaneous overload
    - 9. Sustained overload exceeding 115 percent of controller rated current
    - 10. Over temperature
    - 11. Phase reversal
  - m. Solid state motor overload protection shall be included such that current exceeding an adjustable threshold shall activate a 60 second timing circuit. Should current remain above the threshold continuously for the timing period, the controller will automatically shut down.
  - n. A slip compensation circuit shall be included which will sense changing motor load conditions and adjust output frequency to provide speed regulation of NEMA B motors to within plus or minus 0.5 percent of

maximum speed without the necessity of a tachometer generator.

- o. The VFD shall be factory set for manual restart after the first protective circuit trip for malfunction (overcurrent, undervoltage, overvoltage or overtemperature) or an interruption of power. The VFD shall be capable of being set for automatic restart after a selected time delay. If the drive faults again within a specified time period (adjustable 0-60 seconds), a manual restart will be required.
- p. The VFD shall include external fault reset capability. All the necessary logic to accept an external fault reset contact shall be included.
- q. Provide critical speed lockout circuitry to prevent operating at frequencies with critical harmonics that cause resonant vibrations. The VFD shall have a minimum of three user selectable bandwidths.
- r. Provide the following operator control and monitoring devices mounted on the front panel of the VFD:
  - 1. Manual speed potentiometer.
  - 2. Hand-Off-Auto ( HOA ) switch.
  - 3. Power on light.
  - 4. Drive run power light.
  - 5. Local display.
- s. Provide properly sized NEMA rated by-pass and isolation contactors to enable operation of motor in the event of VFD failure. Mechanical and electrical interlocks shall be installed between the by-pass and isolation contactors. Provide a selector switch and transfer delay timer.

## 2.2 ENCLOSURES

Provide equipment enclosures conforming to NEMA 250, NEMA ICS 7, NEMA ICS 6.

## 2.3 WIRES AND CABLES

All wires and cables shall conform to NEMA 250, NEMA ICS 7, NFPA 70.

## 2.4 NAMEPLATES

Nameplates external to NEMA enclosures shall conform with the requirements of Section 26 00 00 BASIC ELECTRICAL MATERIALS AND METHODS. Nameplates internal to enclosures shall be manufacturer's standard, with the exception that they must be permanent.

## 2.5 SOURCE QUALITY CONTROL

### 2.5.1 VFD Factory Test Plan

To ensure quality, each VFD shall be subject to a series of in-plant quality control inspections before approval for shipment from the manufacturer's facilities. Provide test plans and test reports.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Per **NEMA ICS 3.1**, install equipment in accordance with the approved manufacturer's printed installation drawings, instructions, wiring diagrams, and as indicated on project drawings and the approved shop drawings. A field representative of the drive manufacturer shall supervise the installation of all equipment, and wiring.

#### 3.2 FIELD QUALITY CONTROL

Specified products shall be tested as a system for conformance to specification requirements prior to scheduling the acceptance tests. Contractor shall conduct performance verification tests in the presence of Government representative, observing and documenting complete compliance of the system to the specifications. Contractor shall submit a signed copy of the test results, certifying proper system operation before scheduling tests.

##### 3.2.1 VFD Test

A proposed test plan shall be submitted to the contracting officer at least 28 calendar days prior to proposed testing for approval. The tests shall conform to **NEMA ICS 1**, **NEMA ICS 7**, and all manufacturer's safety regulations. The Government reserves the right to witness all tests and review any documentation. The contractor shall inform the Government at least 14 working days prior to the dates of testing. Contractor shall provide video tapes, if available, of all training provided to the Government for subsequent use in training new personnel. All training aids, texts, and expendable support material for a self-sufficient presentation shall be provided, the amount of which to be determined by the contracting officer.

##### 3.2.2 Performance Verification Tests

"Performance Verification Test" plan shall provide the step by step procedure required to establish formal verification of the performance of the VFD. Compliance with the specification requirements shall be verified by inspections, review of critical data, demonstrations, and tests. The Government reserves the right to witness all tests, review data, and request other such additional inspections and repeat tests as necessary to ensure that the system and provided services conform to the stated requirements. The contractor shall inform the Government 14 calendar days prior to the date the test is to be conducted.

##### 3.2.3 Endurance Test

Immediately upon completion of the performance verification test, the endurance test shall commence. The system shall be operated at varying rates for not less than 192 consecutive hours, at an average effectiveness level of .9998, to demonstrate proper functioning of the complete PCS. Continue the test on a day-to-day basis until performance standard is met. During the endurance test, the contractor shall not be allowed in the building. The system shall respond as designed.



### 3.3 DEMONSTRATION

#### 3.3.1 Training

Coordinate training requirements with the Contracting Officer.

##### 3.3.1.1 Instructions to Government Personnel

Provide the services of competent instructors who will give full instruction to designated personnel in operation, maintenance, calibration, configuration, and programming of the complete control system. Orient the training specifically to the system installed. Instructors shall be thoroughly familiar with the subject matter they are to teach. The Government personnel designated to attend the training will have a high school education or equivalent. The number of training days of instruction furnished shall be as specified. A training day is defined as eight hours of instruction, including two 15-minute breaks and excluding lunch time; Monday through Friday. Provide a training manual for each student at each training phase which describes in detail the material included in each training program. Provide one additional copy for archiving. Provide equipment and materials required for classroom training. Provide a list of additional related courses, and offers, noting any courses recommended. List each training course individually by name, including duration, approximate cost per person, and location of course. Unused copies of training manuals shall be turned over to the Government at the end of last training session.

##### 3.3.1.2 Operating Personnel Training Program

Provide one 2 hour training session at the site at a time and place mutually agreeable between the Contractor and the Government. Provide session to train 4 operation personnel in the functional operations of the system and the procedures that personnel will follow in system operation. This training shall include:

- a. System overview
- b. General theory of operation
- c. System operation
- d. Alarm formats
- e. Failure recovery procedures
- f. Troubleshooting

##### 3.3.1.3 Engineering/Maintenance Personnel Training

Accomplish the training program as specified. Training shall be conducted on site at a location designated by the Government. Provide a one day training session to train 4 engineering personnel in the functional operations of the system. This training shall include:

- a. System overview
- b. General theory of operation
- c. System operation

- d. System configuration
- e. Alarm formats
- f. Failure recovery procedures
- g. Troubleshooting and repair
- h. Maintenance and calibration
- i. System programming and configuration

-- 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.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 580/A 580M	(1998) Stainless Steel Wire
ASTM A 641/A 641M	(1998) Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A 653/A 653M	(2002; Rev. A) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 1008/A 1008M	(2002) Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
ASTM B 633	(1998; E 2001) Electrodeposited Coatings of Zinc on Iron and Steel

## ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA HB-9	(2000) Lighting Handbook, Reference and Application
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## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits (ANSI/IEEE)
IEEE C136.10	(1996) Roadway Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacle Physical and Electrical Interchangeability and Testing

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA C78.42	(2001) Electric Lamps - High-Pressure Sodium Lamps
NEMA C78.81	(2001) Electric Lamps - Double-capped Fluorescent Lamps
NEMA C78.901	(2001) Electric Lamps - Single Base

## Fluorescent Lamps

NEMA C78.1375	(1996) Electric Lamps - 400-Watt, M59 Single-Ended Metal-Halide Lamps
NEMA C78.1376	(1996) Electric Lamps - 1000-Watt, M47 Single-Ended Metal-Halide Lamps
NEMA C78.1377	(1996) Electric Lamps - 175-Watt, M57 Single-Ended Metal-Halide Lamps
NEMA C78.1378	(1996) Electric Lamps - 250-Watt, M58 Single-Ended Metal-Halide Lamps
NEMA C78.1381	(1998) Electric Lamps - 70-Watt, M85 Double-Ended Metal-Halide Lamps
NEMA C78.1382	(1996) Electric Lamps - 100-Watt, M90 Single-Ended Metal-Halide Lamps
NEMA C78.1384	(1997) Electric Lamps - 150-Watt M102 Single-Ended Metal-Halide Lamps
NEMA C82.1	(1997) Electric Lamp Ballast - Line Frequency Fluorescent Lamp Ballast
NEMA C82.2	(2002) Fluorescent Lamp Ballasts - Methods of Measurement
NEMA C82.4	(2002) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
NEMA C82.11	(2002) High-Frequency Fluorescent Lamp Ballasts
NEMA ICS 2	(2000) Industrial Control and Systems Controllers, Contactors, and Overload Relays, Rated 600 Volts
NEMA ICS 6	(1993; R 2001) Industrial Control and Systems Enclosures
NEMA LL 1	(1997; R 2002) Procedures for Linear Fluorescent Lamp Sample Preparation and the TCLP

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; Errata 2 2012) National Electrical Code
NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 101	(2005; Errata 2006; TIA 2006; TIA 2006) Life Safety Code, 2006 Edition

## 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; Bul. 2001) Fluorescent-Lamp Ballasts
UL 1029	(1994; R 2001) High-Intensity-Discharge Lamp Ballasts
UL 1598	(2000; Bul. 2001 and 2002) Luminaires

## 1.2 RELATED REQUIREMENTS

Section 26 00 00, "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 electronic ballasts

Fluorescent lamps

High-intensity-discharge (HID) lighting fixtures

HID ballasts

High-pressure sodium (HPS) lamps

Metal-halide lamps

Lighting contactor

Time switch

Power hook fixture hangers

Emergency lighting equipment

Occupancy sensors

#### SD-06 Test Reports

Operating test

Submit test results as stated in paragraph entitled "Field Quality Control."

#### SD-10 Operation and Maintenance Data

Lighting Control System, Data Package 5

Submit operation and maintenance data specified herein, showing all control modules, control zones, occupancy sensors, light fixtures, and all interconnecting control wire, conduit, and associated hardware.

### 1.5 QUALITY ASSURANCE

#### 1.5.1 Fluorescent Electronic Ballasts

Submit ballast catalog data as required in the paragraph entitled "Fluorescent Lamp Electronic Ballasts" contained herein. As an option, submit the fluorescent fixture manufacturer's electronic ballast specification information in lieu of the actual ballast manufacturer's catalog data. This information shall include published specifications and sketches, which covers the information required by the paragraph entitled "Fluorescent Lamp Electronic Ballasts" herein. This information may be supplemented by catalog data if required, and shall contain a list of vendors with vendor part numbers.

#### 1.5.2 Lighting Fixtures, Complete With Lamps and Ballasts

Submit one sample of each fixture type and large order item for inspection, review, and approval. The sample shall be retained for comparison against the remainder of the fixtures. The sample may be used in the final fixture installation.

#### 1.5.3 Lighting Control System

Submit operation and maintenance manuals for lighting control systems that provide basic data relating to the design, operation, and maintenance of the lighting control system for the building. This shall include:

- a. Schematic diagram of the lighting control system.
- b. Manufacturers' operating and maintenance manuals on active lighting control equipment. Lighting control equipment shall include, if indicated: occupancy sensors, power packs, dimming ballasts, and light level sensors.

#### 1.6 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 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 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

#### 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.

#### 2.1.1.3 T-5 Long Twin Tube Lamp Ballast

- a. Total harmonic distortion (THD): Shall not be greater than 25 percent when operating one lamp, 15 percent when operating two lamps, and 20 percent when operating three lamps.
- b. Input wattage:
  - 1. 45 watts (maximum) when operating one F40 T-5 lamps
  - 2. 74 watts (maximum) when operating two F40 T-5 lamps

#### 2.1.2 Electromagnetic Ballasts

##### 2.1.2.1 Electromagnetic Energy-Saving Ballasts

[NEMA C82.1](#). Provide energy-saving fluorescent ballasts of the CBM certified full light output type. Ballasts shall have an average input wattage of 40 or less when operating one 32-watt F32T8 lamp 72 or less when operating two 32 watt F32T8 lamps tested in accordance with [NEMA C82.2](#) methods. Provide ballasts which are compatible with energy-saving lamps.

##### 2.1.2.2 Electromagnetic Ballasts for Compact Fluorescent Lamps

Provide electromagnetic ballasts for compact fluorescent lamps.



### 2.1.2.3 Electromagnetic Low Temperature Ballasts

Provide fluorescent ballasts having a minimum starting temperature of **zero degrees F** for 800 milliampere, high output (HO) lamps in fixtures mounted outdoors, in unheated buildings, and as indicated.

### 2.1.3 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, U shaped fluorescent lamp, 31 watts maximum, 2600 initial lumens (minimum), 3500 K, 75 CRI (minimum), 20,000 hours average rated life, **1.625 inch** leg spacing.
- c. Compact fluorescent lamps shall be: CRI 80, minimum, 3500 K , 10,000 hours average rated life, and as follows:
  1. T-4, twin tube, rated 9 watts, 600 initial lumens (minimum), and 13 watts, 825 initial lumens (minimum), as indicated.
  2. T-4, double twin tube, rated 13 watts, 900 initial lumens (minimum),

Average rated life is based on 3 hours operating per start.

### 2.1.4 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.

### 2.1.5 Open-Tube Fluorescent Fixtures

Provide with self-locking sockets, or lamp retainers (two per lamp). Provide a clear polycarbonate protective sleeve with end caps, over lamp, with 95 percent (minimum) light transmission. The sleeve shall be rated to withstand the thermal profile of the lamp and ballast.

### 2.1.6 Air Handling Fixtures

Fixtures used as air handling registers shall meet requirements of **NFPA 90A**.

## 2.2 HIGH-INTENSITY-DISCHARGE (HID) LIGHTING FIXTURES

**UL 1598**. Provide HID fixtures with tempered glass lenses when using metal-halide lamps.

### 2.2.1 HID Ballasts

**UL 1029** and **NEMA C82.4** and shall be constant wattage autotransformer (CWA) or regulator, high power factor type. Provide single-lamp ballasts which shall have a minimum starting temperature of minus 30 degrees C. Ballasts

shall be:

- a. Designed to operate on the voltage system to which they are connected.
- b. Designed for installation in a normal ambient temperature of 40 degrees C.
- c. Constructed so that open circuit operation will not reduce the average life.

High-pressure sodium (HPS) ballasts shall have a solid-state igniter/starter with an average life in the pulsing mode of 3500 hours at the intended ambient temperature. Igniter case temperature shall not exceed 90 degrees C in any mode.

#### 2.2.2 High-Pressure Sodium (HPS) Lamps

NEMA C78.42 wattage as indicated. 150 watt lamps, if required, shall be 55 volt type.

#### 2.2.3 Metal-Halide Lamps

- a. 70 watt conforming to NEMA C78.1381
- b. 100 watt conforming to NEMA C78.1382
- c. 150 watt conforming to NEMA C78.1384
- d. 175 watt conforming to NEMA C78.1377
- e. 250 watt conforming to NEMA C78.1378
- f. 400 watt conforming to NEMA C78.1375
- g. 1000 watt conforming to NEMA C78.1376

#### 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 SUSPENDED FIXTURES

Provide hangers capable of supporting twice the combined weight of fixtures supported by hangers. Provide with swivel hangers to ensure a plumb installation. Hangers shall be cadmium-plated steel with a swivel-ball tapped for the conduit size indicated. Hangers shall be shock-absorbing type where indicated. Hangers shall allow fixtures to swing within an angle of 45 degrees. Brace pendants 4 feet or longer provided in shops or hangers to limit swinging. Single-unit suspended fluorescent fixtures shall have twin-stem hangers. Multiple-unit or continuous row fluorescent fixtures shall have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end. Rods shall be a minimum 0.18 inch diameter.

#### 2.5 LIGHTING CONTACTOR

NEMA ICS 2, electrically held contactor. Contacts shall be rated 120

volts, 20 amperes, and 8 poles. Coils shall be rated 120 volts. Provide in NEMA 1 enclosure conforming to NEMA ICS 6. Contactor shall have silver alloy double-break contacts Provide contactor with hand-off-automatic selector switch.

## 2.6 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 switch rated 120 volts, having automatically wound spring mechanism or capacitor, to maintain accurate time for a minimum of 15 hours following power failure. Provide time switch with a manual on-off bypass switch. Housing for the time switch shall be surface-mounted, NEMA 1 enclosure conforming to NEMA ICS 6.

## 2.7 PHOTOCCELL SWITCH

UL 773 or UL 773A, hermetically sealed cadmium-sulfide or silicon diode type cell rated 110 volts ac, 60 Hz with single-throw contacts. Switch shall turn on at or below 3 footcandles and off at 2 to 10 footcandles. A time delay shall prevent accidental switching from transient light sources. Provide switch:

- a. Integral to the luminaire. rated 1000W minimum. Provide a directional lens in front of the cell to prevent fixed light sources from creating a turnoff condition.
- b. In a U.V. stabilized polycarbonate housing with swivel arm and adjustable window slide, rated 1800 VA, minimum.
- c. In a high-impact-resistant, noncorroding and nonconductive molded plastic housing with a locking-type receptacle conforming to IEEE C136.10, rated 1800 VA, minimum.
- d. In a cast weatherproof aluminum housing with adjustable window slide, rated 1800 VA, minimum.

## 2.8 POWER HOOK FIXTURE HANGERS

Provide UL listed assembly including through-wired power hook housing, interlocking plug and receptacle, power cord, and fixture support loop. Power hook housing shall be cast aluminum having two 3/4 inch threaded hubs. Support hook shall have safety screw. Fixture support loop shall be cast aluminum with provisions for accepting 3/4 inch threaded fixture stems. Power cord shall include 16 inches of 3 conductor No. 16 Type SO cord. Assembly shall be rated 120 volts or 277 volts, 15 amperes.

## 2.9 EXIT SIGNS

UL 924, NFPA 70, and NFPA 101. Exit signs shall be self-powered type.

### 2.9.1 Self-Powered LED Type Exit Signs (Battery Backup)

Provide with automatic power failure device, test switch, pilot light, integral self-testing module 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).

#### 2.9.2 Remote-Powered Exit Signs

Provide remote ac/dc exit signs with provisions for wiring to external ac and dc power sources. Provide signs with a minimum of two ac lamps for normal illumination and a minimum of two dc lamps for emergency lighting.

#### 2.10 EMERGENCY LIGHTING EQUIPMENT

UL 924, NFPA 70, and NFPA 101. Provide lamps in wattage indicated. Provide accessories required for remote-mounted lamps where indicated. Remote-mounted lamps shall be as indicated.

##### 2.10.1 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. Equip units with brown-out sensitive circuit to activate battery when ac input falls to 75 percent of normal voltage . Provide integral self-testing module.

#### 2.11 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.

#### 2.12 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.

- a. Ultrasonic sensor shall be crystal controlled and shall not cause detection interference between adjacent sensors.
- b. Infrared sensors shall have a daylight filter. Sensor shall have a fresnel lens that is applicable for indicated usage.

c. Ultrasonic/Infrared Combination Sensor

Occupancy detection to turn lights on requires both ultrasonic and infrared sensor detection. Lights shall remain on if either the ultrasonic or infrared sensor detects movement. Infrared sensor shall have lens selected for indicated usage and daylight filter to prevent short wavelength infrared interference. Ultrasonic sensor frequency shall be crystal controlled.

2.13 SUPPORT HANGERS FOR LIGHTING FIXTURES IN SUSPENDED CEILING

2.13.1 Wires

ASTM A 641/A 641M, galvanized regular coating, soft temper, 0.1055 inches in diameter (12 gage).

2.13.2 Wires, for Humid Spaces

ASTM A 580/A 580M, composition 302 or 304, annealed stainless steel 0.1055 inches in diameter (12 gage).

2.13.3 Straps

Galvanized steel, one by 3/16 inch, conforming to ASTM A 653/A 653M, with a light commercial zinc coating or ASTM A 1008/A 1008M with an electrodeposited zinc coating conforming to ASTM B 633, Type RS.

2.13.4 Rods

Threaded steel rods, 3/16 inch diameter, zinc or cadmium coated.

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 or rods 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 or rods 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 or rods for lighting fixture support in this section.

### 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 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 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.

### 3.1.6 Light Level Sensor

Locate light level sensor as indicated and in accordance with the manufacturer's recommendations. Adjust sensor for 50 footcandles or for the indicated light level at the typical work plane for that area.

## 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 31 11 00

## CLEARING AND GRUBBING

08/08

## PART 1 GENERAL

## 1.1 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

## 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

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 .

## 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

No trees are to be removed.

### 3.4 PRUNING

Trim trees designated to be left standing within the cleared areas of dead branches 1 1/2 inches or more in diameter; and trim branches to heights and in a manner as indicated. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branches. Paint cuts more than 1 1/4 inches in diameter with an approved tree wound paint.

### 3.5 DISPOSAL OF MATERIALS

#### 3.5.1 Saleable Timber

All timber on the project site noted for clearing shall become the property of the Contractor, and shall be removed from the project site and disposed of off stations.

#### 3.5.2 Nonsaleable Materials

Written permission to dispose of such products on private property shall be filed with the Contracting Officer. Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for salable timber, shall be disposed of outside the limits of Government-controlled land at the Contractor's responsibility, except when otherwise directed in writing. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed.

-- End of Section --

## 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 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.))

## U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 530/F-93/004	(1993; Rev O; Updates I, II, IIA, IIB, and III) Test Methods for Evaluating Solid Waste (Vol IA, IB, IC, and II) (SW-846)
EPA 600/4-79/020	(1983) Methods for Chemical Analysis of Water and Wastes

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## 1.2 DEFINITIONS

### 1.2.1 Capillary Water Barrier

A layer of clean, poorly graded crushed rock, stone, or natural sand or gravel having a high porosity which is placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below a slab.

### 1.2.2 Degree of Compaction

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in [ASTM D698](#), for general soil types, abbreviated as percent laboratory maximum density.

### 1.2.3 Hard Materials

Weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

### 1.2.4 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

### 1.2.5 Pile Supported Structure

As used herein, a structure where both the foundation and floor slab are pile supported.

## 1.3 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

## 1.4 CRITERIA FOR BIDDING

Base bids on the following criteria:

- a. All excavation is unclassified.
- b. Ground water elevations indicated by the boring log were those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.
- e. Material character is indicated by the boring logs.
- g. Borrow material in the quantities required is not available at the project site.

## 1.5 REQUIREMENTS FOR OFF SITE SOIL

Soils brought in from off site for use as backfill shall be tested for TPH, BTEX and full TCLP including ignitability, corrosivity and reactivity. Backfill shall contain less than 100 parts per million (ppm) of total petroleum hydrocarbons (TPH) and less than 10 ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and shall not fail the TCPL test. TPH concentrations shall be determined by using EPA 600/4-79/020 Method 418.1. BTEX concentrations shall be determined by using EPA 530/F-93/004 Method 5030/8020. TCLP shall be performed in accordance with EPA 530/F-93/004 Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Material shall not be brought on site until tests have been approved by the Contracting Officer.

## 1.6 QUALITY ASSURANCE

### 1.6.1 Dewatering Work Plan

### 1.6.2 Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

## PART 2 PRODUCTS

### 2.1 SOIL MATERIALS

#### 2.1.1 Satisfactory Materials

Any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and frozen, deleterious, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

#### 2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 6 inches. The Contracting Officer shall be notified of any contaminated materials.

#### 2.1.3 Common Fill

Approved, unclassified soil material with the characteristics required to compact to the soil density specified for the intended location.

#### 2.1.4 Backfill and Fill Material

ASTM D2487, classification GW, GP, GM, SW, SP, SM, with a maximum ASTM D4318 liquid limit of 35, maximum ASTM D4318 plasticity index of 12, and a maximum of 25 percent by weight passing ASTM D1140, No. 200 sieve.

#### 2.1.5 Topsoil

Provide as specified.

#### 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.

##### 3.1.2 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.

##### 3.1.3 Machinery and Equipment

Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

#### 3.2 SURFACE PREPARATION

##### 3.2.1 Clearing and Grubbing

Unless indicated otherwise vegetation and other items that would interfere with construction operations within the 5 feet of each boiler building.

##### 3.2.2 Stripping

Strip suitable soil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be stockpiled and used for backfilling. Locate topsoil so that the material can be used readily for the finished grading. Where sufficient existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil. Protect topsoil and keep in segregated piles until needed.

##### 3.2.3 Unsuitable Material

Remove vegetation, debris, decayed vegetable matter, sod, mulch, and rubbish underneath paved areas or concrete slabs.

### 3.3 EXCAVATION

Excavate to 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 satisfactory material and compact to 95 percent of ASTM D698 maximum density. Unless specified otherwise, refill excavations cut below indicated depth with satisfactory material and compact to 95 percent of ASTM D698 maximum density. Satisfactory material removed below the depths indicated, without specific direction of the Contracting Officer, shall be replaced with satisfactory materials to the indicated excavation grade; except as specified for spread footings. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

#### 3.3.1 Structures With Spread Footings

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Fill over excavations with concrete during foundation placement.

#### 3.3.2 Excavated Materials

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Paragraph "DISPOSITION OF SURPLUS MATERIAL."

#### 3.3.3 Final Grade of Surfaces to Support Concrete

Excavation to final grade shall not be made until just before concrete is to be placed. Only excavation methods that will leave the foundation rock in a solid and unshattered condition shall be used. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. Shales shall be protected from slaking and all surfaces shall be protected from erosion resulting from ponding or flow of water.

### 3.4 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill.

Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by 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.

### 3.5 FILLING AND BACKFILLING

Fill and backfill to dimensions indicated. Compact each lift before placing overlaying lift.

#### 3.5.1 Backfill and Fill Material Placement

Provide for paved areas and under concrete slabs, except where select material is provided. Place in 8 inch lifts. Do not place over wet or frozen areas. Place backfill material adjacent to structures as the structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against the structure.

### 3.6 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved borrow materials shall be obtained as specified herein.

### 3.7 BURIED WARNING AND IDENTIFICATION TAPE

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

### 3.8 BURIED DETECTION WIRE

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

### 3.9 COMPACTION

Determine in-place density of existing subgrade; if required density exists, no compaction of existing subgrade will be required.

#### 3.9.1 General Site

Compact underneath areas designated for vegetation and areas outside the 5 foot line of the paved area or structure to 90 percent of ASTM D698.

#### 3.9.2 Structures, Spread Footings, and Concrete Slabs

Compact top 12 inches of subgrades to 95 percent of ASTM D698. Compact fill and backfill material to 95 percent of ASTM D698.



### 3.9.3 Adjacent Area

Compact areas within 5 feet of structures to 95 percent of ASTM D698.

### 3.9.4 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.

## 3.10 FINISH OPERATIONS

### 3.10.1 Topsoil and Seed

Provide as specified.

### 3.10.2 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.

## 3.11 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.

## 3.12 FIELD QUALITY CONTROL

### 3.12.1 Sampling

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

### 3.12.2 Testing

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

#### 3.12.2.1 Fill and Backfill Material Testing

Test fill and backfill material in accordance with ASTM C136 for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the No. 200 sieve; ASTM D4318 for liquid limit and for plastic limit; ASTM D698 or ASTM D1557 for moisture density relations, as applicable.

#### 3.12.2.2 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.

#### 3.12.2.3 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 Include density test results in daily report. Perform one test for each boiler building subgrade area.

-- End of Section --

SECTION 32 92 19

SEEDING

10/06

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 602 (2007) Agricultural Liming Materials

ASTM D 4972 (2001; R 2007) pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act (1940; R 1988; R 1998) Federal Seed Act

DOA SSIR 42 (1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of Turf

95 percent ground cover of the established species.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

1.3.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.3.1.2 Fertilizerand Lime Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer and lime may be furnished in bulk with certificate indicating the above information.

1.3.2 Storage

1.3.2.1 Seed, Fertilizerand Lime Storage

Store in cool, dry locations away from contaminants.

1.3.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.3.2.3 Handling

Do not drop or dump materials from vehicles.

1.4 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.4.1 Restrictions

Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.5 TIME LIMITATIONS

1.5.1 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide State-certified seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the Contracting Officer .

2.1.2 Planting Dates

As shown on plans.

2.1.3 Seed Purity

As shown on plans

2.1.4 Seed Mixture by Weight

As shown on plans.

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition."

### 2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." .

### 2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D 4972. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable materials. Other components shall conform to the following limits:

Silt	25-50 percent
Clay	10-30 percent
Sand	20-35 percent
pH	5.5 to 7.0
Soluble Salts	600 ppm maximum

## 2.3 SOIL CONDITIONERS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

### 2.3.1 Lime

Commercial grade hydrate or burnt limestone containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C 602 of not less than 100 percent.

## 2.4 FERTILIZER

### 2.4.1 Granular Fertilizer

As shown on plans.

## 2.5 MULCH

Mulch shall be free from noxious weeds, mold, and other deleterious materials.

### 2.5.1 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw shall contain no fertile seed.

### 2.5.2 Hay

Air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Hay shall be sterile, containing no fertile seed.

### 2.5.3 Wood Cellulose Fiber Mulch

Use recovered materials of either paper-based (100 percent) or wood-based (100 percent) hydraulic mulch. Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 5.5 to 8.2 . Use with

hydraulic application of grass seed and fertilizer.

## 2.6 WATER

Source of water shall be approved by Contracting Officer and of suitable quality for irrigation, containing no elements toxic to plant life.

## PART 3 EXECUTION

### 3.1 PREPARATION

#### 3.1.1 EXTENT OF WORK

Provide soil preparation (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

##### 3.1.1.1 Topsoil

Provide 4 inches of off-site topsoil on-site topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer, pH adjusters and soil conditioners into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting Officer. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

##### 3.1.1.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

##### 3.1.1.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site. For bidding purposes only apply at rates for the following:

## 3.2 SEEDING

### 3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy frozen snow covered or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

### 3.2.2 Seed Application Method

Seeding method shall be broadcasted and drop seeding or hydroseeding.

### 3.2.2.1 Broadcast and Drop Seeding

Seed shall be uniformly broadcast at the rate shown on drawings. Use broadcast or drop seeders. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing. Cover seed uniformly to a maximum depth of  $\frac{1}{4}$  inch in clay soils and  $\frac{1}{2}$  inch in sandy soils by means of spike-tooth harrow, cultipacker, raking or other approved devices.

### 3.2.2.2 Hydroseeding

First, mix water and fiber. Wood cellulose fiber, paper fiber, or recycled paper shall be applied as part of the hydroseeding operation. Fiber shall be added at 1,000 pounds, dry weight, per acre. Then add and mix seed and fertilizer to produce a homogeneous slurry. Seed shall be mixed to ensure broadcasting at the rate shown on drawings. When hydraulically sprayed on the ground, material shall form a blotter like cover impregnated uniformly with grass seed. Spread with one application with no second application of mulch.

### 3.2.3 Mulching

#### 3.2.3.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

### 3.2.4 Rolling

Immediately after seeding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds for each foot of roller width. If seeding is performed with cultipacker-type seeder or by hydroseeding, rolling may be eliminated.

### 3.2.5 Erosion Control Material

Install in accordance with manufacturer's instructions, where indicated or as directed by the Contracting Officer.

### 3.2.6 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2 inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

## 3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

## 3.4 RESTORATION

Restore to original condition existing turf areas which have been damaged

during turf installation operations at the Contractor's expense. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

-- End of Section --



## SECTION 33 30 00

## SANITARY SEWERS

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.

## AMERICAN WATER WORKS ASSOCIATION (AWWA)

- AWWA C104/A21.4 (2008; Errata 2010) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
- AWWA C110/A21.10 (2008) Ductile-Iron and Gray-Iron Fittings for Water
- AWWA C111/A21.11 (2007) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- AWWA C153/A21.53 (2011) Ductile-Iron Compact Fittings for Water Service
- AWWA C600 (2010) Installation of Ductile-Iron Water Mains and Their Appurtenances
- AWWA C605 (2005) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
- AWWA C900 (2007; Errata 2008) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution
- AWWA M23 (2002; 2nd Ed) Manual: PVC Pipe - Design and Installation

## ASME INTERNATIONAL (ASME)

- ASME B1.20.1 (1983; R 2006) Pipe Threads, General Purpose (Inch)

## ASTM INTERNATIONAL (ASTM)

- ASTM A123/A123M (2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- ASTM C150/C150M (2011) Standard Specification for Portland Cement

ASTM C270	(2012) Standard Specification for Mortar for Unit Masonry
ASTM C443	(2010) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C478	(2009) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C828	(2011) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C923	(2008) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C924	(2002; R 2009) Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM C94/C94M	(2011b) Standard Specification for Ready-Mixed Concrete
ASTM C969	(2002; R 2009) Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C972	(2000; R 2011) Compression-Recovery of Tape Sealant
ASTM C990	(2009) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM D1784	(2011) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D1785	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	(2009) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2321	(2011) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D2412	(2011) Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading

ASTM D2464	(2006) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2680	(2001; R 2009) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D2751	(2005) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D3034	(2008) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3139	(1998; R 2011) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3212	(2007) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3753	(2005e1) Glass-Fiber-Reinforced Polyester Manholes and Wetwells
ASTM D4101	(2011) Standard Specification for Polypropylene Injection and Extrusion Materials
ASTM D412	(2006ae2) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D624	(2000; R 2007) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM F477	(2010) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F794	(2003; R 2009) Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F949	(2010) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-60005

(Basic; Notice 2) Frames, Covers, Gratings, Steps, Sump And Catch Basin, Manhole

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

29 CFR 1910.27

Fixed Ladders

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-6

(1998) Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe

1.2 SYSTEM DESCRIPTION

1.2.1 Sanitary Sewer Gravity Pipeline

Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein more than 5 feet outside of building walls.

1.2.2 USACE Project

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. Replace damaged material and redo unacceptable work at no additional cost to the Government. Backfilling shall be accomplished after inspection by the Contracting Officer. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3 SUBMITTALS

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

Plan showing sanitary lateral connection to existing sanitary line. Plan shall include sanitary lateral location, pipe slope, inverts, existing utility crossing elevations, and required demolition.

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Installer Qualifications

Install specified materials by a licensed underground utility Contractor licensed for such work in the state where the work is to be performed. Installing Contractor's License shall be current and be state certified or state registered.

##### 1.4.2 Drawings

- a. Submit Installation Drawings showing complete detail, both plan and side view details with proper layout and elevations.
- b. Submit As-Built Drawings for the complete sanitary sewer system showing complete detail with all dimensions, both above and below grade, including invert elevation.
- c. Sign and seal As-Built Drawings by a Professional Surveyor and Mapper. Include the following statement: "All potable water lines crossed by sanitary hazard mains are in accordance with the permitted utility separation requirements."

#### 1.5 DELIVERY, STORAGE, AND HANDLING

##### 1.5.1 Delivery and Storage

###### 1.5.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

###### 1.5.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

###### 1.5.1.3 Cement, Aggregate, and Reinforcement

As specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

##### 1.5.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.

#### 1.6 PROJECT/SITE CONDITIONS

Submit drawings of existing conditions, after a thorough inspection of the area in the presence of the Contracting Officer. Details shall include the environmental conditions of the site and adjacent areas. Submit copies of the records for verification before starting work.

## PART 2 PRODUCTS

## 2.1 PIPELINE MATERIALS

Pipe shall conform to the respective specifications and other requirements specified below. Submit manufacturer's standard drawings or catalog cuts.

## 2.1.1 PVC Plastic Gravity Sewer Piping

## 2.1.1.1 PVC Plastic Gravity Pipe and Fittings

ASTM D3034, SDR 35, or ASTM F949 with ends suitable for elastomeric gasket joints. ASTM F794, Series 46, for ribbed sewer pipe with smooth interior, size 8 inch through 48 inch diameters.

## 2.1.1.2 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to ASTM D3212. Gaskets shall conform to ASTM F477.

## 2.1.2 PVC Plastic Pressure Pipe and Associated Fittings

## 2.1.2.1 PVC Plastic Pressure Pipe and Fittings

a. Pipe and Fittings Less Than 4 inch Diameter: Pipe, couplings and fittings shall be manufactured of materials conforming to ASTM D1784, Class 12454B.

(1) Screw-Joint: Pipe shall conform to dimensional requirements of ASTM D1785, Schedule 80, with joints meeting requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified. Fittings for threaded pipe shall conform to requirements of ASTM D2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings. Pipe couplings when used, shall be tested as required by ASTM D2464.

(2) Push-On Joint: ASTM D3139, with ASTM F477 gaskets. Fittings for push-on joints shall be iron conforming to AWWA C110/A21.10 or AWWA C111/A21.11. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104/A21.4.

(3) Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D1785 or ASTM D2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure. Fittings for solvent cement jointing shall conform to ASTM D2466 or ASTM D2467.

b. Pipe and Fittings 4 inch Diameter to 12 inch: Pipe shall conform to AWWA C900 and shall be plain end or gasket bell end, Pressure Class 150 (DR 18), with cast-iron-pipe-equivalent OD. Fittings shall be gray-iron or ductile-iron conforming to AWWA C110/A21.10 or AWWA C153/A21.53 and shall have cement-mortar lining conforming to AWWA C104/A21.4, standard thickness. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that bell design shall be modified, as approved, for push-on joint suitable for use with the PVC plastic pressure pipe specified in this paragraph.

### 2.1.2.2 PVC Plastic Pressure Joints and Jointing Material

Joints for pipe, 4 inch to 12 inch diameter, shall be push-on joints as specified in ASTM D3139. Joints between pipe and fittings shall be push-on joints as specified in ASTM D3139 or shall be compression-type joints/mechanical-joints as respectively specified in ASTM D3139 and AWWA C111/A21.11. Each joint connection shall be provided with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets for push-on joints for pipe shall conform to ASTM F477. Gaskets for push-on joints and compression-type joints/mechanical-joints for joint connections between pipe and fittings shall be as specified in AWWA C111/A21.11, respectively, for push-on joints and mechanical-joints.

## 2.2 CONCRETE MATERIALS

### 2.2.1 Cement Mortar

Cement mortar shall conform to ASTM C270, Type M with Type II cement.

### 2.2.2 Portland Cement

Submit certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes. Portland cement shall conform to ASTM C150/C150M, Type II for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking.

### 2.2.3 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C94/C94M, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

## 2.3 MISCELLANEOUS MATERIALS

### 2.3.1 Precast Concrete Manholes & Glass-Fiber-Reinforced Polyester Manholes

Precast concrete manhole risers, base sections, and tops shall conform to ASTM C478 and be manufactured in accordance with NCDOT Standards and Specifications; base and first riser shall be monolithic. Glass-Fiber-Reinforced Polyester Manholes shall conform to ASTM D3753.

### 2.3.2 Gaskets and Connectors

Gaskets for joints between manhole sections shall conform to ASTM C443. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C923 or ASTM C990.

### 2.3.3 External Preformed Rubber Joint Seals

An external preformed rubber joint seal shall be an accepted method of sealing cast iron covers to precast concrete sections to prevent ground water infiltration into sewer systems. All finished and sealed manholes constructed in accordance with paragraph entitled "Manhole Construction" shall be tested for leakage in the same manner as pipelines as described in

paragraph entitled "Leakage Tests." The seal shall be multi-section with a neoprene rubber top section and all lower sections made of Ethylene Propylene Diene Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit shall consist of a top and bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be a non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. Extension sections shall cover up to two more adjusting rings. Properties and values are listed in the following tables:

Properties, Test Methods and Minimum Values for  
Rubber used in Preformed Joint Seals

Physical Properties	Test Methods	EPDM	Neoprene	Butyl mastic
Tensile, psi	ASTM D412	1840	2195	-
Elongation percent	ASTM D412	553	295	350
Tear Resistance, ppi	ASTM D624 (Die B)	280	160	-
Rebound, percent, 5 minutes	ASTM C972 (mod.)	-	-	11
Rebound, percent, 2 hours	ASTM C972	-	-	12

#### 2.3.4 Metal Items

##### 2.3.4.1 Frames, Covers, and Gratings for Manholes

CID A-A-60005, cast iron; figure numbers shall be as follows:

- a. Traffic manhole: Provide in paved areas.

Frame: Figure 1, Size 22A  
Cover: Figure 8, Size 22A  
Steps: Figure 19

- b. Non-traffic manhole:

Frame: Figure 4, Size 22  
Cover: Figure 12, Size 22  
Steps: Figure 19

Frames and covers shall be cast iron, ductile iron or reinforced concrete. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. Reinforced concrete frames and covers shall be as indicated or shall conform to ASTM C478. The word "Sanitary Sewer" shall be stamped or cast into covers so that it is plainly visible.

##### 2.3.4.2 Manhole Steps

Zinc-coated steel conforming to 29 CFR 1910.27. As an option, plastic or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D4101, copolymer polypropylene. Rubber shall conform



to ASTM C443, except shore A durometer hardness shall be 70 plus or minus 5. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less than 4 feet deep.

#### 2.3.4.3 Manhole Ladders

A steel ladder shall be provided where the depth of a manhole exceeds 12 feet. The ladder shall not be less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. The two stringers shall be a minimum 3/8 inch thick and 2 inches wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A123/A123M.

#### 2.4 REPORTS

Submit Test Reports.. Submit Inspection Reports for daily activities during the installation of the sanitary system. Information in the report shall be detailed enough to describe location of work and amount of pipe laid in place, measured in linear feet.

### PART 3 EXECUTION

#### 3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

##### 3.1.1 General Requirements for Installation of Pipelines

These general requirements apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

##### 3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 5 feet from the building. Where the location of the sewer is not clearly defined by dimensions on the drawings, do not lay sewer line closer horizontally than 10 feet to a water main or service line. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 10 feet on each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 3 feet, horizontal distance, to the water line.

##### a. Sanitary piping installation parallel with water line:

- (1) Normal conditions: Sanitary piping or manholes shall be laid at least 10 feet horizontally from a water line whenever possible. The distance shall be measured edge-to-edge.
- (2) Unusual conditions: When local conditions prevent a horizontal separation of 10 feet, the sanitary piping or manhole may be laid closer to a water line provided that:
  - (a) The top (crown) of the sanitary piping shall be at least 18 inches below the bottom (invert) of the water main.
  - (b) Where this vertical separation cannot be obtained, the sanitary piping shall be constructed of AWWA-approved ductile iron water pipe pressure tested in place without leakage prior to backfilling.

(c) The sewer manhole shall be of watertight construction and tested in place.

b. Installation of sanitary piping crossing a water line:

(1) Normal conditions: Lay sanitary sewer piping by crossing under water lines to provide a separation of at least 18 inches between the top of the sanitary piping and the bottom of the water line whenever possible.

(2) Unusual conditions: When local conditions prevent a vertical separation described above, use the following construction:

(a) Sanitary piping passing over or under water lines shall be constructed of AWWA-approved ductile iron water pipe, pressure tested in place without leakage prior to backfilling.

(b) Sanitary piping passing over water lines shall, in addition, be protected by providing:

(1) A vertical separation of at least 18 inches between the bottom of the sanitary piping and the top of the water line.

(2) Adequate structural support for the sanitary piping to prevent excessive deflection of the joints and the settling on and breaking of the water line.

(3) That the length, minimum 20 feet, of the sanitary piping be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the water line.

c. Sanitary sewer manholes: No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

3.1.1.2 Earthwork

Perform earthwork operations as specified.

3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell or groove ends in the upgrade direction. Adjust spigots in bells and tongues in grooves to give a uniform space all around. Blocking or wedging between bells and spigots or tongues and grooves will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose. Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of ASTM D2680; saddles for ABS pipe shall comply with Table 3 of ASTM D2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D3034.

#### 3.1.1.4 Connections to Existing Lines

Obtain approval from the Contracting Officer before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

#### 3.1.2 Special Requirements

##### 3.1.2.1 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of [ASTM D2321](#) for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of [ASTM D2321](#) for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

##### 3.1.2.2 Installation of PVC Plastic Pressure Pipe and Fittings

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section; with the requirements of [AWWA C605](#) for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in [AWWA M23](#), Chapter 7, "Installation."

###### a. Pipe Less Than 4 Inch Diameter:

- (1) Threaded joints shall be made by wrapping the male threads with joint tape or by applying an approved thread lubricant, then threading the joining members together. The joints shall be tightened with strap wrenches which will not damage the pipe and fittings. The joint shall be tightened no more than 2 threads past hand-tight.
- (2) Push-On Joints: The ends of pipe for push-on joints shall be beveled to facilitate assembly. Pipe shall be marked to indicate when the pipe is fully seated. The gasket shall be lubricated to prevent displacement. Care shall be exercised to ensure that the gasket remains in proper position in the bell or coupling while making the joint.
- (3) Solvent-weld joints shall comply with the manufacturer's instructions.

- b. Pipe 4 Inch Diameter Joints: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to fittings, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of [AWWA C605](#) for laying the pipe and the recommendations in [AWWA M23](#), Chapter 7, "Installation," for pipe joint assembly. Assemble push-on joints for connection to fittings in accordance with the requirements

of AWWA C605 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners specified for this type joint and assemble in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111/A21.11. Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel.

- c. Pipe anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Size and position thrust blocks as indicated. Use concrete conforming to ASTM C94/C94M having a minimum compressive strength of 2,000 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.

### 3.1.3 Concrete Work

Cast-in-place concrete is included in Section 03 30 00 CAST-IN-PLACE CONCRETE. The pipe shall be supported on a concrete cradle, or encased in concrete as needed.

### 3.1.4 Manhole Construction

Construct base slab of cast-in-place concrete or use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Cast-in-place concrete work shall be in accordance with the requirements specified under paragraph entitled "Concrete Work" of this section. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.

### 3.1.5 Miscellaneous Construction and Installation

#### 3.1.5.1 Connecting to Existing Manholes

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cutting the manhole shall be done in a manner that

will cause the least damage to the walls.

#### 3.1.5.2 Metal Work

- a. Workmanship and finish: Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.
- b. Field painting: After installation, clean cast-iron frames, covers, gratings, and steps not buried in concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

#### 3.1.6 Installations of Wye Branches

Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

### 3.2 FIELD QUALITY CONTROL

#### 3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. Perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

#### 3.2.2 Tests for Nonpressure Lines

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line. When pressure piping is used in a nonpressure line for nonpressure use, test this piping as specified for nonpressure pipe.

##### 3.2.2.1 Leakage Tests

Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe

sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

- a. Infiltration tests and exfiltration tests: Perform these tests for sewer lines made of the specified materials, not only concrete, in accordance with [ASTM C969](#). Make calculations in accordance with the Appendix to [ASTM C969](#).
- b. Low-pressure air tests: Perform tests as follows:
  - (1) Clay pipelines: Test in accordance with [ASTM C828](#). Allowable pressure drop shall be as given in [ASTM C828](#). Make calculations in accordance with the Appendix to [ASTM C828](#).
  - (2) Concrete pipelines: Test in accordance with [ASTM C924](#). Allowable pressure drop shall be as given in [ASTM C924](#). Make calculations in accordance with the Appendix to [ASTM C924](#).
  - (3) Ductile-iron pipelines: Test in accordance with the applicable requirements of [ASTM C924](#). Allowable pressure drop shall be as given in [ASTM C924](#). Make calculations in accordance with the Appendix to [ASTM C924](#).
  - (4) ABS composite plastic pipelines: Test in accordance with the applicable requirements of [UBPPA UNI-B-6](#). Allowable pressure drop shall be as given in [UBPPA UNI-B-6](#). Make calculations in accordance with the Appendix to [UBPPA UNI-B-6](#).
  - (5) PVC plastic pipelines: Test in accordance with [UBPPA UNI-B-6](#). Allowable pressure drop shall be as given in [UBPPA UNI-B-6](#). Make calculations in accordance with the Appendix to [UBPPA UNI-B-6](#).

#### 3.2.2.2 Deflection Testing

Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads determined in accordance with [ASTM D2412](#).

Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection measuring device.

- a. Pull-through device: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided the device meets the applicable requirements specified in this paragraph, including those for diameter of the device, and that the mandrel has a minimum of 9 arms. Ball, cylinder, or circular sections shall conform to the following:
  - (1) A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.

- (2) Homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall have a surface Brinell hardness of not less than 150.
  - (3) Center bored and through-bolted with a 1/4 inch minimum diameter steel shaft having a yield strength of not less than 70,000 psi, with eyes or loops at each end for attaching pulling cables.
  - (4) Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.
- b. Deflection measuring device: Sensitive to 1.0 percent of the diameter of the pipe being tested and shall be accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved prior to use.
  - c. Pull-through device procedure: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions.
  - d. Deflection measuring device procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, replace pipe which has excessive deflection and completely retest in same manner and under same conditions.

-- End of Section --







Mr. Christopher D. Hardwood  
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Subject:

Limited Asbestos Survey – (CP12-0121)  
Buildings FC400, FC411, FC412, FC413, FC414, FC415, FC416, FC500, FC515,  
FC530, FC550, FC555, FC560, FC565, FC571, and FC573.  
Marine Corps Base  
Camp Lejeune, North Carolina

ENVIRONMENT

Date:  
July 11, 2012

Dear Mr. Hardwood:

Contact:  
Phillip Santiago

Crystal Coast Environmental, Inc. (CCEI) conducted a Limited Asbestos Survey (LAS) of asbestos-containing building materials (ACBMs) at the above-referenced buildings for Wiley Wilson. The survey was requested by Mr. Christopher Hardwood to identify the location and quantity of ACBMs within the mechanical rooms and steam pits as part of a planned boiler modification project. The focus of the survey was to identify visible and accessible suspect ACBMs. Background information on the Site, a summary of the asbestos survey as well as the inspector's certification and license are provided below.

Phone:  
910.938.7998

Email:  
[pasantiago@cceinc.biz](mailto:pasantiago@cceinc.biz)

Our ref:  
11-2782

## BACKGROUND INFORMATION

These sites are located aboard MCB, Camp Lejeune, NC and are owned by **The US Government**. All buildings consists of a brick frame skeleton and brick and mortar exterior walls, glass windows and metal doors. Thermal System Insulation (TSI) was present in the form of fiberglass and mudded insulation within the mechanical rooms and steam pits. Spray-applied fireproofing was not observed on structural steel beams and columns.

## ASBESTOS SURVEY

The survey was performed on June 11, 2102 and July 7, 2012 by Mr. Robert Elbertson of CCEI. A copy of his North Carolina asbestos inspector license is provided in Attachment A. During the inspection, a total of 26 homogeneous applications (HAs) were identified and a total of 36 bulk samples were collected and



Mr. Christopher D. Hardwood  
July 11, 2012

submitted for laboratory analysis. The results of the limited survey are presented in the Attachments to this report as follows:

- Attachment B – Homogeneous Application Table
- Attachment C - Types, Categories, Classes, and Condition Codes
- Attachment D – Laboratory Data Package and Chain of Custody
- Attachment E – Photographs of Homogeneous Applications

Consistent with scope of work, unless noted herein, destructive testing was not performed at the site in order to identify materials which may be hidden or obstructed. Examples of potentially hidden or obstructed areas include but are not limited to wall cavity interiors, pipe chases, spaces above fixed ceilings, grout/adhesive beneath ceramic tiles/marble tiles/granite, sub floors, and adhesives behind wall mounted mirrors, etc.

The methodology utilized to identify samples obtained during the survey is comprised of the CCEI job number, building number, homogeneous number and corresponding sample number: 000 – 1 – 01.

Visible suspected material were placed in clean Zip-Lock plastic baggies, marked for identification, cataloged, then logged onto a chain of custody, and then mailed, via FedEx, to Carolina Environmental, Inc (CEI) an approved laboratory participating in the National Volunteer Laboratory Accreditation Program (NVLAP) under Lab Code 101768-0.

Number of samples obtained from the project does not reflect any sample that may be subdivided by the laboratory for analysis.

## **CONCLUSIONS**

As presented in the HAT in Attachment B, the results of the survey did not identify any ACBMs.

When reviewing the HAT, in general, materials confirmed as ACBMs are identified by the National Emission Standards for Hazardous Air Pollutants (NESHAP) categories (refer to the NESHAP column of the HAT):

- Friable RACM
- CAT 1 Non-friable RACM
- CAT 2 Non-friable RACM
- ACCM



In some cases, materials which may be ACBMs could not be sampled and are identified as "Suspect ACM, Not Sampled" in the HAT. Until determined otherwise, suspect and not sampled ACBMs should be treated as asbestos-containing.

Materials confirmed as non-ACBMs are identified by the NESHAP categories:

- Non-ACM, Sampled
- Non-Suspect ACM, Not Sampled

**RECOMMENDATIONS**

CCEI recommends that all suspect and confirmed ACBMs, if present, be managed in accordance with an O&M Program. In most cases, when an ACBM is in "Good" condition, we anticipate that the material can be managed under the Operations and Maintenance program in-place with abatement only being required when materials will be disturbed (i.e. renovation and some maintenance activities).

As defined by the Environmental Protection Agency (EPA) under the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulation 40 CFR 61, Subpart M and Occupational Safety and Health Administration (OSHA) regulation 29 CFR 1926.1101, it is recommended the following material located within the identified project be treated within the limits of the guidelines outlined in the following table:

*Table 1*

Material	HOA	Type	EPA Category	OSHA Class	Condition
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See Attachment C - for a list of Types, Categories, Classes, and Condition Codes

For abatement purposes, unless otherwise tested, all like asbestos containing materials (ACMs) identified during any demolish or renovation should be considered ACMs throughout their individual site and handled accordingly.

All abatement projects involving over 160 square feet, 35 cubic feet, or 260 linear feet of ACM must be permitted by North Carolina Department of Environmental Health and Natural Resources (NCDEHNR), Health Hazards Control Unit (HHCU). Applications for permits shall be postmarked or received by NCDEHNR HHCU at least ten (10) working days prior to the scheduled removal start date.

Submission of the application is typically handled by the selected asbestos abatement contractor and a listing of state licensed asbestos abatement contractors, along with consulting firms, may be obtained from the NCDEHNR HHCU.



Mr. Christopher D. Hardwood  
July 11, 2012

The primary Federal Regulations regarding identified ACM is EPA NESHAP Revision 40 CFR Part 61. Under this mandate, asbestos fibers must be controlled during removal. The HHCU, telephone 919-707-5983, is the North Carolina State agency responsible for the enforcement of the EPA NESHAP Regulations.

## **CLOSING**

The asbestos survey described herein was conducted by the undersigned of CCEI. CCEI's investigation consisted solely of the activities described herein and is subject to the Limitations and Service Constraints in Attachment G. Prior to performing renovation or demolition activities, the existing data should be reviewed to confirm all building materials which may be impacted have been evaluated to determine if they are ACBMs and that the existing data is complete and complies with all laws and regulations. In some cases, additional testing, including destructive testing, may be required prior to demolition or renovation activities, especially with respect to potentially hidden, obstructed or non-sampled ACBMs. Contact the CCEI if you have any questions regarding this data and/or the need for additional sampling.

Thank you for your time and consideration. Please do not hesitate to call if you have questions regarding the results of this asbestos survey or require additional information.

Sincerely,  
Crystal Coast Environment, Inc.

A handwritten signature in blue ink that reads "Robert Elbertson" with a horizontal line extending to the right.

Robert Elbertson  
North Carolina Licensed Inspector

### Attachments:

- A Certifications and Licenses
- B Asbestos Homogeneous Application Table
- C Types, Categories, Classes, and Condition Codes
- D Laboratory Data Package and Chain of Custody
- E Photographs
- F Limitations and Service Constraints

**Homogeneous Application Table**

HA No.	Material Type	Primary Color	Texture	Description	NESHAP Cat.	Building #	Rooms	Location	Condition	Amt.	Units	Status	Modified Date	Description
1	T - Mastic Coating on Thermal Pipe Jacket Cover	White	Rough	Pipe Mastic	Non-ACM, Sampled	FC400	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
2	T - Boiler Insulation	Gray	Rough	Insulation Located Around Tank	Non-ACM, Sampled	FC411	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
3	T - Pipe Insulation - Fittings, Elbows, Mudded Joint	White	Rough	Pipe Insulation	Non-ACM, Sampled	FC411	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
4	T - Boiler Insulation	Gray	Rough	Insulation Located Around Tank	Non-ACM, Sampled	FC412	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
5	T - Boiler Insulation	Gray	Rough	Insulation Located Around Tank	Non-ACM, Sampled	FC412	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
6	T - Boiler Insulation	Gray	Rough	Insulation Located Around Tank	Non-ACM, Sampled	FC413	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
7	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	White	Rough	Pipe Insulation	Non-ACM, Sampled	FC413	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
8	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	White	Rough	Pipe Insulation	Non-ACM, Sampled	FC414	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
9	T - Boiler Insulation	Gray	Rough	Insulation Located Around Tank	Non-ACM, Sampled	FC415	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
10	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	White	Rough	Pipe Insulation	Non-ACM, Sampled	FC415	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
11	T - Boiler Insulation	Gray	Rough	Insulation Located Around Tank	Non-ACM, Sampled	FC416	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
12	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	White	Rough	Pipe Insulation	Non-ACM, Sampled	FC420	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
13	T - Mastic Coating on Thermal Pipe Jacket Cover	White	Rough	Pipe Mastic	Non-ACM, Sampled	FC500	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
14	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	White	Rough	Pipe Insulation	Non-ACM, Sampled	FC500	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
15	T - Boiler Insulation	Gray	Rough	Insulation Located Around Tank	Non-ACM, Sampled	FC515	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
16	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	White	Rough	Pipe Insulation	Non-ACM, Sampled	FC530	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
17	T - Boiler Insulation	Gray	Rough	Insulation Located Around Tank	Non-ACM, Sampled	FC530	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
18	T - Boiler Insulation	Gray	Rough	Insulation Located Around Tank	Non-ACM, Sampled	FC550	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
19	M - Fire Stop Penetration Sealant	Red	Rough	Penetration Mastic	Non-ACM, Sampled	FC550	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
20	T - Boiler Insulation	Gray	Rough	Insulation Located Around Tank	Non-ACM, Sampled	FC555	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
21	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	White	Rough	Pipe Insulation	Non-ACM, Sampled	FC560	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
22	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	White	Rough	Pipe Insulation	Non-ACM, Sampled	FC565	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
23	T - Mastic Coating on Thermal Pipe Jacket Cover	White	Rough	Pipe Mastic	Non-ACM, Sampled	FC572	Mechanical	Other	Good	N/A	N/A	Undetermined	6/11/2012	
24	NSM - Silicone Caulk / Sealant	Gray	Smooth	Pipe Caulking	Non-Suspect ACM, Not Sampled	FC400	Steam Pit	Other	Good	N/A	N/A	Undetermined	7/6/2012	
25	T - Pipe Insulation - Fittings, Elbows, Mudded Joint	Gray	Rough	Pipe Insulation	Non-ACM, Sampled	FC571	Steam Pit	Other	Good	N/A	N/A	Undetermined	7/6/2012	
26	T - Pipe Insulation - Fittings, Elbows, Mudded Joint	Black	Rough	Glass Foam Insulation	Non-ACM, Sampled	FC573	Steam Pit	Other	Good	N/A	N/A	Undetermined	7/6/2012	

**Results of Sample Analyses**

HA No.	Material Type	ID	Location	Content	Type	Friable	Sample Date	Consultant	Method	Lab
1	T - Mastic Coating on Thermal Pipe Jacket Cover	2782-400-1-01	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
1	T - Mastic Coating on Thermal Pipe Jacket Cover	2782-400-1-02	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
2	T - Boiler Insulation	2782-411-2-03	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
3	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-411-3-04	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
4	T - Boiler Insulation	2782-412-4-05	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
5	T - Boiler Insulation	2782-412-5-06	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
6	T - Boiler Insulation	2782-413-6-07	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
7	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-413-7-08	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
8	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-414-8-09	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
8	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-414-8-10	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
9	T - Boiler Insulation	2782-415-9-11	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
10	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-415-10-12	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
11	T - Boiler Insulation	2782-416-11-13	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
11	T - Boiler Insulation	2782-416-11-14	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
12	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-420-12-15	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
12	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-420-12-16	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
13	T - Mastic Coating on Thermal Pipe Jacket Cover	2782-500-13-17	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
14	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-500-14-18	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
15	T - Boiler Insulation	2782-515-15-19	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
15	T - Boiler Insulation	2782-515-15-20	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
16	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-530-16-21	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
17	T - Boiler Insulation	2782-530-17-22	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
18	T - Boiler Insulation	2782-550-18-23	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
19	M - Fire Stop Penetration Sealant	2782-550-19-24	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
20	T - Boiler Insulation	2782-555-20-25	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
20	T - Boiler Insulation	2782-555-20-26	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
21	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-560-21-27	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
21	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-560-21-28	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
22	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-565-22-29	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
22	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-565-22-30	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
23	T - Mastic Coating on Thermal Pipe Jacket Cover	2782-572-23-31	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
23	T - Mastic Coating on Thermal Pipe Jacket Cover	2782-572-23-32	Mechanical Room	ND		No	6/11/2012	CCEI	PLM	Carolina Environmental
25	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-571-25-33	Steam Pit	ND		No	7/6/2012	CCEI	PLM	Carolina Environmental
25	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-571-25-34	Steam Pit	ND		No	7/6/2012	CCEI	PLM	Carolina Environmental
26	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-573-26-35	Steam Pit	ND		No	7/6/2012	CCEI	PLM	Carolina Environmental
26	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2783-573-26-36	Steam Pit	ND		No	7/6/2012	CCEI	PLM	Carolina Environmental

## Exhibit 1

### Type, Category, Classification, and Condition Codes Of Asbestos Containing Material

Types of Asbestos Containing Material (ACM)	Thermal System Insulation (TSI)
	Surfacing
	Miscellaneous

EPA Category of ACM (40 CFR 61, Subpart M)	Friable
	Nonfriable Category I Asphalt Roofing Material Resilient Flooring & Mastic Packing Material Gaskets
	Nonfriable Category II Other Nonfirable Materials

OSHA Classification of ACM (29 CFR 1926.1101)	Class I Thermal System Insulation and Surfacing Material
	Class II Other Materials
	Class III Operational & Maintenance activity No bigger than one glovebag
	Class IV Janitorial – Contact with but does not disturb ACM

Condition Codes (40 CFR 763.88, Subpart E)	
1	Damaged or significantly damaged thermal system insulation ACM
2	Damaged friable surfacing ACM
3	Significantly damaged friable surfacing ACM
4	Damaged or significantly damaged friable miscellaneous ACM
5	Asbestos containing material building material (ACBM) with potential for damage
6	ACBM with potential for significant damage
7	Any remaining friable ACBM or friable suspected ACBM



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## ASBESTOS LABORATORY REPORT

Prepared for

**Crystal Coast Environmental Inc.**

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**PROJECT:** Frnch Creek, Camp Lejeune, NC; 12-2782

**CEI LAB CODE:** A12-5135

**DATE REPORTED:** 06/15/12

**TOTAL SAMPLES ANALYZED:** 32

**# SAMPLES >1% ASBESTOS:**

**TEL: 866-481-1412**

*[www.ceilabs.com](http://www.ceilabs.com)*





# Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

**PROJECT:** Frnch Creek, Camp Lejeune, NC; 12-2782 **CEI LAB CODE:** A12-5135

**METHOD:** EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
2782-400-1-01		A1302449	White,Grey	Mastic Coating	None Detected
2782-400-1-02		A1302450	White	Mastic Coating	None Detected
2782-411-2-03		A1302451	Grey,Cream	Insulation	None Detected
2782-411-3-04		A1302452	Grey,Yellow	Insulation	None Detected
2782-412-4-05		A1302453	Grey	Insulation	None Detected
2782-412-5-06		A1302454	Grey,Cream	Insulation	None Detected
2782-413-6-07		A1302455	Grey,Cream	Insulation	None Detected
2782-413-7-08		A1302456	Black,Brown	Insulation	None Detected
2782-414-8-09		A1302457	Yellow,Cream	Insulation	None Detected
2782-414-8-10		A1302458	Brown,Off-white	Insulation	None Detected
2782-415-9-11		A1302459	Grey,Cream	Insulation	None Detected
2782-415-10-12		A1302460	Brown,Tan	Insulation	None Detected
2782-416-11-13		A1302461	Grey,Cream	Insulation	None Detected
2782-416-11-14		A1302462	Grey,Cream	Insulation	None Detected
2782-420-12-15		A1302463	Tan,Cream	Insulation	None Detected
2782-420-12-16		A1302464	White,Tan	Insulation	None Detected
2782-500-13-17		A1302465	Tan,Green	Mastic Coating	None Detected
2782-500-14-18		A1302466	Pink,Beige	Insulation	None Detected
2782-515-15-19		A1302467	Tan	Insulation	None Detected
2782-515-15-20		A1302468	Tan,Red	Insulation	None Detected
2782-530-16-21		A1302469	Blue,Cream	Insulation	None Detected
2782-530-17-22		A1302470	Tan	Insulation	None Detected
2782-550-18-23		A1302471	Off-white	Insulation	None Detected
2782-550-19-24		A1302472	Red,White	Fire Stop Penetration Sealant	None Detected
2782-555-20-25		A1302473	Off-white,Tan	Insulation	None Detected
2782-555-20-26		A1302474	Off-white	Insulation	None Detected
2782-560-21-27		A1302475	Blue,Off-white	Insulation	None Detected
2782-560-21-28		A1302476	Yellow,Off-white	Insulation	None Detected
2782-565-22-29		A1302477	Yellow,Off-white	Insulation	None Detected
2782-565-22-30		A1302478	Black,Off-white	Insulation	None Detected
2782-565-23-31		A1302479	White,Silver	Mastic Coating	None Detected



# Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

**PROJECT:** Frnch Creek, Camp Lejeune, NC; 12-2782 **CEI LAB CODE:** A12-5135

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**METHOD:** EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
2782-565-23-32		A1302480	White,Silver	Mastic Coating	None Detected



# ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

**Client:** Crystal Coast Environmental Inc.  
410 New Bridge Street, Ste.  
Jacksonville, NC 28540

**CEI Lab Code:** A12-5135

**Date Received:** 06-14-12

**Date Reported:** 06-14-12

**Project:** Frnch Creek, Camp Lejeune, NC; 12-2782

## ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS				ASBESTOS %
			Fibrous		Non-Fibrous		
<b>2782-400-1 -01</b> A1302449	Mastic Coating	Heterogeneous White,Grey Fibrous Tightly Bound	<1%	Synthetic Fiber	10% 20% 70%	Silicates Calc Carb Binder	<b>None Detected</b>
<b>2782-400-1 -02</b> A1302450	Mastic Coating	Heterogeneous White Fibrous Tightly Bound	<1%	Synthetic Fiber	10% 20% 70%	Silicates Calc Carb Binder	<b>None Detected</b>
<b>2782-411-2 -03</b> A1302451	Insulation	Heterogeneous Grey,Cream Fibrous Bound	30%	Fiberglass	10% 60%	Silicates Binder	<b>None Detected</b>
<b>2782-411-3 -04</b> A1302452	Insulation	Heterogeneous Grey,Yellow Fibrous Loosely Bound	35% 5%	Fiberglass Cellulose	5% 50% 5%	Silicates Binder Metal Foil	<b>None Detected</b>
<b>2782-412-4 -05</b> A1302453	Insulation	Homogeneous Grey Fibrous Bound	25% 5%	Fiberglass Cellulose	10% 60%	Silicates Binder	<b>None Detected</b>
<b>2782-412-5 -06</b> A1302454	Insulation	Heterogeneous Grey,Cream Fibrous Bound	25% 5%	Fiberglass Cellulose	10% 55% 5%	Silicates Binder Paint	<b>None Detected</b>
<b>2782-413-6 -07</b> A1302455	Insulation	Heterogeneous Grey,Cream Fibrous Bound	30%	Fiberglass	10% 60%	Silicates Binder	<b>None Detected</b>
<b>2782-413-7 -08</b> A1302456	Insulation	Heterogeneous Black,Brown Fibrous Bound	5%	Fiberglass	5% 90%	Binder Foam	<b>None Detected</b>



# ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

**Client:** Crystal Coast Environmental Inc.  
410 New Bridge Street, Ste.  
Jacksonville, NC 28540

**CEI Lab Code:** A12-5135

**Date Received:** 06-14-12

**Date Reported:** 06-14-12

**Project:** Frnch Creek, Camp Lejeune, NC; 12-2782

## ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS				ASBESTOS %
			Fibrous		Non-Fibrous		
<b>2782-414-8-09</b> A1302457	Insulation	Heterogeneous Yellow, Cream Fibrous Loosely Bound	90% 5%	Fiberglass Cellulose	5%	Metal Foil	<b>None Detected</b>
<b>2782-414-8-10</b> A1302458	Insulation	Heterogeneous Brown, Off-white Fibrous Loosely Bound	5% 5%	Fiberglass Talc	90%	Binder	<b>None Detected</b>
<b>2782-415-9-11</b> A1302459	Insulation	Heterogeneous Grey, Cream Fibrous Bound	30%	Fiberglass	10% 60%	Silicates Binder	<b>None Detected</b>
<b>2782-415-10-12</b> A1302460	Insulation	Heterogeneous Brown, Tan Fibrous Bound	5%	Fiberglass	5% 90%	Binder Foam	<b>None Detected</b>
<b>2782-416-11-13</b> A1302461	Insulation	Heterogeneous Grey, Cream Fibrous Bound	30%	Fiberglass	10% 60%	Silicates Binder	<b>None Detected</b>
<b>2782-416-11-14</b> A1302462	Insulation	Heterogeneous Grey, Cream Fibrous Bound	30%	Fiberglass	10% 60%	Silicates Binder	<b>None Detected</b>
<b>2782-420-12-15</b> A1302463	Insulation	Heterogeneous Tan, Cream Fibrous Bound	15% 10%	Cellulose Talc	75%	Binder	<b>None Detected</b>
<b>2782-420-12-16</b> A1302464	Insulation	Heterogeneous White, Tan Fibrous Bound	30% 10%	Cellulose Fiberglass	50% 5%	Binder Metal Foil Mastic	<b>None Detected</b>



# ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

**Client:** Crystal Coast Environmental Inc.  
410 New Bridge Street, Ste.  
Jacksonville, NC 28540

**CEI Lab Code:** A12-5135

**Date Received:** 06-14-12

**Date Reported:** 06-14-12

**Project:** Frnch Creek, Camp Lejeune, NC; 12-2782

## ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS				ASBESTOS %
			Fibrous		Non-Fibrous		
<b>2782-500-13-17</b> A1302465	Mastic Coating	Heterogeneous	20%	Cellulose	50%	Binder	<b>None Detected</b>
		Tan,Green	10%	Fiberglass	10%	Metal Foil	
		Fibrous			10%	Mastic	
		Bound					
<b>2782-500-14-18</b> A1302466	Insulation	Heterogeneous	5%	Talc	90%	Foam	<b>None Detected</b>
		Pink,Beige			5%	Binder	
		Non-fibrous					
<b>2782-515-15-19</b> A1302467	Insulation	Homogeneous	15%	Fiberglass	10%	Silicates	<b>None Detected</b>
		Tan			50%	Binder	
		Fibrous			25%	Calc Carb	
		Loosely Bound					
<b>2782-515-15-20</b> A1302468	Insulation	Heterogeneous	15%	Fiberglass	10%	Silicates	<b>None Detected</b>
		Tan,Red			50%	Binder	
		Fibrous			25%	Calc Carb	
		Loosely Bound					
<b>2782-530-16-21</b> A1302469	Insulation	Heterogeneous			5%	Binder	<b>None Detected</b>
		Blue,Cream			95%	Foam	
		Non-fibrous					
<b>2782-530-17-22</b> A1302470	Insulation	Heterogeneous	10%	Cellulose	40%	Binder	<b>None Detected</b>
		Tan	20%	Fiberglass	10%	Silicates	
		Fibrous			20%	Calc Carb	
		Loosely Bound					
<b>2782-550-18-23</b> A1302471	Insulation	Heterogeneous	5%	Cellulose	40%	Binder	<b>None Detected</b>
		Off-white	25%	Fiberglass	10%	Silicates	
		Fibrous			20%	Calc Carb	
		Loosely Bound					
<b>2782-550-19-24</b> A1302472	Fire Stop Penetration Sealant	Heterogeneous	15%	Fiberglass	65%	Binder	<b>None Detected</b>
		Red,White			20%	Calc Carb	
		Fibrous					
		Tightly Bound					



# ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

**Client:** Crystal Coast Environmental Inc.  
410 New Bridge Street, Ste.  
Jacksonville, NC 28540

**CEI Lab Code:** A12-5135

**Date Received:** 06-14-12

**Date Reported:** 06-14-12

**Project:** Frnch Creek, Camp Lejeune, NC; 12-2782

## ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS				ASBESTOS %
			Fibrous		Non-Fibrous		
<b>2782-555-20</b> <b>-25</b> A1302473	Insulation	Heterogeneous	5%	Cellulose	50%	Binder	<b>None Detected</b>
		Off-white,Tan	15%	Fiberglass	10%	Silicates	
		Fibrous			20%	Calc Carb	
		Loosely Bound					
<b>2782-555-20</b> <b>-26</b> A1302474	Insulation	Heterogeneous	5%	Cellulose	50%	Binder	<b>None Detected</b>
		Off-white	15%	Fiberglass	10%	Silicates	
		Fibrous			20%	Calc Carb	
		Loosely Bound					
<b>2782-560-21</b> <b>-27</b> A1302475	Insulation	Heterogeneous	<1%	Fiberglass	90%	Foam	<b>None Detected</b>
		Blue,Off-white			5%	Silicates	
		Non-fibrous			5%	Binder	
		Bound					
<b>2782-560-21</b> <b>-28</b> A1302476	Insulation	Heterogeneous	<1%	Fiberglass	90%	Foam	<b>None Detected</b>
		Yellow,Off-white			5%	Silicates	
		Non-fibrous			5%	Binder	
		Bound					
<b>2782-565-22</b> <b>-29</b> A1302477	Insulation	Heterogeneous			90%	Foam	<b>None Detected</b>
		Yellow,Off-white			5%	Silicates	
		Non-fibrous			5%	Binder	
		Bound					
<b>2782-565-22</b> <b>-30</b> A1302478	Insulation	Heterogeneous			90%	Foam	<b>None Detected</b>
		Black,Off-white			5%	Silicates	
		Non-fibrous			5%	Binder	
		Bound					
<b>2782-565-23</b> <b>-31</b> A1302479	Mastic Coating	Heterogeneous	15%	Cellulose	15%	Metal Foil	<b>None Detected</b>
		White,Silver	10%	Fiberglass	10%	Mastic	
		Fibrous			50%	Binder	
		Bound					
<b>2782-565-23</b> <b>-32</b> A1302480	Mastic Coating	Heterogeneous	15%	Cellulose	15%	Metal Foil	<b>None Detected</b>
		White,Silver	10%	Fiberglass	10%	Mastic	
		Fibrous			50%	Binder	
		Bound					



# ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

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**Client:** Crystal Coast Environmental Inc.  
410 New Bridge Street, Ste.  
Jacksonville, NC 28540

**CEI Lab Code:** A12-5135

**Date Received:** 06-14-12

**Date Reported:** 06-14-12

**Project:** Frnch Creek, Camp Lejeune, NC; 12-2782

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## ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS		ASBESTOS %
			Fibrous	Non-Fibrous	



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**LEGEND:**      Non-Anth = Non-Asbestiform Anthophyllite  
                    Non-Trem = Non-Asbestiform Tremolite  
                    Calc Carb = Calcium Carbonate

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**METHOD:**    **EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020**

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The detection limit for the method is <1% by visual estimation and 0.25% by 400 point counts or 0.1% by 1,000 point counts.

Due to the limitations of the EPA 600 Method, nonfriable organically bound materials (NOBs) such as vinyl floor tiles can be difficult to analyze via polarizing light microscopy (PLM). EPA recommends that all NOBs analyzed by PLM, and found not to contain asbestos, be further analyzed by Transmission Electron Microscopy (TEM). Please note that PLM analysis of dust and soil samples for asbestos is not covered under NVLAP accreditation.

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**ANALYST:** Thomas Messina  
                    Thomas Messina

**APPROVED BY:** Tianbao Bai  
                                    Tianbao Bai, Ph.D.  
                                    Laboratory Director







107 New Edition Court, Cary, NC 27511  
 Tel: 866-481-1412; Fax: 919-481-1442

# CHAIN OF CUSTODY

<b>LAB USE ONLY:</b>
CEI Lab Code: <u>A12-5135 (2)</u>
CEI Lab I.D. Range: <u>A1302449- A1302480</u>

COMPANY CONTACT INFORMATION	
Company: <u>Crystal Coast Environmental</u>	Client #: <u>23935</u>
Address: <u>410 New Bridge St, Suite 4B</u> <u>Jacksonville, NC 28540</u>	Job Contact: <u>Mistry S. Mitchell</u> Email: <u>crystalcoast@cceinc.biz / mmitchell@cceinc.biz</u>
Project Name: <u>Frnch Creek, Camp Lejeune, NC</u>	Tel: <u>(910) 938-7998</u> Fax: <u>(910) 938-3441</u>
Project ID #: <u>12-2782</u>	P.O. #:

ASBESTOS	METHOD	TURN AROUND TIME						
		4 HR*	8 HR*	12 HR*	1 DAY	2 DAY	3 DAY	5 DAY
PLM BULK	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PLM POINT COUNT (400)	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PLM POINT COUNT (1000)	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PLM GRAVIMETRIC	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PLM GRAV w POINT COUNT	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PCM AIR	NIOSH 7400	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM AIR	AHERA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM AIR	EPA Level II	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM AIR	NIOSH 7402	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM BULK	CHATFIELD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM DUST WIPE	ASTM D6480-05	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM DUST MICROVAC	ASTM D5755-03	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM QUALITATIVE	CEI LABS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
OTHER:		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LEAD PAINT	METHOD	4 HR*	8 HR*	12 HR*	24 HR	2 DAY	3 DAY	5 DAY
LEAD PAINT	EPA SW846 7000B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LEAD WIPE	EPA SW846 7000B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LEAD SOIL	EPA SW846 7000B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LEAD AIR	NIOSH 7082	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
OTHER:		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

REMARKS: <u>32 Bulk Samples</u>		<input checked="" type="checkbox"/> Accept Samples
<u>32 Bulk Samples</u>		<input type="checkbox"/> Reject Samples
Relinquished By:	Date/Time	Received By:
<u>Ralph L. Elbert</u>	<u>6/12/2012</u>	<u>[Signature]</u>
		<u>6/14 @ 1000</u>

\*Call to confirm RUSH analysis.

Samples will be disposed of 30 days after analysis

# Results of Sample Analyses

12-2782

A12. 5135

HA No.	Material Type	ID	Location
1	T - Mastic Coating on Thermal Pipe Jacket Cover	2782-400-1-01	Mechanical Room
1	T - Mastic Coating on Thermal Pipe Jacket Cover	2782-400-1-02	Mechanical Room
2	T - Boiler Insulation	2782-411-2-03	Mechanical Room
3	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-411-3-04	Mechanical Room
4	T - Boiler Insulation	2782-412-4-05	Mechanical Room
5	T - Boiler Insulation	2782-412-5-06	Mechanical Room
6	T - Boiler Insulation	2782-413-6-07	Mechanical Room
7	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-413-7-08	Mechanical Room
8	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-414-8-09	Mechanical Room
8	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-414-8-10	Mechanical Room
9	T - Boiler Insulation	2782-415-9-11	Mechanical Room
10	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-415-10-12	Mechanical Room
11	T - Boiler Insulation	2782-416-11-13	Mechanical Room
11	T - Boiler Insulation	2782-416-11-14	Mechanical Room
12	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-420-12-15	Mechanical Room
12	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-420-12-16	Mechanical Room
13	T - Mastic Coating on Thermal Pipe Jacket Cover	2782-500-13-17	Mechanical Room
14	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-500-14-18	Mechanical Room
15	T - Boiler Insulation	2782-515-15-19	Mechanical Room
15	T - Boiler Insulation	2782-515-15-20	Mechanical Room
16	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-530-16-21	Mechanical Room
17	T - Boiler Insulation	2782-530-17-22	Mechanical Room
18	T - Boiler Insulation	2782-550-18-23	Mechanical Room
19	M - Fire Stop Penetration Sealant	2782-550-19-24	Mechanical Room
20	T - Boiler Insulation	2782-555-20-25	Mechanical Room
20	T - Boiler Insulation	2782-555-20-26	Mechanical Room
21	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-560-21-27	Mechanical Room
21	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-560-21-28	Mechanical Room
22	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-565-22-29	Mechanical Room
22	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-565-22-30	Mechanical Room
23	T - Mastic Coating on Thermal Pipe Jacket Cover	2782-572-23-31	Mechanical Room
23	T - Mastic Coating on Thermal Pipe Jacket Cover	2782-572-23-32	Mechanical Room



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## ASBESTOS LABORATORY REPORT

Prepared for

**Crystal Coast Environmental Inc.**

---

**PROJECT:** French Creek, Camp Lejeune, NC; 12-2782

**CEI LAB CODE:** A12-6058

**DATE REPORTED:** 07/12/12

**TOTAL SAMPLES ANALYZED:** 4

**# SAMPLES >1% ASBESTOS:**

**TEL: 866-481-1412**

*[www.ceilabs.com](http://www.ceilabs.com)*



# Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

**PROJECT:** French Creek, Camp Lejeune, NC; 12  
-2782

**CEI LAB CODE:** A12-6058

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**METHOD:** EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
2782-571-25-33		A1313727	White	Pipe Insulation	None Detected
2782-571-25-34		A1313728	White	Pipe Insulation	None Detected
2782-573-26-35		A1313729	Black,White	Pipe Insulation	None Detected
2783-573-26-36		A1313730	Black,White	Pipe Insulation	None Detected



# ASBESTOS BULK ANALYSIS

By: POLARIZING LIGHT MICROSCOPY

**Client:** Crystal Coast Environmental Inc.  
410 New Bridge Street, Ste.  
Jacksonville, NC 28540

**CEI Lab Code:** A12-6058

**Date Received:** 07-12-12

**Date Reported:** 07-12-12

**Project:** French Creek, Camp Lejeune, NC; 12-2782

## ASBESTOS BULK PLM, EPA 600 METHOD

Client ID Lab ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS				ASBESTOS %
			Fibrous		Non-Fibrous		
<b>2782-571-25 -33</b> A1313727	Pipe Insulation	Homogeneous	20%	Cellulose	50%	Calc Carb	<b>None Detected</b>
		White	5%	Fiberglass	20%	Binder	
		Fibrous			5%	Silicates	
		Loosely Bound					
<b>2782-571-25 -34</b> A1313728	Pipe Insulation	Homogeneous	20%	Cellulose	50%	Calc Carb	<b>None Detected</b>
		White	5%	Fiberglass	20%	Binder	
		Fibrous			5%	Silicates	
		Loosely Bound					
<b>2782-573-26 -35</b> A1313729	Pipe Insulation	Heterogeneous	<1%	Cellulose	75%	Foam	<b>None Detected</b>
		Black,White	<1%	Fiberglass	20%	Mastic	
		Non-fibrous			5%	Silicates	
		Bound					
<b>2783-573-26 -36</b> A1313730	Pipe Insulation	Heterogeneous	<1%	Cellulose	95%	Foam	<b>None Detected</b>
		Black,White	<1%	Fiberglass	5%	Mastic	
		Non-fibrous			<1%	Silicates	
		Bound					



---

**LEGEND:** Non-Anth = Non-Asbestiform Anthophyllite  
Non-Trem = Non-Asbestiform Tremolite  
Calc Carb = Calcium Carbonate

---

**METHOD:** EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

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The detection limit for the method is <1% by visual estimation and 0.25% by 400 point counts or 0.1% by 1,000 point counts.

Due to the limitations of the EPA 600 Method, nonfriable organically bound materials (NOBs) such as vinyl floor tiles can be difficult to analyze via polarizing light microscopy (PLM). EPA recommends that all NOBs analyzed by PLM, and found not to contain asbestos, be further analyzed by Transmission Electron Microscopy (TEM). Please note that PLM analysis of dust and soil samples for asbestos is not covered under NVLAP accreditation.

This report may not be reproduced, except in full, without written approval by CEI LABS. CEI LABS makes no warranty representation regarding the accuracy of client submitted information in preparing and presenting analytical results. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U. S. Government.

**ANALYST:** \_\_\_\_\_

A handwritten signature in black ink that reads "Susannah Small".

Susannah Small

**APPROVED BY:** \_\_\_\_\_

A handwritten signature in black ink that reads "Tianbao Bai".

Tianbao Bai, Ph.D.  
Laboratory Director





107 New Edition Court, Cary, NC 27511  
 Tel: 866-481-1412; Fax: 919-481-1442

# CHAIN OF CUSTODY

<b>LAB USE ONLY:</b>	
CEI Lab Code:	A12.6058 (4)
CEI Lab I.D. Range:	A1212722 - A1213720

COMPANY CONTACT INFORMATION	
Company: Crystal Coast Environmental	Client #: 23935
Address: 410 New Bridge St, Suite 4B Jacksonville, NC 28540	Job Contact: Mystery S. Mitchell Email: crystalcoast@cceinc.biz / mmitchell@cceinc.biz Tel: (910) 938-7998
Project Name: French Creek, Camp Lejeune, NC	Fax: (910) 938-3441
Project ID #: 12-2782	P.O. #:

ASBESTOS	METHOD	TURN AROUND TIME						
		4 HR*	8 HR*	12 HR*	1 DAY	2 DAY	3 DAY	5 DAY
PLM BULK	EPA 600	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PLM POINT COUNT (400)	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PLM POINT COUNT (1000)	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PLM GRAVIMETRIC	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PLM GRAV w POINT COUNT	EPA 600	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PCM AIR	NIOSH 7400	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM AIR	AHERA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM AIR	EPA Level II	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM AIR	NIOSH 7402	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM BULK	CHATFIELD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM DUST WIPE	ASTM D6480-05	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM DUST MICROVAC	ASTM D5755-03	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TEM QUALITATIVE	CEI LABS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
OTHER:		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LEAD PAINT	METHOD	4 HR*	8 HR*	12 HR*	24 HR	2 DAY	3 DAY	5 DAY
LEAD PAINT	EPA SW846 7000B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LEAD WIPE	EPA SW846 7000B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LEAD SOIL	EPA SW846 7000B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LEAD AIR	NIOSH 7082	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
OTHER:		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

REMARKS: 4 Bulk Samples		<input checked="" type="checkbox"/> Accept Samples	
4 Bulk Samples		<input type="checkbox"/> Reject Samples	
Relinquished By:	Date/Time	Received By:	Date/Time
<i>Rob L. Ellers</i>	7/7/2012	<i>Christa P. Smith</i>	JUL 12 2012 9:45AM

\* Call to confirm RUSH analysis. Samples will be disposed of 30 days after analysis

**Results of Sample Analyses**  
CP12-0121

A12.6058

HA No.	Material Type	ID	Location
25	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-571-25-33	Steam Pit
25	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-571-25-34	Steam Pit
26	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2782-573-26-35	Mechanical Room
26	T - Pipe Insulation - Fittings, Elbows, Mudded Joint Packing	2783-573-26-36	Mechanical Room



**CP 12-0121 Boiler Modifications, French Creek NC**



**HAs-1,13,23: Mastic Coating on Thermal Pipe Insulation**



**HAs-2,4,5,6,9,11,15,17,18,20: Tank Insulation**



**HAs-3,7,8,10,12,14,16,21,22: Mudded Elbows**

LIMITATIONS AND SERVICE CONSTRAINTS  
Asbestos Related Services

All professional opinions presented in this report are based on information made available to us either by review of data provided by others or data gathered by Crystal Coast Environmental (CCE) personnel.

CCE affirms that data gathered and presented by CCE in this report was collected in an appropriate manner in accordance with generally accepted methods and practices. CCE cannot be responsible for decisions made by our client solely on the basis of economic factors.

Conditions described in this report are as found at the time of investigation, unless otherwise stated. CCE analyzed only the substances, conditions and locations described in the report at the time indicated. No inferences regarding other substances, conditions, location or time can be made unless specifically stated in this report.

No recommendations were provided for materials containing less than one-percent asbestos. Materials containing less than one percent asbestos do not meet either the generally accepted industry definition of asbestos-containing material (any material containing greater than one percent asbestos) or the EPA definition of friable ACM (any material friable bulk insulation material contain greater than one percent asbestos by weight as analyzed by Polarized Light Microscopy). CCE, however, makes no statement, implied or explicit, about the hazards of materials containing less than one percent asbestos.

This report is intended for the use listed in the section of this report described as the Introduction. The use of this report in any manner other than that listed in the Introduction requires the written consent of CCE. This report must be presented in its entirety.



**Wiley Wilson**

**Limited Lead-Base**

**Paint Survey**

Buildings: FC400, FC411,  
FC412, FC413, FC414, FC415,  
FC416, FC500, FC515, FC530,  
FC550, FC555, FC560, FC565,  
FC571, and FC573  
MCB, Camp Lejeune, NC

July 11, 2012





Mr. Christopher D. Hardwood  
Wiley Wilson  
6606 West Broad Street, Suite 500  
Richmond, Virginia 23230  
chardwood@wileywilson.com

Subject:

Limited Lead-Based Paint (CP12-0121)  
Buildings FC400, FC411, FC412, FC413, FC414, FC415, FC416, FC500, FC515,  
FC530, FC550, FC555, FC560, FC565, FC571, and FC573  
MCB Camp Lejeune, North Carolina

Dear Mr. Hardwood:

Crystal Coast Environmental., Inc. (CCEI) conducted a limited lead-based paint determination of interior and exterior components that may be impacted during the renovation activities at the above-referenced buildings. The survey was conducted by Mr. Robert Elbertson on June 11 and July 7, 2012. The survey consisted solely of the activities described in this letter report and is subject to the attached Limitations and Service Constraints provided in Attachment F.

## **METHODOLOGY**

For OSHA due diligence purposes, CCEI investigated the building's interior and exterior in order to identify building components which are likely to be impacted by the construction activity and may be painted with suspected Lead Based Paint (LBP). The LBP inspection methodology followed guidelines for investigating dwellings as included in the US Department of Housing and Urban Development's *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* published in June 1995 (Chapter 7 updated in 1997). Generally, the inspection process includes visually inspecting the project for suspected LBP and testing these areas with an XRF Spectrum Analyzer.

The results of the limited lead-based paint survey are presented in the Appendices to this report as follows:

- Attachment B – XRF Lead Base Paint Results

Crystal Coast Environmental, Inc.  
410 New Bridge Street  
Suite 4-B  
Jacksonville, NC 28540  
Tel: 910.938.7998  
Fax: 910.938.3441  
[www.cceinc.biz](http://www.cceinc.biz)

ENVIRONMENTAL

Date: July 11, 2012

Contact:

Phillip Santiago

Phone:

910.938.7998

Email:

[pasantiago@cceinc.biz](mailto:pasantiago@cceinc.biz)

Our ref:

12-2782



Mr. Christopher D.  
Hardwood  
July 11, 2012

- Attachment C – XRF Performance Characteristics Sheet
- Attachment D – Photographs

## FINDINGS

Based on the results of the investigation, the following painted components were identified as LBP:

CCEI recommends that any contractor who would disturb any lead-based paint be notified of the hazard and their requirement to comply with the OSHA Lead in Construction Standard (29 CFR 1926.62).

CCEI recommends that any work that could disturb a known or suspect lead containing surface be conducted in a way to minimize and control dust and that the contractor performs a thorough clean up.

Waste characterization sampling and analysis should be performed for each representative waste stream. Waste stream analyses should include the total threshold limit concentration (TTLIC), soluble threshold limit concentration (STLC), and toxicity characteristic leaching procedure (TCLP) analysis, as required.

Should you have any questions in regards to the aforementioned or if CCEI can be of further assistance, please feel free to contact CCEI at (910) 938-7998.

Sincerely,  
Crystal Coast Environmental, Inc.

A handwritten signature in black ink that reads "Robert Elbertson".

---

Robert Elbertson

Lead Inspector

## Attachments

- A Certifications and Licenses
- B XRF Lead Base Paint Results
- C XRF Performance Characteristics Sheet

No	Type	Act	Component	Substrate	Side	Condition	Color	Room	Results	PbL	Floor	Site
1	Shutter	1			Cal				Neg	0.04		
2	Paint	1			Cal				Pos	1.2		
3	Paint	1			Cal				Pos	1		
4	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC400
5	Paint	1	BOILER	METAL	A	INTACT	GRAY	MECH	Neg	0.01	FIRST	FC400
6	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0.01	FIRST	FC411
7	Paint	1	BOILER	METAL	A	INTACT	GRAY	MECH	Neg	0	FIRST	FC411
8	Paint	1			Cal				Pos	1		
9	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC413
10	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC413
11	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC415
12	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC415
13	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC412
14	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0.01	FIRST	FC412
15	Paint	1			Cal				Neg	1		
16	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC414
17	Paint	1	TANK	METAL	A	INTACT	RED	MECH	Neg	0.01	FIRST	FC414
18	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC416
19	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0.01	FIRST	FC416
20	Paint	1	TANK	METAL	A	INTACT	RED	MECH	Neg	0.01	FIRST	FC420
21	Paint	1	TANK	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC420
22	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC550
23	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC550
24	Paint	1	TANK	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC560
25	Paint	1	TANK	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC560
26	Paint	1	TANK	METAL	A	INTACT	RED	MECH	Neg	0.01	FIRST	FC565
27	Paint	1	TANK	METAL	A	INTACT	RED	MECH	Neg	0.01	FIRST	FC565
28	Paint	1			Cal				Neg	1		
29	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC500
30	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC500
31	Paint	1	TANK	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC572
32	Paint	1	TANK	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC572
33	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC530
34	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC530
35	Paint	1			Cal				Negative	0.9		
36	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC571

37	Paint	1	TANK	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC571
38	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC573
39	Paint	1	RISER	METAL	A	INTACT	RED	MECH	Neg	0	FIRST	FC573



## Performance Characteristic Sheet

EFFECTIVE DATE: September 24, 2004

EDITION NO.: 1

### MANUFACTURER AND MODEL:

Make: Niton LLC

Tested Model: XLP 300

Source: <sup>109</sup> Cd

Note: This PCS is also applicable to the equivalent model variations indicated below, for the Lead-in-Paint K+L variable reading time mode, in the XLI and XLP series:

XLI 300A, XLI 301A, XLI 302A and XLI 303A.

XLP 300A, XLP 301A, XLP 302A and XLP 303A.

XLI 700A, XLI 701A, XLI 702A and XLI 703A.

XLP 700A, XLP 701A, XLP 702A, and XLP 703A.

Note: The XLI and XLP versions refer to the shape of the handle part of the instrument. The differences in the model numbers reflect other modes available, in addition to Lead-in-Paint modes. The manufacturer states that specifications for these instruments are identical for the source, detector, and detector electronics relative to the Lead-in-Paint mode.

## FIELD OPERATION GUIDANCE

### OPERATING PARAMETERS:

Lead-in-Paint K+L variable reading time mode.

### XRF CALIBRATION CHECK LIMITS:

0.8 to 1.2 mg/cm<sup>2</sup> (inclusive)

The calibration of the XRF instrument should be checked using the paint film nearest 1.0 mg/cm<sup>2</sup> in the NIST Standard Reference Material (SRM) used (e.g., for NIST SRM 2579, use the 1.02 mg/cm<sup>2</sup> film).

If readings are outside the acceptable calibration check range, follow the manufacturer's instructions to bring the instruments into control before XRF testing proceeds.

### SUBSTRATE CORRECTION:

For XRF results using Lead-in-Paint K+L variable reading time mode, substrate correction is not needed for:

Brick, Concrete, Drywall, Metal, Plaster, and Wood

### INCONCLUSIVE RANGE OR THRESHOLD:

K+L MODE READING DESCRIPTION	SUBSTRATE THRESHOLD (mg/cm <sup>2</sup> )	
Results not corrected for substrate bias on any substrate	Brick	1.0
	Concrete	1.0
	Drywall	1.0
	Metal	1.0
	Plaster	1.0
	Wood	1.0

## BACKGROUND INFORMATION

### EVALUATION DATA SOURCE AND DATE:

This sheet is supplemental information to be used in conjunction with Chapter 7 of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* ("HUD Guidelines"). Performance parameters shown on this sheet are calculated from the EPA/HUD evaluation using archived building components. Testing was conducted in August 2004 on 133 testing combinations. The instruments that were used to perform the testing had new sources; one instrument's was installed in November 2003 with 40 mCi initial strength, and the other's was installed June 2004 with 40 mCi initial strength.

### OPERATING PARAMETERS:

Performance parameters shown in this sheet are applicable only when properly operating the instrument using the manufacturer's instructions and procedures described in Chapter 7 of the HUD Guidelines.

### SUBSTRATE CORRECTION VALUE COMPUTATION:

Substrate correction is not needed for brick, concrete, drywall, metal, plaster or wood when using Lead-in-Paint K+L variable reading time mode, the normal operating mode for these instruments. If substrate correction is desired, refer to Chapter 7 of the HUD Guidelines for guidance on correcting XRF results for substrate bias.

### EVALUATING THE QUALITY OF XRF TESTING:

Randomly select ten testing combinations for retesting from each house or from two randomly selected units in multifamily housing. Use the K+L variable time mode readings.

Conduct XRF retesting at the ten testing combinations selected for retesting.

Determine if the XRF testing in the units or house passed or failed the test by applying the steps below.

Compute the Retest Tolerance Limit by the following steps:

Determine XRF results for the original and retest XRF readings. Do not correct the original or retest results for substrate bias. In single-family housing a result is defined as the average of three readings. In multifamily housing, a result is a single reading. Therefore, there will be ten original and ten retest XRF results for each house or for the two selected units.

Calculate the average of the original XRF result and retest XRF result for each testing combination.

Square the average for each testing combination.

Add the ten squared averages together. Call this quantity C.

Multiply the number C by 0.0072. Call this quantity D.

Add the number 0.032 to D. Call this quantity E.

Take the square root of E. Call this quantity F.

Multiply F by 1.645. The result is the Retest Tolerance Limit.

Compute the average of all ten original XRF results.

Compute the average of all ten re-test XRF results.

Find the absolute difference of the two averages.

If the difference is less than the Retest Tolerance Limit, the inspection has passed the retest. If the difference of the overall averages equals or exceeds the Retest Tolerance Limit, this procedure should be repeated with ten new testing combinations. If the difference of the overall averages is equal to or greater than the Retest Tolerance Limit a second time, then the inspection should be considered deficient.

Use of this procedure is estimated to produce a spurious result approximately 1% of the time. That is, results of this procedure will call for further examination when no examination is warranted in approximately 1 out of 100 dwelling units tested.

**TESTING TIMES:**

For the Lead-in-Paint K+L variable reading time mode, the instrument continues to read until it is moved away from the testing surface, terminated by the user, or the instrument software indicates the reading is complete. The following table provides testing time information for this testing mode. The times have been adjusted for source decay, normalized to the initial source strengths as noted above. Source strength and type of substrate will affect actual testing times. At the time of testing, the instruments had source strengths of 26.6 and 36.6 mCi.

Testing Times Using K+L Reading Mode (Seconds)						
Substrate	All Data			Median for laboratory-measured lead levels (mg/cm <sup>2</sup> )		
	25 <sup>th</sup> Percentile	Median 75	75 <sup>th</sup> Percentile	Pb < 0.25	0.25 ≤ Pb < 1.0	1.0 ≤ Pb
Wood Drywall	4	11 19 11	15 11			
Metal	4 12		18	9 12		14
Brick Concrete Plaster	8	16 22 15	18 16			

**CLASSIFICATION RESULTS:**

XRF results are classified as positive if they are greater than or equal to the threshold, and negative if they are less than the threshold.

**DOCUMENTATION:**

A document titled *Methodology for XRF Performance Characteristic Sheets* provides an explanation of the statistical methodology used to construct the data in the sheets, and provides empirical results from using the recommended inconclusive ranges or thresholds for specific XRF instruments. For a copy of this document call the National Lead Information Center Clearinghouse at 1-800-424-LEAD.

This XRF Performance Characteristic Sheet was developed by the Midwest Research Institute (MRI) and QuanTech, Inc., under a contract between MRI and the XRF manufacturer. HUD has determined that the information provided here is acceptable when used as guidance in conjunction with Chapter 7, Lead-Based Paint Inspection, of HUD's *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*.





Red in color interior Riser  
(Photo 01)



Red in color tank  
(Photo 02)



Gray in color Tank Boiler  
(Photo 03)



## **Limitations and Service Constraints**

The opinions, conclusions and recommendations presented in this report are limited to the information obtained during the performance of the specific scope of service identified in the report. To the extent that Crystal Coast Environmental, Inc. (CCEI) relied upon any information prepared by other parties not under direct contract to CCEI, no representation as to the accuracy or completeness of such information is made. This report is an instrument of professional service and the services described in the report were performed in accordance with generally accepted standards and level of skill and care ordinarily exercised by members of the profession working under similar conditions including comparable budgetary and schedule constraints. No warranty, guarantee or certification express or implied, is intended or given with respect to CCEI's services, opinions, conclusions or recommendations. This statement is in lieu of any other statement either expressed or implied.

CCEI's observations, the results of testing and CCEI's opinions, conclusions and recommendations apply solely to conditions existing at the specific times when and specific locations where CCEI's investigative work was performed. Observation and testing activities such as those conducted by CCEI are inherently limited and do not represent a conclusive or complete characterization. Conditions in other parts of the project site, building or area may vary from conditions at the specific locations where observations were made and where testing was performed by CCEI. Additionally, other building material hazards which were not identified by CCEI, may also be present in the indoor air, un-accessed areas and in walls, ceilings, cavities and floors. Therefore, the extent of CCEI's opinions, conclusions and recommendations are limited and 100% confidence in these opinions, conclusions and recommendations cannot reasonably be achieved. Nothing contained in this report shall relieve any other party of its responsibility to abide by contract documents and applicable laws, codes, regulations, or standards nor shall it be considered medical advice or consultation.

This report may document whether work conducted by CCEI or under CCEI's observation was done so in accordance with applicable regulatory standards. In the absence of standards such as is often the case for microbial assessment and abatement, this report may not be construed as providing clearance, approval, or authorization for use or re-occupancy of a given structure. Actual site conditions and quantities should be field verified and unless expressly stated.

This report is expressly for the sole and exclusive use of the party for whom this report was originally prepared for and for the particular purpose outlined in the report. Only the party for whom this report was originally prepared and/or other specifically named parties have the right to make use of and rely upon this report. Reuse of this report or any portion thereof for other than its intended purpose, or if modified, or if used by third parties, shall be at the user's sole risk.







REPORT OF SUBSURFACE INVESTIGATION AND  
GEOTECHNICAL ENGINEERING SERVICES

**Boiler Upgrades to Various Buildings – French Creek  
MCB Camp Lejeune, North Carolina**

**G E T PROJECT NO: JX12-106G  
July 9, 2012**

Prepared for

**Wiley Wilson**  
6606 West Broad Street, Suite 500  
Richmond, Virginia 23230

ATTN: Mr. Neil E. McSweeney, P.E.

Prepared by

**GET Solutions, Inc.**





July 9, 2012

TO: **Wiley Wilson**  
6606 West Broad Street, Suite 500  
Richmond, Virginia 23230

Attn: Mr. Neil E. McSweeney, P.E.

RE: Report of Subsurface Investigation and Geotechnical Engineering Services  
**Boiler Upgrades to Various Buildings – French Creek**  
MCB Camp Lejeune, North Carolina  
**G E T** Project No: JX12-106G

Dear Mr. McSweeney:

In compliance with your instructions, we have completed our Geotechnical Engineering Services for the referenced project. The results of this study, together with our recommendations, are presented in this report.

Often, because of design and construction details that occur on a project, questions arise concerning subsurface conditions. **G E T Solutions, Inc.** would be pleased to continue its role as Geotechnical Engineer during the project implementation.

Thank you for the opportunity to work with you on this project. We trust that the information contained herein meets your immediate need, and should you have any questions or if we could be of further assistance, please do not hesitate to contact us.

Respectfully Submitted,  
**G E T Solutions, Inc.**

Glenn W. Hohmeier, P.E.  
Senior Project Engineer  
NC Reg. # 033529



Camille A. Kattan, P.E.  
Principal Engineer  
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Copies: (1) Client



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## **1.0 PROJECT INFORMATION**

### **1.1 Project Authorization**

**GET Solutions, Inc.** has completed our Geotechnical Engineering study for the proposed Boiler Upgrades to Various Buildings – French Creek project located at MCB Camp Lejeune in North Carolina. The geotechnical engineering services were conducted in general accordance with **GET Solutions, Inc.** Proposal No. PJX12-105G. Authorization to proceed with the services was obtained in the form of an executed proposal from Mr. Neil E. McSweeney, P.E..

### **1.2 Project Location and Project Description**

The project site is located within the French Creek section of the Camp LeJeune military installation in North Carolina. The construction at this site is planned to consist of building seventeen (17) small boiler room structure additions (approximately 400 square feet in footprint area) adjacent (10 feet or more) to seventeen existing buildings within the French Creek area of Camp Lejeune. The proposed new buildings and boiler facilities will replace and tie into the existing buildings mechanical systems. The new buildings will be constructed of masonry walls and light gauge steel truss and roof members supported on a turn down slab shallow foundation system. The maximum wall loads associated with the addition are not expected to exceed 2 klf. Each of the project sites currently consists of an undeveloped grass covered area surrounded by existing structures, drive lanes and parking areas. It is our understanding that cut and/or fill operations are not expected to be less than about 2 feet in order to establish the design grade elevations.

If any of the noted information is incorrect or has changed, please inform **GET Solutions, Inc.** so that we may amend the recommendations presented in this report, if appropriate.

### **1.3 Purpose and Scope of Services**

The purpose of this study was to obtain information on the general subsurface conditions at the proposed project site. The subsurface conditions encountered were then evaluated with respect to the available project characteristics. In this regard, engineering assessments for the following items were formulated:

1. General assessment of the soils revealed by the borings performed at the proposed site.
2. General location and description of potentially deleterious material encountered in the borings that may interfere with construction progress or structure performance, including existing fills, expansive soils, or surficial/subsurface organics.

3. Soil subgrade preparation, including stripping, grading and compaction. Engineering criteria for placement and compaction of approved structural fill material.
4. Construction considerations for fill placement, subgrade preparation, and foundation excavations.
5. Feasibility of utilizing a shallow foundation system for support of the proposed additions. Design parameters required for the foundation system, including foundation size, allowable bearing pressure, foundation level and expected total and differential settlements.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic material in the soil, bedrock, surface water, groundwater or air, on or below or around this site. Prior to development of these sites, an environmental assessment is advisable.

## **2.0 FIELD AND LABORATORY PROCEDURES**

### **2.1 Field Exploration**

In order to explore the general subsurface soil types and to aid in developing associated foundation design parameters, one (1) 25-foot deep Standard Penetration Test (SPT) boring was drilled within the footprint of each of the seventeen proposed boiler room structures (designated as B-1 through B-17).

Standard Penetration Tests were performed in the field in general accordance with ASTM D 1586. The tests were performed continuously from the existing ground surface to a depth of 12 feet, and at 5-foot intervals thereafter. The soil samples were obtained with a standard 1.4" I.D., 2" O.D., 30" long split-spoon sampler. The sampler was driven with blows of a 140 lb. hammer falling 30 inches, using an automatic hammer. The number of blows required to drive the sampler each 6-inch increment of penetration was recorded and is shown on the boring logs. The sum of the second and third penetration increments is termed the SPT N-value (uncorrected for automatic hammer). A representative portion of each disturbed split-spoon sample was collected with each SPT, placed in a glass jar, sealed, labeled, and returned to our laboratory for review.

The boring locations were identified and staked in the field by a representative of **GET Solutions, Inc.** The approximate boring locations are shown on the attached "Boring Location Plan" (Appendix I).

The boring schedule noting the SPT boring depths and locations are presented in the table on the following page (Table I – Boring Schedule).



**Table I – Boring Schedule**

Boring Number	Boring Depth (feet)	Boring Location
B-1	25	SPT boring adjacent to the southeastern corner of existing Building FC 400
B-2	25	SPT boring adjacent to the northeastern corner of existing Building FC 411
B-3	25	SPT boring adjacent to the northeastern corner of existing Building FC 413
B-4	25	SPT boring adjacent to the southwestern corner of existing Building FC 414
B-5	25	SPT boring adjacent to the southwestern corner of existing Building FC 412
B-6	25	SPT boring adjacent to the northeastern corner of existing Building FC 415
B-7	25	SPT boring adjacent to the southeastern corner of existing Building FC 420
B-8	25	SPT boring adjacent to the southwestern corner of existing Building FC 416
B-9	25	SPT boring adjacent to the north central portion of existing Building FC 515
B-10	25	SPT boring adjacent to the west central portion of existing Building FC 573
B-11	25	SPT boring adjacent to the west central portion of existing Building FC 571
B-12	25	SPT boring adjacent to the east central portion of existing Building FC 566
B-13	25	SPT boring adjacent to the north central portion of existing Building FC 556
B-14	25	SPT boring adjacent to the north central portion of existing Building FC 561
B-15	25	SPT boring adjacent to the east central portion of existing Building FC 500A
B-16	25	SPT boring adjacent to the west central portion of existing Building FC 531
B-17	25	SPT boring adjacent to the west central portion of existing Building FC 551

## 2.2 Laboratory Testing

Representative portions of all soil samples collected during drilling were sealed in glass jars, labeled and transferred to our laboratory for classification and analysis. The soil classification was performed by a Geotechnical Engineer in accordance with ASTM D 2488. A summary of the soil classification system is provided in Appendix IV.

Eleven (11) representative soil samples were selected and subjected to laboratory testing, which included natural moisture, Atterberg limits and -#200 sieve wash testing and analysis, in order to corroborate the visual classification. These test results are provided in Table II on the following page and are presented on the “Boring Log” sheets (Appendix II), included with this report.

**Table II - Laboratory Test Results**

Boring No.	Depth (Feet)	Natural Moisture (%)	% Passing #200	Atterberg Limits (LL/PL/PI)	USCS Classification
B-1	2-4	10.1	15.1	Non-Plastic	SM
B-1	4-6	5.4	4.1	Non-Plastic	SP
B-1	18-20	32.9	32.0	Not Tested	SC
B-2	13-15	27.8	27.4	27/16/11	SC
B-3	13-15	46.1	41.5	58/20/38	SC
B-3	18-20	65.9	77.2	99/28/71	CH
B-6	2-4	11.1	19.3	Non-Plastic	SM
B-6	13-15	46.5	48.4	Not Tested	SC
B-6	23-25	46.7	53.4	53/15/38	CH
B-11	13-15	21.2	8.3	Non-Plastic	SP-SM
B-13	8-10	22.4	4.4	Non-Plastic	SP

### **3.0 SUBSURFACE CONDITIONS**

#### **3.1 Site Geology**

The project site lies within a major physiographic province called the Atlantic Coastal Plain. Numerous transgressions and regressions of the Atlantic Ocean have deposited marine, lagoonal, and fluvial (stream lain) sediments. The regional geology is very complex, and generally consists of interbedded layers of varying mixtures of sands, silts and clays. Based on our review of existing geologic and soil boring data, the geologic stratigraphy encountered in our subsurface explorations generally consisted of marine deposited sands and silts.

#### **3.2 Subsurface Soil Conditions**

The results of our field exploration indicated the presence of approximately 1 to 4 inches of topsoil material at the boring locations. In addition, approximately 2 feet of “Fill” material was encountered beneath the topsoil material at boring location B-7 (adjacent to Building FC 420). The fill material consisted of SAND (SP-SM) with varying amounts of Silt, Gravel and Organic materials. The fill material appears to have been previously placed as part of prior construction activities associated with the existing Building FC 420 facilities located within the project area. The topsoil material thicknesses are expected to vary throughout each of the proposed building pad areas. The Fill material thicknesses are also expected to vary throughout the proposed boiler building footprint in the vicinity of boring B-7 (adjacent to Building FC 420), and may possibly be present at other locations within the proposed

construction areas. Underlying the topsoil and fill materials the remaining subsurface soils recovered at the boring locations were generally noted to be arranged in a two-layer configuration.

The initial soil layer underlying the topsoil and fill materials at the boring locations and extending to depths ranging from 13 to 25 feet below the existing site grades was noted to be primarily granular in nature consisting of SAND (SP-SM, SM, SC) with varying amounts of silt, clay and marine shell fragments. The N-values recorded within these granular soils ranged from WOH to 31 blows-per-foot (BPF) indicating a very loose to dense relative density.

The final soil layer ranged from approximate depths of 23 to 25 feet (boring termination depth) below existing site grades was noted to consist of fat CLAY (CH) with varying amounts of sand. The Standard Penetration Test (SPT) results, N-values, recorded within this soil layer ranged from Weight of Hammer (WOH) to 3 blows-per-foot (BPF) indicating a very soft to soft consistency. As an exception, this soil stratum was not encountered at boring B-8, B-10, and B-15 locations. In addition, a loose to medium dense granular soil layer was encountered beneath this CLAY stratum at the location of borings B-4 and B-5.

The subsurface description is of a generalized nature provided to highlight the major soil strata encountered. The records of the subsurface exploration are included on the “Boring Log” sheets (Appendix II) and in the “Generalized Soil Profile” (Appendix III), which should be reviewed for specific information as to the individual borings. The stratifications shown on the records of the subsurface exploration represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the transition may be gradual or occur between sample intervals. It is noted that the topsoil designation references the presence of surficial organic laden soil, and does not represent any particular quality specification. This material is to be tested for approval prior to use.

### **3.3 Groundwater Information**

The groundwater level was recorded at the boring locations and as observed through the wetness of the recovered soil samples during the drilling operations. The initial groundwater table was measured to occur at depths ranging from 5.75 to 8.75 feet below the existing site grades at the boring locations. The variation in groundwater depths are anticipated to have been contributed by the variations in existing site grade elevations and the associated distance between boring locations. The boreholes were backfilled upon completion for safety considerations. As such, the reported groundwater levels may not be indicative of the static groundwater level.

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences, such as existing swales, drainage ponds, underdrains and areas of covered soil (paved parking lots, sidewalks, etc.). Seasonal groundwater fluctuations of  $\pm 2$  feet or more are common in the project's area; however, greater fluctuations have been documented. We recommend that the contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on the construction procedures.

#### **4.0 EVALUATIONS AND RECOMMENDATIONS**

Our recommendations are based on the previously discussed project information, our interpretation of the soil test borings and our observations during our site reconnaissance. If the proposed construction should vary from what was described, we request the opportunity to review our recommendations and make any necessary changes.

##### **4.1 Clearing and Grading**

The proposed construction areas should be cleared by means of removing the topsoil and any other unsuitable material. It is estimated that a cut of 4 to 6 inches in depth will be required to remove the topsoil material. These cuts should be expected to extend deeper in isolated areas to remove deeper deposits of organic soils, debris, Fill or other unsuitable soils, which become evident during the clearing. It is recommended that the clearing operations extend laterally at least 5 feet beyond the perimeter of the proposed construction areas.

Following the initial clearing, the resulting exposed subgrade will generally be comprised of SAND (SP-SM, SM) and Fill SAND (SP-SM boring B-7 only) with trace Gravel and Organics. Combinations of excess surface moisture from precipitation ponding on the site and the construction traffic, including heavy compaction equipment, may create pumping and general deterioration of the bearing capabilities of the surface soils. Therefore, undercutting to remove very loose soils may be required. The extent of the undercut will be determined in the field during construction, based on the outcome of the field testing procedures (subgrade proofroll).

Due to the primarily granular consistency of the encountered Fill materials at boring B-7, it is anticipated that these materials will be suitable to remain in place within the building area at this boring location provided that substantial amounts of organics or other unsuitable materials are not present. This should be substantiated in the field during the subgrade preparation procedures by means of compaction testing, subgrade proofrolls and test pit excavations as further described in Section 4.2.

Grading should be performed during a dry season if at all possible. This should minimize these potential problems, although they may not be eliminated. Control of surface water is very important to the successful completion of the proposed construction. The contractor should plan his grading activities to control surface water and minimize erosion of exposed cut or fill material. This may include constructing temporary berms, ditches, flumes and/or slope drains to intercept runoff and discharge it in a controlled fashion, while complying with state and local regulations.

#### **4.2 Subgrade Preparation**

Following the clearing operation, the exposed subgrade soils should be densified with a large static drum or sheepsfoot roller. After the subgrade soils have been densified, they should be evaluated by **GET Solutions, Inc.** for stability. Accordingly, the subgrade soils should be proofrolled to check for pockets of soft material hidden beneath a crust of better soil. Several passes should be made by a large rubber-tired roller or loaded dump truck over the construction areas, with the successive passes aligned perpendicularly. The number of passes will be determined in the field by the Geotechnical Engineer depending on the soils conditions. Again, any pumping and unstable areas observed during proofrolling (beyond the initial clearing cut) should be undercut and/or stabilized at the directions of the Geotechnical Engineer.

Following the proofroll operations, it is recommended that a series of test pit excavations and compaction testing be performed within the vicinity of boring B-7 in order to further evaluate the FILL soils to substantiate the suitability of these materials to remain in-place. The depths and locations of the test pit excavations should be determined in the field by **GET Solutions, Inc.**

The prepared subgrade should be sloped to prevent the accumulation and/or ponding of surface water. If the exposed subgrade becomes wet or frozen, the geotechnical engineer should be consulted.

#### **4.3 Structural Fill and Placement**

Following the proper compaction and approval of the natural subgrade soils by the Geotechnical Engineer, the placement of the fill required to establish the design grades may begin. Any material to be used for backfill or structural fill should be evaluated and tested by **GET Solutions, Inc.** prior to placement to determine if they are suitable for the intended use. Suitable structural fill material should consist of sand or gravel containing less than 20 percent by weight of fines (SP, SP-SM, SM, SW, SW-SM, GP, GP-GM, GW, GW-GM), having a liquid limit less than 20 and plastic limit less than 6, and should be free of rubble, organics, clay, debris and other unsuitable material.

All structural fill should be compacted to a dry density of at least 95 percent of the Modified Proctor maximum dry density (ASTM D1557). In general, the compaction should be accomplished by placing the fill in maximum 10-inch loose lifts and mechanically compacting each lift to at least the specified minimum dry density. A representative of **GET Solutions, Inc.** should perform field density tests on each lift as necessary to assure that adequate compaction is achieved.

Backfill material in utility trenches within the construction areas should be compacted to at least 95 percent of ASTM D1557. This fill should be placed in 4 to 6 inch loose lifts when hand compaction equipment is used.

#### **4.4 Suitability of On-site Soils**

Based on the laboratory testing program, the shallow subsurface SAND (SP-SM, SM) soils encountered at the boring locations appear to meet the criteria recommended in this report for reuse as structural fill. Further classification testing (natural moisture content, gradation analysis, and Proctor testing) should be performed in the field during construction to evaluate the suitability of excavated soils for reuse as fill and backfill within the building and utility areas. Additionally, stockpiling and allowing these soils to air dry may be required in order to obtain moisture content suitable for compaction procedures. Any on-site excavated soils with appreciable amounts of organics should not be reused as structural fill but may be used as fill within green areas.

#### **4.5 Shallow Foundation Design Recommendations**

Provided that the construction procedures are properly performed, the proposed structure can be supported by a monolithic slab with turn-down edges or conventional shallow footings bearing upon firm natural soil, well compacted structural fill material or in-situ fill material (vicinity of boring B-7 only) pending the recommended testing procedures (as discussed in Section 4.2) and acceptance by the Geotechnical Engineer. Depending on the outcome of the field testing procedures some foundation undercut may be required to penetrate fill materials (please see Section 4.6 for further information concerning the foundation undercut). The footings or turn down edges can be designed using a net allowable soil pressure of 2,000 pounds per square foot (psf). In using net pressures, the weight of the footings and backfill over the footings, including the weight of the floor slab, need not be considered. Hence, only loads applied at or above the finished floor need to be used for dimensioning the footings.

In order to develop the recommended bearing capacity of 2,000 pounds per square foot (psf), the base of the footings should have an embedment of at least 18 inches beneath finished grades and wall footings should have a minimum width of 18 inches. The recommended 18-inch footing embedment is considered sufficient to provide adequate cover against frost penetration to the bearing soils.

#### **4.6 Settlements**

It is estimated that, with proper site preparation, the maximum resulting post construction total settlement of the proposed foundations should be up to 1 inch. The maximum differential settlement magnitude is expected to be less than ½ -inch between adjacent footings (wall footings and column footings of widely varying loading conditions). The settlements were estimated on the basis of the results of the SPT borings. Careful field control will contribute substantially towards minimizing the settlements.

#### **4.7 Foundation Excavations**

In preparation for shallow foundation support, the foundation excavations should extend into firm natural soil or well compacted select fill. The in-situ fill material may remain in place if approved by the Geotechnical Engineer (to be determined following the completion of the test pit and compaction testing). All foundation excavations should be observed by **GET Solutions, Inc.** At that time, the Geotechnical Engineer should also explore the extent of excessively loose, soft, or otherwise unsuitable material within the exposed excavations. Also, at the time of foundation observations, the Geotechnical Engineer may find it necessary to perform hand auger borings or use a hand penetration device in the bases of the foundation excavations. The necessary depth of penetration will be established during the subgrade observations.

If unsuitable soils requiring undercut are encountered in the foundation excavations, the proposed footing elevation should be re-established by backfilling after the unsuitable material has been removed. This backfilling may be done with very lean concrete, No. 57 stone or with a well-compacted, suitable select fill such as sand (as described in Section 4.3 of this report).

Immediately prior to foundation concrete placement, it is suggested that the bearing surfaces of all foundations be compacted using hand operated mechanical tampers. In this manner, any localized areas, which have been loosened by excavation operations, should be adequately recompacted. The compaction testing in the base of the foundation may be waived by the Geotechnical Engineer, where firm bearing soils are observed during the foundation inspections.

Soils exposed in the bases of all satisfactory foundation excavations should be protected against any detrimental change in condition such as from physical disturbance, rain or frost.

Surface run-off water should be drained away from the excavations and not be allowed to pond. If possible, all foundation concrete should be placed the same day the excavation is made. If this is not possible, the foundation excavations should be adequately protected.

#### 4.8 Slab-on-Grade Design

The floor slab may be constructed as a slab-on-grade member provided the previously recommended earthwork activities and evaluations are carried out properly. It is recommended that all ground floor slabs be directly supported by at least a 4-inch layer of relatively clean, compacted, poorly graded sand (SP) or gravel (GP) with less than 5% passing the No. 200 Sieve (0.074 mm). The purpose of the 4-inch layer is to act as a capillary barrier and equalize moisture conditions beneath the slab. The slabs can be designed with the use of a subgrade modulus on the order of about 125 psi/in for compacted structural fill.

It is also recommended that the floor slab bearing soils be covered by a vapor barrier or retarder in order to minimize the potential for floor dampness, which can affect the performance of glued tile and carpet. Generally, use a vapor retarder for minimal vapor resistance protection below the slab-on-grade. When floor finishes, site conditions or other considerations require greater vapor resistance protection; consideration should be given to using a vapor barrier. Selection of a vapor retarder or barrier should be made by the architect based on project requirements.

#### 4.9 Design Soil Parameters for Below Grade Structures

The estimated soil parameters for below grade structures are presented below (Table III).

**Table III - Estimated Soil Parameters**

Soil Type	SAND (SM, SP, SP-SM, SC)	CLAY (CH)
Average SPT N-value	10	1
Total Moist Unit Weight (pcf)	120	110
Friction Angle ( $\phi$ ) degrees	32	5
Cohesion (c) pcf	0	800
Active Soil Pressure Ka	0.31	0.84
At-Rest Soil Pressure Ko	0.47	0.91
Passive Soil Pressure Kp	3.25	1.19
Friction Factor	0.39	0.06



#### **4.10 Seismic Evaluation**

It is noted that, in accordance with the NC Building Code; Chapter 16, this site is classified as a site Class D, based on which seismic designs should be incorporated. This recommendation is based on the data obtained from the 25-foot deep SPT borings, our experience with 100-foot deep CPT soundings and SPT borings performed within the vicinity of the project site, as well as the requirements indicated in the North Carolina State Building Code (2009 International Building Code).

### **5.0 CONSTRUCTION CONSIDERATIONS**

#### **5.1 Drainage and Groundwater Concerns**

It is expected that dewatering may be required for excavations that extend near or below the existing groundwater table. Dewatering above the groundwater level could probably be accomplished by pumping from sumps. Dewatering at depths below the groundwater level will require well pointing.

It would be advantageous to construct all fills early in the construction. If this is not accomplished, disturbance of the existing site drainage could result in collection of surface water in some areas, thus rendering these areas wet and very loose. Temporary drainage ditches should be employed by the contractor to accentuate drainage during construction. Again, we recommend that the contractor determine the actual groundwater levels at the time of construction to determine groundwater impact on this project.

#### **5.2 Site Utility Installation**

The base of the utility trenches should be observed by a qualified inspector prior to the pipe and structure placement to verify the suitability of the bearing soils.

It is expected that excavations within the SAND (SM, SP and SP-SM) soils will experience varying degrees of cave-in as a result of the soils composition (relatively clean Sands). A combination of dewatering and shoring should be implemented to reduce the potential cave-ins. In addition, depending on the depth of the utility trench excavation, some means of dewatering may be required to facilitate the utility installation and associated backfilling. The resulting excavations should be backfilled with structural fill, as described in Section 4.3 of this report.

### **5.3 Excavations**

In Federal Register, Volume 54, No. 209 (October, 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its “Construction Standards for Excavations, 29 CFR, part 1926, Subpart P”. This document was issued to better insure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new (OSHA) guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor’s responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor’s safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. **GET Solutions, Inc.** is not assuming responsibility for construction site safety or the contractor’s activities; such responsibility is not being implied and should not be inferred.

### **6.0 REPORT LIMITATIONS**

The recommendations submitted are based on the available soil information obtained by **GET Solutions, Inc.** and the information supplied by the client for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, **GET Solutions, Inc.** should be notified immediately to determine if changes in the foundation recommendations are required. If **GET Solutions, Inc.** is not retained to perform these functions, **GET Solutions, Inc.** can not be responsible for the impact of those conditions on the geotechnical recommendations for the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

**Boiler Upgrades to Various Buildings – French Creek**

MCB Camp Lejeune, North Carolina

**GET** Project No: JX12-106G

After the plans and specifications are more complete the Geotechnical Engineer should be provided the opportunity to review the final design plans and specifications to assure our engineering recommendations have been properly incorporated into the design documents, in order that the earthwork and foundation recommendations may be properly interpreted and implemented. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of Wiley Wilson and their consultants for the specific application to the Boiler Upgrades to Various Buildings – French Creek project in MCB Camp Lejeune, North Carolina.



## **APPENDICES**

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- I BORING LOCATION PLAN**
- II BORING LOGS**
- III GENERALIZED SOIL PROFILE**
- IV SUMMARY OF SOIL CLASSIFICATION**

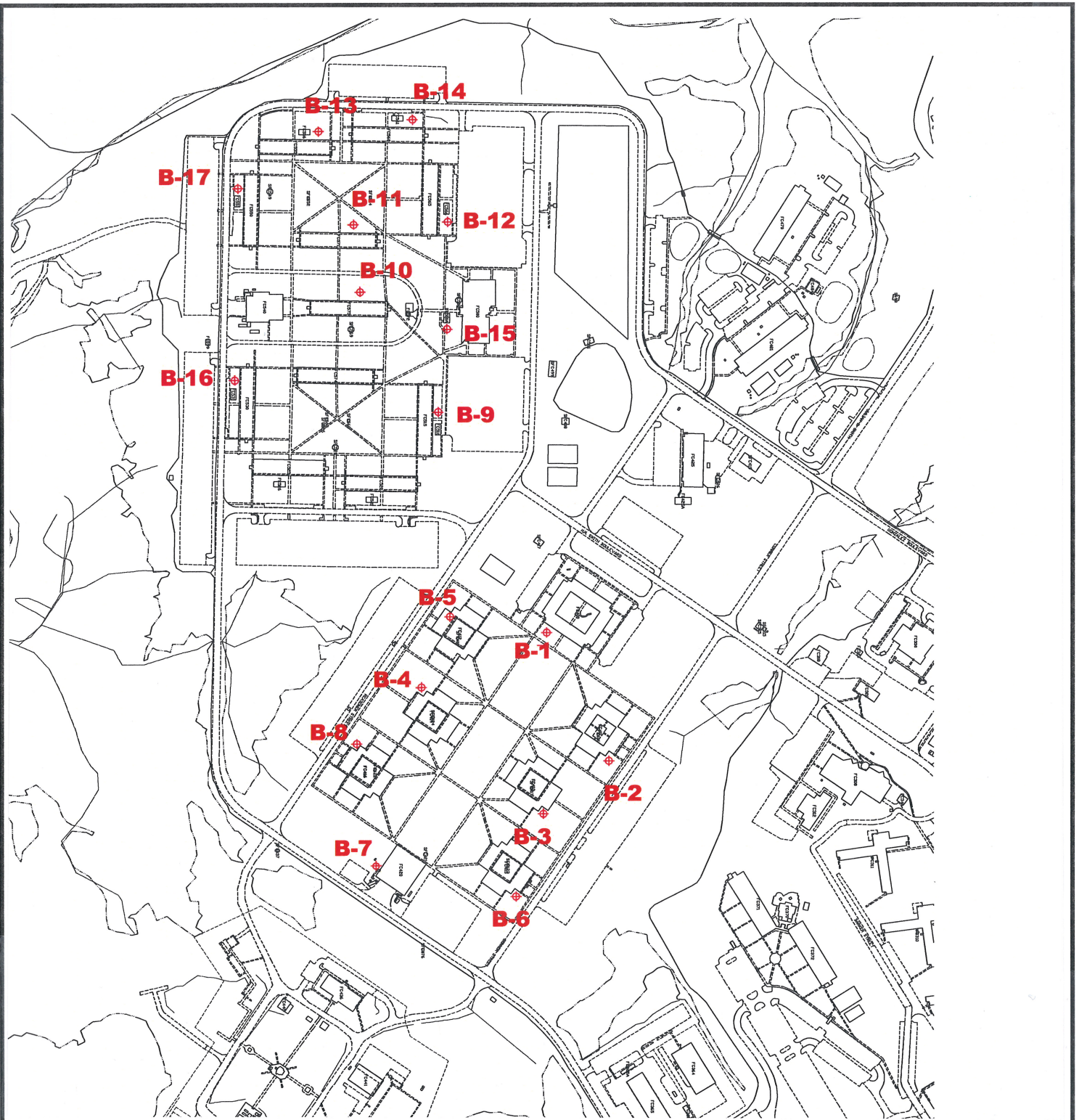


**APPENDIX I**

**BORING LOCATION PLAN**







**BORING LOCATION PLAN**

**PROJECT:** Boiler Upgrades to Various Buildings – French Creek **SCALE:** As Drawn  
**MCB Camp Lejeune, North Carolina**

**DATE:** 7/6/2012

**PROJECT NO:** JX12-106G  
**CLIENT:** Wiley Wilson

**PLOT BY:** GH



**APPENDIX II**  
**BORING LOGS**







# BORING LOG B-2

**PROJECT:** French Creek Boiler Upgrades  
**CLIENT:** Wiley Wilson  
**PROJECT LOCATION:** Camp Lejeune, NC  
**BORING LOCATION:** See attached Boring Location Plan  
**DRILLER:** Mid-Atlantic Drilling  
**DRILLING METHOD:** Rotary Wash Mud Drilling  
**DEPTH TO WATER - INITIAL\*:** 6.75 **AFTER 24 HOURS:** 6.75  
**PROJECT NO.:** JX12-106G  
**SURFACE ELEVATION:**  
**LOGGED BY:** gwh  
**DATE:** 5-17-12  
**CAVING:** C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevation (MSL) (ft)	Depth (meters)	Depth (feet)	Description	Graphic	Sample No.	Sample Recovery	Sample Type	Blows per 6"	N-Value	% < #200	TEST RESULTS	
											Plastic Limit	Liquid Limit
0	0	0	2 inches of Topsoil									
		0.17	Brown and yellowish brown, moist, Silty fine to medium SAND (SM), Loose		1		ss	5 5 4 4	9			
					2		ss	3 4 4 4	8			
	5	4	Tan and yellowish brown, moist, Silty fine to medium SAND (SM), Loose		3		ss	5 5 4 4	9			
	2	6	Grayish tan, moist to wet, Poorly Graded fine to medium SAND (SP) with trace Silt, Loose to Medium Dense		4		ss	2 2 3 4	5			
	10	10	Yellowish brown and tan, wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense		5		ss	3 4 7 7	11			
	4	13	Gray, orangish brown and tan, wet, Clayey fine to medium SAND (SC), Medium Dense		6		ss	3 5 7 9	12			
	15	18	Gray, wet, Fat CLAY (CH) with little Sand, Very Soft to Soft		7		ss	5 7 12 12	19	27.4		
	6	20			8		ss	WOH WOH WOH WOH				
	25	25	Boring terminated at 25 ft.		9		ss	1 2 1 2	3			

**Notes:**

\*The initial groundwater reading may not be indicative of the static groundwater level.

SS = Split Spoon Sample  
 ST = Shelby Tube Sample  
 HA = Hand Auger Sample  
 BS = Bulk Sample  
 WOH = Weight of Hammer





# BORING LOG B-4

**PROJECT:** French Creek Boiler Upgrades  
**CLIENT:** Wiley Wilson  
**PROJECT LOCATION:** Camp Lejeune, NC  
**BORING LOCATION:** See attached Boring Location Plan  
**DRILLER:** Mid-Atlantic Drilling  
**DRILLING METHOD:** Rotary Wash Mud Drilling  
**DEPTH TO WATER - INITIAL\*:**  $\nabla$  6.5 **AFTER 24 HOURS:**  $\nabla$   
**PROJECT NO.:** JX12-106G  
**SURFACE ELEVATION:**  
**LOGGED BY:** gwh  
**DATE:** 5-17-12  
**CAVING**  $\rightarrow$  C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevation (MSL) (ft)	Depth (meters)	Depth (feet)	Description	Graphic	Sample No.	Sample Recovery	Sample Type	Blows per 6"	N-Value	% < #200	TEST RESULTS	
											Plastic Limit	Liquid Limit
0	0	0	2 inches of Topsoil					5				
		0.17	Brown, moist, Silty fine to medium SAND (SM), Medium Dense		1		ss	9	20			
		2	Brown and tan, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense		2		ss	8	18			
		4	Whitish tan and brown, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose		3		ss	7	19			
	5	5	Grayish tan, wet, Poorly Graded fine to medium SAND (SP) with trace Silt, Very Loose to Medium Dense		4		ss	9	22			
	2	6			5		ss	11	2			
		10	Orangish brown and gray, wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Very Loose		6		ss	1	4			
		10			6		ss	2	4			
		13	Gray, wet, Silty fine to medium SAND (SM) with trace Clay, Very Loose		7		ss	1				
	15	15			7		ss	WOH				
		18	Gray, wet, Fat CLAY (CH) with little Sand, Very Soft		8		ss	WOH				
	6	20			8		ss	WOH				
		23	Gray, wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense		9		ss	4	19			
		25	Boring terminated at 25 ft.					9				
	8	25						10				
		30						12				
	10	35										

**Notes:**

\*The initial groundwater reading may not be indicative of the static groundwater level.

SS = Split Spoon Sample  
 ST = Shelby Tube Sample  
 HA = Hand Auger Sample  
 BS = Bulk Sample  
 WOH = Weight of Hammer





# BORING LOG B-5

**PROJECT:** French Creek Boiler Upgrades  
**CLIENT:** Wiley Wilson  
**PROJECT LOCATION:** Camp Lejeune, NC  
**BORING LOCATION:** See attached Boring Location Plan  
**DRILLER:** Mid-Atlantic Drilling  
**DRILLING METHOD:** Rotary Wash Mud Drilling  
**DEPTH TO WATER - INITIAL\*:**  $\nabla$  5.75 **AFTER 24 HOURS:**  $\nabla$   
**PROJECT NO.:** JX12-106G  
**SURFACE ELEVATION:**  
**LOGGED BY:** gwh  
**DATE:** 5-17-12  
**CAVING** > C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevation (MSL) (ft)	Depth (meters)	Depth (feet)	Description	Graphic	Sample No.	Sample Recovery	Sample Type	Blows per 6"	N-Value	% < #200	TEST RESULTS	
											Plastic Limit	Liquid Limit
0	0	0	2 inches of Topsoil					3	11			
		0.17	Brown and tan, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense		1		ss	5				
		2	Tan, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose		2		ss	4	9			
		4	Whitish tan and tan, moist to wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose		3		ss	5	9			
	5	5						4				
		6	Grayish tan, wet, Poorly Graded fine to medium SAND (SP) with trace Silt, Very Loose to Medium Dense		4		ss	5	21			
	2	6						8				
		10						13				
		13	Gray, wet, Silty fine to medium SAND (SM) with trace Clay, Very Loose		5		ss	3	6			
		15						3				
		18	Grayish brown, wet, Fat CLAY (CH) with little Sand, Very Soft		6		ss	3	3			
	4	18						4				
		20						1				
		23	Gray, wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose		7		ss	2	9			
	6	20						4				
		25	Boring terminated at 25 ft.		8		ss	4				
	8	25						5				
		30						7				
		35										
	10											

**Notes:**

SS = Split Spoon Sample  
 ST = Shelby Tube Sample  
 HA = Hand Auger Sample  
 BS = Bulk Sample  
 WOH = Weight of Hammer

\*The initial groundwater reading may not be indicative of the static groundwater level.



# BORING LOG B-6

PROJECT: French Creek Boiler Upgrades

CLIENT: Wiley Wilson

PROJECT LOCATION: Camp Lejeune, NC

PROJECT NO.: JX12-106G

BORING LOCATION: See attached Boring Location Plan

SURFACE ELEVATION: \_\_\_\_\_

DRILLER: Mid-Atlantic Drilling

LOGGED BY: gwh

DRILLING METHOD: Rotary Wash Mud Drilling

DATE: 5-17-12

DEPTH TO WATER - INITIAL\*: 5.75 AFTER 24 HOURS: \_\_\_\_\_

CAVING> C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevation (MSL) (ft)	Depth (meters)	Depth (feet)	Description	Graphic	Sample No.	Sample Recovery	Sample Type	Blows per 6"	N-Value	% < #200	TEST RESULTS	
											Plastic Limit	Liquid Limit
0	0	0	3 inches of Topsoil					5				
		0.25	Yellowish brown and brown, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose		1		ss	6	9			
		2	Orangish brown and brown, moist, Silty fine to medium SAND (SM), Loose		2		ss	2	6	19.3		
		4	Whitish tan, moist to wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose		3		ss	3	9			
	5	4						4				
		5						4				
	2	5						4				
		8	Grayish tan, wet, Poorly Graded fine to medium SAND (SP) with trace Silt, Very Loose to Medium Dense		4		ss	4	10			
		8						6				
		10	Orangish brown, wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense		5		ss	8	16			
		10						8				
		10						8				
		10						10				
		13	Gray, wet, Clayey fine to medium SAND (SC) with trace Marine Shell Fragments, Very Loose		6		ss	6	15			
		13						7				
		15						8				
		15						8				
		15						8				
		18	Gray, wet, Silty fine to medium SAND (SM) with trace Marine Shell Fragments, Very Loose		7		ss	1	48.4			
		18						WOH				
		18						WOH				
		18						WOH				
		18						WOH				
		23	Brownish gray, wet, Fat CLAY (CH) with some Sand, Very Soft		8		ss	1				
		23						WOH				
		23						WOH				
		23						1				
		25	Boring terminated at 25 ft.		9		ss	2	53.4			
		25						1				
		25						2				
	8	25										
		30										
		30										
	10	30										
		35										
		35										

**Notes:**

\*The initial groundwater reading may not be indicative of the static groundwater level.

SS = Split Spoon Sample  
 ST = Shelby Tube Sample  
 HA = Hand Auger Sample  
 BS = Bulk Sample  
 WOH = Weight of Hammer



# BORING LOG B-7

**PROJECT:** French Creek Boiler Upgrades  
**CLIENT:** Wiley Wilson  
**PROJECT LOCATION:** Camp Lejeune, NC  
**BORING LOCATION:** See attached Boring Location Plan  
**DRILLER:** Mid-Atlantic Drilling  
**DRILLING METHOD:** Rotary Wash Mud Drilling  
**DEPTH TO WATER - INITIAL\*:**  $\nabla$  7.5 **AFTER 24 HOURS:**  $\nabla$   
**PROJECT NO.:** JX12-106G  
**SURFACE ELEVATION:**  
**LOGGED BY:** gwh  
**DATE:** 5-17-12  
**CAVING**  $\rightarrow$  C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevation (MSL) (ft)	Depth (meters)	Depth (feet)	Description	Graphic	Sample No.	Sample Recovery	Sample Type	Blows per 6"	N-Value	% < #200	TEST RESULTS	
											Plastic Limit	Liquid Limit
0	0	0	2 inches of Topsoil									
		0.17	Brown and tan, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Gravel and Organics, (FILL), Loose		1		ss	5 3 3	6			
		2	Brown and tan, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Very Loose		2		ss	1 2 2	4			
	5				3		ss	1 2 2 3	4			
	2	6	Tan, moist to wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Very Loose		4		ss	1 2 1	3			
		8	Grayish tan, wet, Poorly Graded fine to medium SAND (SP) with trace Silt, Loose		5		ss	2 3 3 4	6			
	10				6		ss	3 2 3 2	5			
	4				7		ss	3 3 5 5	8			
	15				8		ss	4 5 5 6	10			
	6	20			9		ss	2 1 WOH WOH	1			
		23	Gray, wet, Fat CLAY (CH) with little Sand, Very Soft									
		25	Boring terminated at 25 ft.									
	8											
		30										
	10											
		35										

**Notes:**

\*The initial groundwater reading may not be indicative of the static groundwater level.

SS = Split Spoon Sample  
 ST = Shelby Tube Sample  
 HA = Hand Auger Sample  
 BS = Bulk Sample  
 WOH = Weight of Hammer



# BORING LOG B-8

**PROJECT:** French Creek Boiler Upgrades  
**CLIENT:** Wiley Wilson  
**PROJECT LOCATION:** Camp Lejeune, NC  
**BORING LOCATION:** See attached Boring Location Plan  
**DRILLER:** Mid-Atlantic Drilling  
**DRILLING METHOD:** Rotary Wash Mud Drilling  
**DEPTH TO WATER - INITIAL\*:**  $\nabla$  6.0 **AFTER 24 HOURS:**  $\nabla$   
**PROJECT NO.:** JX12-106G  
**SURFACE ELEVATION:** \_\_\_\_\_  
**LOGGED BY:** gwh  
**DATE:** 5-17-12  
**CAVING**  $\rightarrow$  C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevation (MSL) (ft)	Depth (meters)	Depth (feet)	Description	Graphic	Sample No.	Sample Recovery	Sample Type	Blows per 6"	N-Value	% < #200	TEST RESULTS	
											Plastic Limit	Liquid Limit
0	0	0	2 inches of Topsoil					2				
		0.17	Tan and brown, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose		1		ss	3	8			
		2	Yellowish tan, moist to wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Very Loose to Medium Dense		2		ss	2	4			
	5				3		ss	3	6			
	2				4		ss	4	10			
					5		ss	3	9			
	10				6		ss	6	12			
	4				7		ss	6	15			
	15		Orangish brown, wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense		7		ss	6				
					8		ss	9				
	6				9		ss	10	19			
	20		Gray, wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense		8		ss	10				
					9		ss	8	22			
	25							10				
	25		Boring terminated at 25 ft.					12				
	8							15				
	30											
	10											
	35											

**Notes:**

\*The initial groundwater reading may not be indicative of the static groundwater level.

SS = Split Spoon Sample  
 ST = Shelby Tube Sample  
 HA = Hand Auger Sample  
 BS = Bulk Sample  
 WOH = Weight of Hammer



# BORING LOG B-9

PROJECT: French Creek Boiler Upgrades

CLIENT: Wiley Wilson

PROJECT LOCATION: Camp Lejeune, NC

PROJECT NO.: JX12-106G

BORING LOCATION: See attached Boring Location Plan

SURFACE ELEVATION: \_\_\_\_\_

DRILLER: Mid-Atlantic Drilling

LOGGED BY: gwh

DRILLING METHOD: Rotary Wash Mud Drilling

DATE: 5-17-12

DEPTH TO WATER - INITIAL\*: 8.0 AFTER 24 HOURS: 8.0

CAVING: C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevation (MSL) (ft)	Depth (meters)	Depth (feet)	Description	Graphic	Sample No.	Sample Recovery	Sample Type	Blows per 6"	N-Value	% < #200	TEST RESULTS	
											Plastic Limit	Liquid Limit
0	0	0	3 inches of Topsoil					2				
		0.25	Brown and yellowish brown, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense		1		ss	8	16			
		2	Orangish brown and yellowish brown, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose		2		ss	4	8			
		4	Whitish tan, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Very Loose to Loose		3		ss	5	10			
	2	5	Grayish tan, wet, Poorly Graded fine to medium SAND (SP) with trace Silt, Very Loose to Medium Dense		4		ss	2	4			
		8			5		ss	3	6			
	4	10			6		ss	1	4			
		15			7		ss	2	4			
	6	20			8		ss	4	15			
		23										
	8	25	Brownish gray, wet, Fat CLAY (CH) with some Sand, Very Soft		9		ss	2	2			
			Boring terminated at 25 ft.									
		30										
	10	35										

**Notes:**

\*The initial groundwater reading may not be indicative of the static groundwater level.

SS = Split Spoon Sample  
 ST = Shelby Tube Sample  
 HA = Hand Auger Sample  
 BS = Bulk Sample  
 WOH = Weight of Hammer



# BORING LOG B-10

**PROJECT:** French Creek Boiler Upgrades  
**CLIENT:** Wiley Wilson  
**PROJECT LOCATION:** Camp Lejeune, NC  
**BORING LOCATION:** See attached Boring Location Plan  
**DRILLER:** Mid-Atlantic Drilling  
**DRILLING METHOD:** Rotary Wash Mud Drilling  
**DEPTH TO WATER - INITIAL\*:** 6.75 **AFTER 24 HOURS:**   
**PROJECT NO.:** JX12-106G  
**SURFACE ELEVATION:**   
**LOGGED BY:** gwh  
**DATE:** 5-21-12  
**CAVING:** C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevation (MSL) (ft)	Depth (meters)	Depth (feet)	Description	Graphic	Sample No.	Sample Recovery	Sample Type	Blows per 6"	N-Value	% < #200	TEST RESULTS	
											Plastic Limit	Liquid Limit
0	0	0	1 inch of Topsoil					3	13			
		0.08	Brown and tan, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense		1		ss	5 8 8				
		2	Whitish tan, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense		2		ss	8 10 10 11	20			
	5	4	Tan, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense		3		ss	5 6 6 7	12			
	2	6	Grayish tan and yellowish tan, moist to wet, Poorly Graded fine to medium SAND (SP) with trace Silt, Medium Dense		4		ss	6 5 6 7	11			
		8	Grayish tan, wet, Poorly Graded fine to medium SAND (SP) with trace Silt, Loose		5		ss	3 4 5 3	9			
	10				6		ss	2 2 5 7	7			
	4	13	Gray, wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense to Dense		7		ss	3 5 7 11	12			
	15											
	6	20			8		ss	7 15 21 30	36			
	25											
	8	25	Boring terminated at 25 ft.		9		ss	8 12 17 17	29			
	30											
	10	35										

**Notes:**

SS = Split Spoon Sample  
 ST = Shelby Tube Sample  
 HA = Hand Auger Sample  
 BS = Bulk Sample  
 WOH = Weight of Hammer

\*The initial groundwater reading may not be indicative of the static groundwater level.



# BORING LOG B-11

**PROJECT:** French Creek Boiler Upgrades  
**CLIENT:** Wiley Wilson  
**PROJECT LOCATION:** Camp Lejeune, NC  
**BORING LOCATION:** See attached Boring Location Plan  
**DRILLER:** Mid-Atlantic Drilling  
**DRILLING METHOD:** Rotary Wash Mud Drilling  
**DEPTH TO WATER - INITIAL\*:**  $\nabla$  6.75 **AFTER 24 HOURS:**  $\nabla$   
**PROJECT NO.:** JX12-106G  
**SURFACE ELEVATION:**  
**LOGGED BY:** gwh  
**DATE:** 5-21-12  
**CAVING**  $\rightarrow$  C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevation (MSL) (ft)	Depth (meters)	Depth (feet)	Description	Graphic	Sample No.	Sample Recovery	Sample Type	Blows per 6"	N-Value	% < #200	TEST RESULTS	
											Plastic Limit	Liquid Limit
0	0	0	1 inch of Topsoil					3				
		0.08	Brown, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose to Medium Dense		1		SS	4	9			
					2		SS	5	13			
	5				3		SS	3	12			
		6	Tan, moist to wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense		4		SS	5	19			
	2				5		SS	6	13			
		8	Grayish tan, wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose		6		SS	3	9			
	10				7		SS	4	12	8.3	●	
	4				8		SS	1	2			
		15			9		SS	1	2			
		18	Gray, wet, Fat CLAY (CH) with little Sand, Very Soft					1				
	6	20						1				
		25	Boring terminated at 25 ft.					1				
	8							1				
		30						1				
	10							1				
		35						1				

**Notes:**

\*The initial groundwater reading may not be indicative of the static groundwater level.

SS = Split Spoon Sample  
 ST = Shelby Tube Sample  
 HA = Hand Auger Sample  
 BS = Bulk Sample  
 WOH = Weight of Hammer



# BORING LOG B-12

**PROJECT:** French Creek Boiler Upgrades  
**CLIENT:** Wiley Wilson  
**PROJECT LOCATION:** Camp Lejeune, NC  
**BORING LOCATION:** See attached Boring Location Plan  
**DRILLER:** Mid-Atlantic Drilling  
**DRILLING METHOD:** Rotary Wash Mud Drilling  
**DEPTH TO WATER - INITIAL\*:**  $\nabla$  6.75 **AFTER 24 HOURS:**  $\nabla$   
**PROJECT NO.:** JX12-106G  
**SURFACE ELEVATION:**  
**LOGGED BY:** gwh  
**DATE:** 5-18-12  
**CAVING:**  $\subset$

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevation (MSL) (ft)	Depth (meters)	Depth (feet)	Description	Graphic	Sample No.	Sample Recovery	Sample Type	Blows per 6"	N-Value	% < #200	TEST RESULTS		
											Plastic Limit	Liquid Limit	
0	0	0	2 inches of Topsoil										
		0.17	Brown, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose to Medium Dense		1		SS	4 5 6	11				
					2		SS	3 4 5 8	9				
	5				3		SS	12 11 10 10	21				
	2	$\nabla$	Brown and tan, moist to wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense		4		SS	8 6 8 7	14				
					5		SS	4 6 6 7	12				
		10	Grayish tan, wet, Poorly Graded fine to medium SAND (SP) with trace Silt, Loose		6		SS	2 4 2 5	6				
	4				7		SS	2 3 3 4	6				
		15	Gray, wet, Silty fine to medium SAND (SM) with trace Clay, Very Loose		8		SS	WOH WOH WOH WOH					
	6	20			9		SS	1 WOH 1 1	1				
		23	Brownish gray, wet, Fat CLAY (CH) with some Sand, Very Soft										
		25											
	8		Boring terminated at 25 ft.										
		30											
	10												
		35											

**Notes:**

SS = Split Spoon Sample  
 ST = Shelby Tube Sample  
 HA = Hand Auger Sample  
 BS = Bulk Sample  
 WOH = Weight of Hammer

\*The initial groundwater reading may not be indicative of the static groundwater level.





# BORING LOG B-13

**PROJECT:** French Creek Boiler Upgrades  
**CLIENT:** Wiley Wilson  
**PROJECT LOCATION:** Camp Lejeune, NC  
**BORING LOCATION:** See attached Boring Location Plan  
**DRILLER:** Mid-Atlantic Drilling  
**DRILLING METHOD:** Rotary Wash Mud Drilling  
**DEPTH TO WATER - INITIAL\*:** 6.75 **AFTER 24 HOURS:** 6.75  
**PROJECT NO.:** JX12-106G  
**SURFACE ELEVATION:**  
**LOGGED BY:** gwh  
**DATE:** 5-18-12  
**CAVING:** C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevation (MSL) (ft)	Depth (meters)	Depth (feet)	Description	Graphic	Sample No.	Sample Recovery	Sample Type	Blows per 6"	N-Value	% < #200	TEST RESULTS	
											Plastic Limit	Liquid Limit
0	0	0	2 inches of Topsoil					4				
		0.17	Tan, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose		1		ss	4 4 6 6	10			
		2	Brown, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose		2		ss	5 3 3 4	6			
	5	4	Yellowish brown, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose		3		ss	2 3 2 3	5			
	2	6	Yellowish brown, moist to wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose		4		ss	2 3 4 6	7			
		8	Grayish tan, wet, Poorly Graded fine to medium SAND (SP) with trace Silt, Loose		5		ss	7 10 15 17	25	4.4		
	10				6		ss	4 7 9 9	16			
	4	13	Gray, wet, Fat CLAY (CH) with little Sand and trace Marine Shell Fragments, Very Soft		7		ss	1 1 WOH 1	1			
	15				8		ss	WOH WOH WOH WOH				
	6	20										
		23	Slightly mottled gray-orangish brown, wet, Fat CLAY (CH) with little Sand, Very Soft		9		ss	1 1 1 1	2			
	25		Boring terminated at 25 ft.									
	8											
		30										
	10											
		35										

**Notes:**

SS = Split Spoon Sample  
 ST = Shelby Tube Sample  
 HA = Hand Auger Sample  
 BS = Bulk Sample  
 WOH = Weight of Hammer

\*The initial groundwater reading may not be indicative of the static groundwater level.



# BORING LOG B-14

PROJECT: French Creek Boiler Upgrades

CLIENT: Wiley Wilson

PROJECT LOCATION: Camp Lejeune, NC

PROJECT NO.: JX12-106G

BORING LOCATION: See attached Boring Location Plan

SURFACE ELEVATION: \_\_\_\_\_

DRILLER: Mid-Atlantic Drilling

LOGGED BY: gwh

DRILLING METHOD: Rotary Wash Mud Drilling

DATE: 5-18-12

DEPTH TO WATER - INITIAL\*: 6.25 AFTER 24 HOURS: \_\_\_\_\_

CAVING> C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevation (MSL) (ft)	Depth (meters)	Depth (feet)	Description	Graphic	Sample No.	Sample Recovery	Sample Type	Blows per 6"	N-Value	% < #200	TEST RESULTS	
											Plastic Limit	Liquid Limit
0	0	0	2 inches of Topsoil					3				
		0.17	Brown, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense		1		ss	6 9 10	15			
		2	Tan, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Dense		2		ss	13 15 16 13	31			
	5	4	Brown, moist to wet, Silty fine to medium SAND (SM), Very Loose to Medium Dense		3		ss	9 8 6 7	14			
	2				4		ss	2 1 1 2	2			
		8	Grayish tan, wet, Poorly Graded fine to medium SAND (SP) with trace Silt, Loose		5		ss	1 1 1 5	2			
	10				6		ss	3 7 7 11	14			
	4	13	Gray, wet, Silty fine to medium SAND (SM), Very Loose		7		ss	2 1 1 1	2			
	15				8		ss	WOH 1 1	1			
	6	20	Gray, wet, Clayey fine to medium SAND (SC), Very Loose		8		ss	WOH 1 1	1			
		23	Brownish gray, wet, Fat CLAY (CH) with some Sand, Very Soft		9		ss	WOH 1 1	1			
	25		Boring terminated at 25 ft.									
	8											
		30										
	10											
		35										

**Notes:**

SS = Split Spoon Sample  
 ST = Shelby Tube Sample  
 HA = Hand Auger Sample  
 BS = Bulk Sample  
 WOH = Weight of Hammer

\*The initial groundwater reading may not be indicative of the static groundwater level.



# BORING LOG B-15

**PROJECT:** French Creek Boiler Upgrades  
**CLIENT:** Wiley Wilson  
**PROJECT LOCATION:** Camp Lejeune, NC  
**BORING LOCATION:** See attached Boring Location Plan  
**DRILLER:** Mid-Atlantic Drilling  
**DRILLING METHOD:** Rotary Wash Mud Drilling  
**DEPTH TO WATER - INITIAL\*:**  $\nabla$  8 **AFTER 24 HOURS:**  $\nabla$   
**PROJECT NO.:** JX12-106G  
**SURFACE ELEVATION:**  
**LOGGED BY:** gwh  
**DATE:** 5-17-12  
**CAVING**  $\hookrightarrow$  C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevation (MSL) (ft)	Depth (meters)	Depth (feet)	Description	Graphic	Sample No.	Sample Recovery	Sample Type	Blows per 6"	N-Value	% < #200	TEST RESULTS	
											Plastic Limit	Liquid Limit
0	0	0	4 inches of Topsoil					2				
		0.33	Tan and brown, moist, Silty fine to medium SAND (SM), Loose		1		ss	4	6			
					2		ss	5	10			
		4	Tan and orangish brown, moist, Silty fine to medium SAND (SM), Loose		3		ss	4	8			
	5				4		ss	4	8			
	2		Whitish tan, moist to wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose to Medium Dense		5		ss	5	17			
		6			6		ss	8	22			
		10						9				
		15						12				
	4				7		ss	8	18			
		18						10				
		18	Orangish brown, wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose		8		ss	4	8			
	6	20						4				
		23						4				
		23	Grayish tan and orangish brown, wet, Poorly Graded fine to medium SAND (SP- SM) with trace Silt, Medium Dense		9		ss	5	13			
		25						8				
	8		Boring terminated at 25 ft.					5				
		30						9				
	10											
		35										

**Notes:**

SS = Split Spoon Sample  
 ST = Shelby Tube Sample  
 HA = Hand Auger Sample  
 BS = Bulk Sample  
 WOH = Weight of Hammer

\*The initial groundwater reading may not be indicative of the static groundwater level.



# BORING LOG B-16

**PROJECT:** French Creek Boiler Upgrades  
**CLIENT:** Wiley Wilson  
**PROJECT LOCATION:** Camp Lejeune, NC  
**BORING LOCATION:** See attached Boring Location Plan  
**DRILLER:** Mid-Atlantic Drilling  
**DRILLING METHOD:** Rotary Wash Mud Drilling  
**DEPTH TO WATER - INITIAL\*:**  $\nabla$  5.75 **AFTER 24 HOURS:**  $\nabla$   
**PROJECT NO.:** JX12-106G  
**SURFACE ELEVATION:**  
**LOGGED BY:** gwh  
**DATE:** 5-18-12  
**CAVING**  $\rightarrow$  C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevation (MSL) (ft)	Depth (meters)	Depth (feet)	Description	Graphic	Sample No.	Sample Recovery	Sample Type	Blows per 6"	N-Value	% < #200	TEST RESULTS	
											Plastic Limit	Liquid Limit
0	0	0	2 inches of Topsoil									
		0.17	Orangish brown and tan, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose to Medium Dense	[Pattern]	1		SS	3 6 7 7	13			
					2		SS	3 3 3 4	6			
	5	4	Whitish tan and brown, moist to wet, Poorly Graded fine to medium SAND (SP-SM), Loose to Medium Dense	[Pattern]	3		SS	3 3 3 3	6			
	2				4		SS	4 4 6 6	10			
					5		SS	7 5 7 7	12			
	10	10	Light gray and brown, wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense	[Pattern]	6		SS	4 6 6 7	12			
	4	13	Light gray, wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Medium Dense	[Pattern]	7		SS	5 7 10 10	17			
	15											
	6	20	Dark grayish brown, wet, Fat CLAY (CH) with little Sand, Very Soft	[Pattern]	8		SS	WOH WOH WOH WOH				
					9		SS	WOH WOH WOH WOH				
	25		Boring terminated at 25 ft.									
	8											
		30										
	10											
		35										

**Notes:**

\*The initial groundwater reading may not be indicative of the static groundwater level.

SS = Split Spoon Sample  
 ST = Shelby Tube Sample  
 HA = Hand Auger Sample  
 BS = Bulk Sample  
 WOH = Weight of Hammer



# BORING LOG B-17

**PROJECT:** French Creek Boiler Upgrades  
**CLIENT:** Wiley Wilson  
**PROJECT LOCATION:** Camp Lejeune, NC  
**BORING LOCATION:** See attached Boring Location Plan  
**DRILLER:** Mid-Atlantic Drilling  
**DRILLING METHOD:** Rotary Wash Mud Drilling  
**DEPTH TO WATER - INITIAL\*:**  $\nabla$  7.5 **AFTER 24 HOURS:**  $\nabla$   
**PROJECT NO.:** JX12-106G  
**SURFACE ELEVATION:**  
**LOGGED BY:** gwh  
**DATE:** 5-18-12  
**CAVING:** C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Elevation (MSL) (ft)	Depth (meters)	Depth (feet)	Description	Graphic	Sample No.	Sample Recovery	Sample Type	Blows per 6"	N-Value	% < #200	TEST RESULTS	
											Plastic Limit	Liquid Limit
0	0	0	2 inches of Topsoil					4	13			
			Tan and brown, moist, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose to Medium Dense		1		ss	5 8 9				
					2		ss	9 9 8 11	17			
	5				3		ss	4 4 3 6	7			
	2		Whitish tan, moist to wet, Poorly Graded fine to medium SAND (SP-SM), Medium Dense		4		ss	4 5 8 10	13			
					5		ss	5 7 7 8	14			
	10		Light gray, wet, Poorly Graded fine to medium SAND (SP-SM) with trace Silt, Loose		6		ss	3 4 6 6	10			
	4		Gray, wet, Clayey fine to medium SAND (SC) with trace Marine Shell Fragments, Very Loose		7		ss	WOH WOH WOH WOH				
	15											
	6		Dark grayish brown, wet, Fat CLAY (CH) with little Sand, Very Soft		8		ss	WOH 1 1 1	2			
	20											
					9		ss	WOH WOH WOH WOH				
	25		Boring terminated at 25 ft.									
	8											
	30											
	10											
	35											

**Notes:**

SS = Split Spoon Sample  
 ST = Shelby Tube Sample  
 HA = Hand Auger Sample  
 BS = Bulk Sample  
 WOH = Weight of Hammer

\*The initial groundwater reading may not be indicative of the static groundwater level.

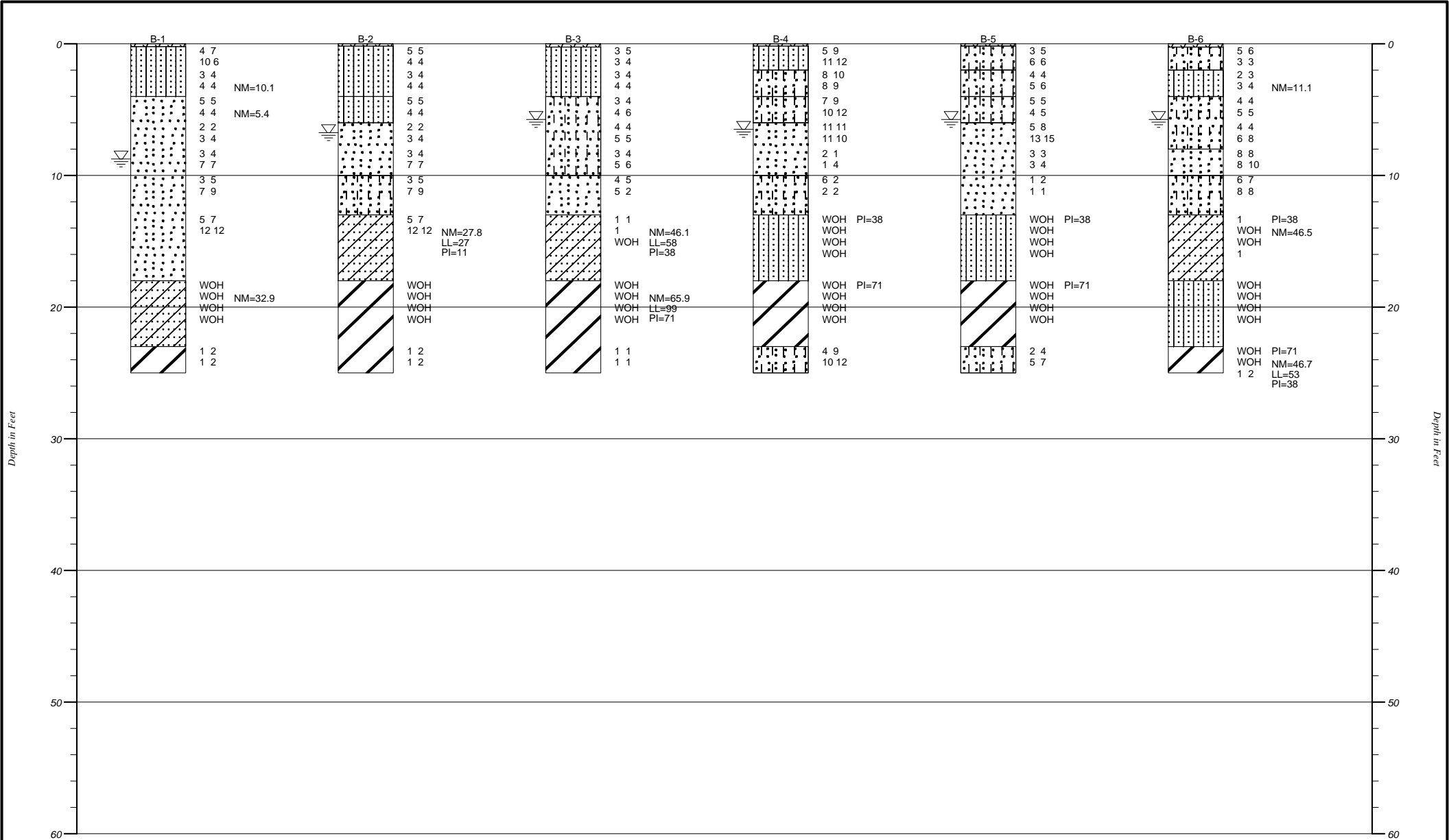


**APPENDIX III**

GENERALIZED SOIL PROFILE

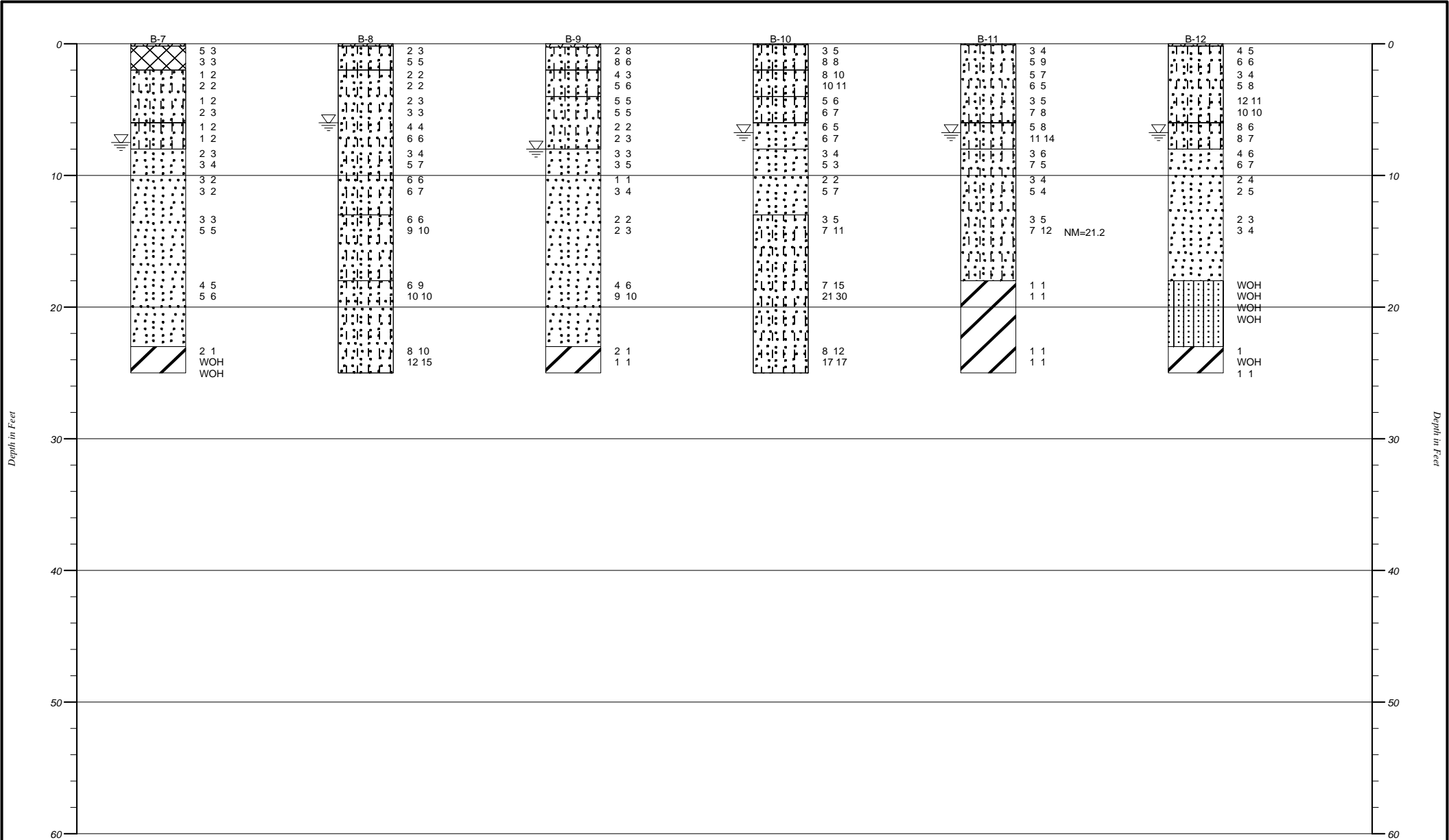






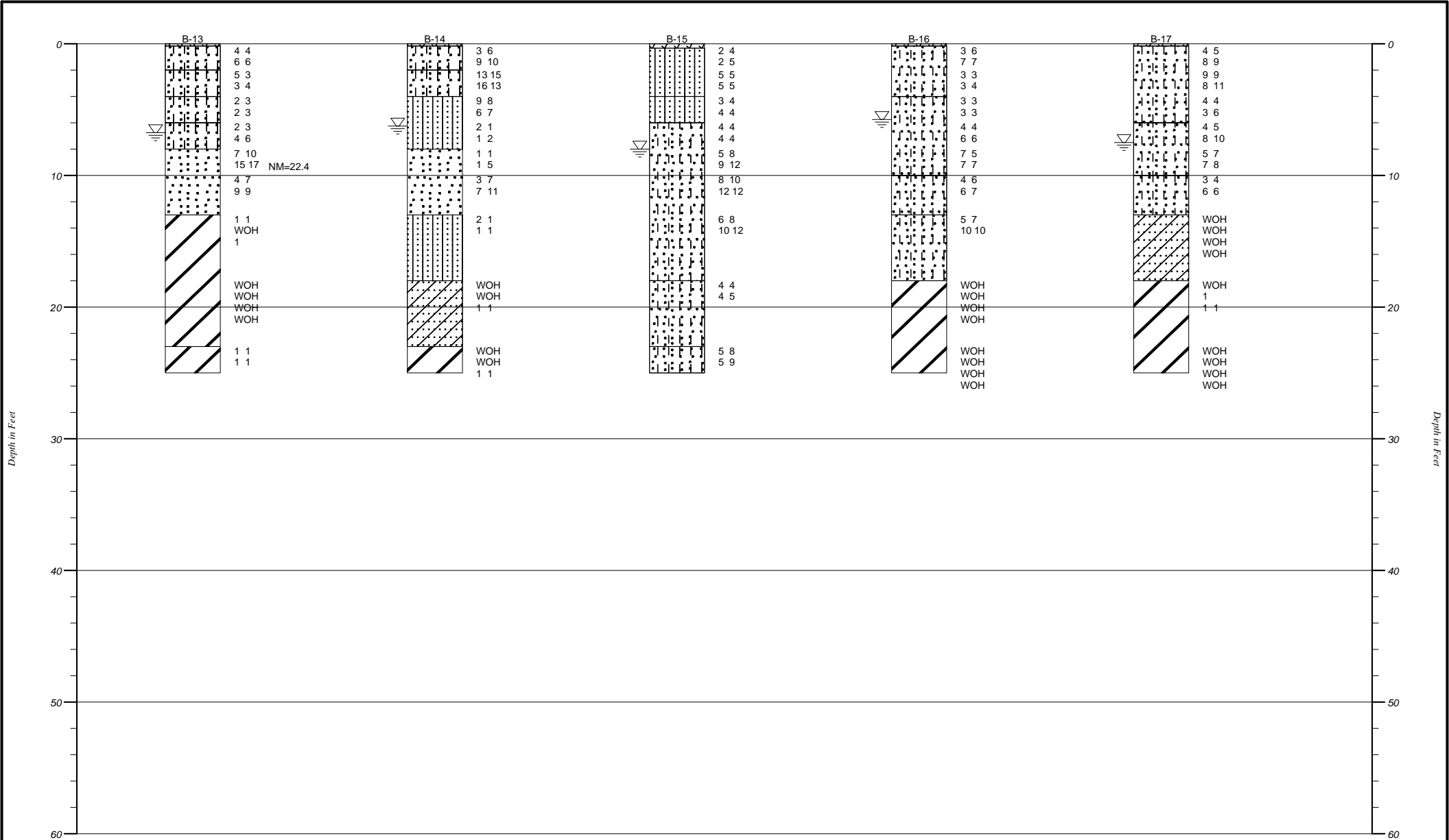
- Strata symbols**
- Topsoil
  - Silty Sand
  - Poorly graded Sand
  - Clayey Sand
  - Fat Clay
  - Poorly graded Sand with Silt

<b>GET Solutions, Inc.</b>		
<b>GENERALIZED SOIL PROFILE</b>		
HORIZONTAL SCALE:	DRAWN BY/APPROVED BY	DATE DRAWN
VERTICAL SCALE: 1"=10'	gwh	7/9/2012
<b>French Creek Boiler Upgrades</b>		
<b>PROJECT NO. JX12-106G</b>		<b>FIGURE NUMBER</b>



- Strata symbols**
- Topsoil
  - Silty Sand
  - Poorly graded Sand
  - Clayey Sand
  - Fat Clay
  - Poorly graded Sand with Silt
  - Fill and/or Uncontrolled Fill

<b>GET Solutions, Inc.</b>		
<b>GENERALIZED SOIL PROFILE</b>		
HORIZONTAL SCALE:	DRAWN BY/APPROVED BY	DATE DRAWN
VERTICAL SCALE: 1"=10'	gwh	7/9/2012
<b>French Creek Boiler Upgrades</b>		
<b>PROJECT NO. JX12-106G</b>		<b>FIGURE NUMBER</b>



- Strata symbols**
- Topsoil
  - Silty Sand
  - Poorly graded Sand
  - Clayey Sand
  - Fat Clay
  - Poorly graded Sand with Silt
  - Fill and/or Uncontrolled Fill

<b>GET Solutions, Inc.</b>		
<b>GENERALIZED SOIL PROFILE</b>		
HORIZONTAL SCALE:	DRAWN BY/APPROVED BY	DATE DRAWN
VERTICAL SCALE: 1"=10'	gwh	7/9/2012
<b>French Creek Boiler Upgrades</b>		
<b>PROJECT NO. JX12-106G</b>		<b>FIGURE NUMBER</b>



**APPENDIX IV**

SUMMARY OF SOIL CLASSIFICATION



## CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

### Standard Penetration Test (SPT), N-value

Standard Penetration Tests (SPT) were performed in the field in general accordance with ASTM D 1586. The soil samples were obtained with a standard 1.4" I.D., 2" O.D., 30" long split-spoon sampler. The sampler was driven with blows of a 140 lb. hammer falling 30 inches. The number of blows required to drive the sampler each 6-inch increment (4 increments for each soil sample) of penetration was recorded and is shown on the boring logs. The sum of the second and third penetration increments is termed the SPT N-value.

### NON COHESIVE SOILS

(SILT, SAND, GRAVEL and Combinations)

#### Relative Density

Very Loose	4 blows/ft. or less
Loose	5 to 10 blows/ft.
Medium Dense	11 to 30 blows/ft.
Dense	31 to 50 blows/ft.
Very Dense	51 blows/ft. or more

#### Particle Size Identification

<b>Boulders</b>	8 inch diameter or more
<b>Cobbles</b>	3 to 8 inch diameter
<b>Gravel</b>	Coarse 1 to 3 inch diameter
	Medium 1/2 to 1 inch diameter
	Fine 1/4 to 1/2 inch diameter
<b>Sand</b>	Coarse 2.00 mm to 1/4 inch (diameter of pencil lead)
	Medium 0.42 to 2.00 mm (diameter of broom straw)
	Fine 0.074 to 0.42 mm (diameter of human hair)
<b>Silt</b>	0.002 to 0.074 mm (cannot see particles)

### CLASSIFICATION SYMBOLS (ASTM D 2487 and D 2488)

#### Coarse Grained Soils

More than 50% retained on No. 200 sieve

**GW** - Well-graded Gravel  
**GP** - Poorly graded Gravel  
**GW-GM** - Well-graded Gravel w/Silt  
**GW-GC** - Well-graded Gravel w/Clay  
**GP-GM** - Poorly graded Gravel w/Silt  
**GP-GC** - Poorly graded Gravel w/Clay  
**GM** - Silty Gravel  
**GC** - Clayey Gravel  
**GC-GM** - Silty, Clayey Gravel  
**SW** - Well-graded Sand  
**SP** - Poorly graded Sand  
**SW-SM** - Well-graded Sand w/Silt  
**SW-SC** - Well-graded Sand w/Clay  
**SP-SM** - Poorly graded Sand w/Silt  
**SP-SC** - Poorly graded Sand w/Clay  
**SM** - Silty Sand  
**SC** - Clayey Sand  
**SC-SM** - Silty, Clayey Sand

#### Fine-Grained Soils

50% or more passes the No. 200 sieve

**CL** - Lean Clay  
**CL-ML** - Silty Clay  
**ML** - Silt  
**OL** - Organic Clay/Silt  
Liquid Limit 50% or greater  
**CH** - Fat Clay  
**MH** - Elastic Silt  
**OH** - Organic Clay/Silt

#### Highly Organic Soils

**PT** - Peat

### COHESIVE SOILS

(CLAY, SILT and Combinations)

#### Consistency

Very Soft	2 blows/ft. or less
Soft	3 to 4 blows/ft.
Medium Stiff	5 to 8 blows/ft.
Stiff	9 to 15 blows/ft.
Very Stiff	16 to 30 blows/ft.
Hard	31 blows/ft. or more

#### Relative Proportions

<u>Descriptive Term</u>	<u>Percent</u>
Trace	0-5
Few	5-10
Little	15-25
Some	30-45
Mostly	50-100

#### Strata Changes

In the column "Description" on the boring log, the horizontal lines represent approximate strata changes.

#### Groundwater Readings

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as tidal influences and man-made influences, such as existing swales, drainage ponds, underdrains and areas of covered soil (paved parking lots, side walks, etc.).

Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent	GW, GP, SW, SP
More than 12 percent	GM, GC, SM, SC
5 to 12 percent	Borderline cases requiring dual symbols

#### Plasticity Chart

