



**US Army Corps
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Wilmington District

Solicitation No. W912PM20R0001

PN81165 Construct SOF Human Performance Training Center (HPTC)

Ft. Bragg, North Carolina

RTA Specifications Vol 1 of 3

July 2020



**US Army Corps
of Engineers®**

Specifications – Volume I of III Division 00 – Division 07

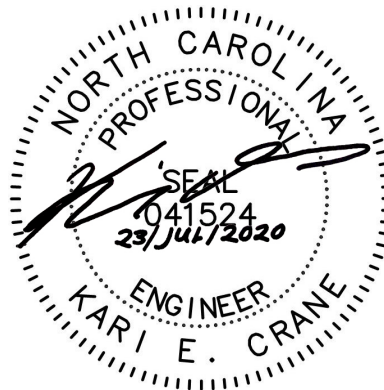
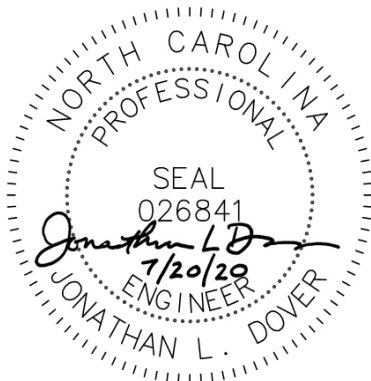
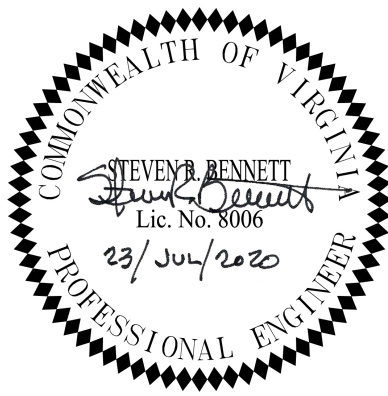
Fort Bragg, North Carolina
SOF Human Platform-Force Generation
(FORGE) Facility
PN81165

Solicitation No.: W912PM-20-R-0001

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July 23, 2020



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LIST OF DRAWINGS
02/11

PART 1 GENERAL

1.1 SUMMARY

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

1.2 CONTRACT DRAWINGS

Contract drawings are as follows:

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SUPPLEMENTARY SPECIAL CONTRACT REQUIREMENTS
DREDGING / CONSTRUCTION
08/18

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 American Association of State Highway and
Transportation Officials

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT)

NCDOT Standard Specifications For Roads And
Structures

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

ER 1-1-11 (1995) Administration -- Progress,
Schedules, and Network Analysis Systems

ER 1110-1-5 Plant Pest Quarantined Area and Foreign
Soil Sample

ER 415-1-15 Construction Time Extensions for Weather

U.S. DEPARTMENT OF TRANSPORTATION (DOT)

DOT Barricades, Danger, Warning and Detour
Signs

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

29 CFR 1910.20 Access to Employee Exposure and Medical
Records

29 CFR 1910.134 Respiratory Protection

29 CFR 1910.1001 Asbestos

29 CFR 1926.55 Gases, Vapors, Fumes, Dusts, and Mists

40 CFR 61 National Emission Standards for Hazardous
Air Pollutants

40 CFR 61.40	General Provisions
40 CFR 61.40-61.156	Cross-reference to other Asbestos Regulations
40 CFR 61.140	40 CFR Subpart M - National Emission Standard for Asbestos
40 CFR 61.156	National Emission Standard for Asbestos
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 172.101	Hazardous Material Regulation-Purpose and Use of Hazardous Material Table
49 CFR 173	Shippers - General Requirements for Shipments and Packagings

1.2 DEPARTMENT OF ARMY MANDATED SECURITY REQUIREMENTS

The Contractor shall be required to comply with the following security requirements mandated by the Department of the Army:

Short-term employees (working on site less than or equal to 6 months): If a criminal history is found, the employee MAY not be allowed to work at the project site at the sole discretion of the Government.

Long-term employees (working on site more than 6 months):
ALL of the following is required WHEN REPORTING FOR WORK -

- a) A completed OMB Form No. 3206-0182 (also designated as Optional Form 306).
- b) A completed OMB Form No. 3206-0191 (also designated as Standard Form 85P).
- c) A resume.

The Government will use all provided information to perform a National Agency Check and Inquiries (NACI) check and will pay the required fee.

The Contractor shall be responsible for furnishing to each employee and for requiring each employee engaged on the work to display such identification as may be approved and directed by the Contracting Officer or his/her designated representative. All prescribed identification shall immediately be delivered to the Contracting Officer or his/her designated representative for cancellation upon the release of any employee.

(End of Clause)

1.3 IDENTIFICATION OF EMPLOYEES - MOTSU

At least 10 days before mobilizing, the Contractor shall furnish the

Contracting Officer or his/her designated representative, names, driver's license, and vehicular tag numbers of each employee that will be working on this project. The Contractor shall require employees to display identification when requested.

If there are any changes in employees who are assigned to the work at any time after the information is submitted and prior to completion of work, the Contractor shall promptly furnish updated information to the Contracting Officer or his/her designated representative.

It will be the responsibility of the Contractor to take those measures which deem necessary to protect plant and personnel prior to beginning work.

The Contracting Officer or his/her designated representative will arrange an initial coordination meeting between the Contractor and MOTSU which will be held before the Contractor begins work. When work begins, the Contractor shall coordinate all activities with the designated MOTSU personnel on a day to day basis.

(End of Clause)

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Subcontractors

Progress Chart; G, A

Quality Control Plan; G, A

Certificate of Insurance

Within 24 hours of conclusion of physical tests, 5 copies of test results including calibration curves and results of calibration tests.

SD-03 Product Data

WORK PLAN

PROGRESS SCHEDULE

SD-07 Certificates

U.S. Coast Guard Certification

Completion of Corps CQC Course

Letter Appointing Superintendent

Qualifications of the commercial testing laboratory or
 Contractor's testing laboratory/facilities G, A

1.5 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

ER 415-1-15 dtd 31 OCT 89

(a) This provision specifies the procedure for determination of time extensions for unusually severe weather in accordance with the contract clause entitled "DEFAULT (FIXED-PRICE CONSTRUCTION)". In order for the Contracting Officer to award a time extension under this clause, the following conditions must be found to be satisfied in the sole discretion of the Contracting Officer:

(1) The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

(2) The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

(b) The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER
 AND/OR SEA CONDITIONS DELAYS (HOURS)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

MONTHLY ANTICIPATED ADVERSE WEATHER **DELAY**
WORK DAYS BASED ON (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

(c) Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day.

(d) The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph (2), above, the Contracting Officer will convert any

qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the contract clause entitled "DEFAULT (FIXED-PRICE CONSTRUCTION)".

(End of Clause)

1.6 PERFORMANCE AND PAYMENT BONDS

Each bidder shall include his premiums for performance and payment bonds under the appropriate, "Performance and Payment Bonds" contract line item of the Bidding Schedule. Payment to the Contractor therefore, shall not exceed the bid price and shall be made in accordance with the Contract Clause entitled "PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS." Any additional amount bid in excess of the actual bond premium will be included in the final pay estimate for this contract.

Each bidder shall include in his bid premiums for performance and payment bonds. Payment shall be made in accordance with the Contract Clause entitled "PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS." Any additional amount bid in excess of the actual bond premium will be included in the final pay estimate for this contract.

Each bidder shall include his premiums for performance and payment bonds in his bid. Payment to the Contractor therefore, shall be made in accordance with the Contract Clause entitled in accordance with the Contract Clause entitled "PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS." Any additional amount included in the Contractor's bid which is in excess of the actual bond premium will be included in the final pay estimate for this contract.

(End of Clause)

1.7 VARIATIONS IN ESTIMATED QUANTITIES - DREDGING (1998 January HQUSACE)

(a) Where the quantity of a pay item in this contract is an estimated quantity and where the actual quantity of material within the required dredging prism, including the associated side slopes, varies more than 15 percent above or below the stated estimated quantity within the required dredging prism, an equitable adjustment in the contract unit price will be made upon demand of either party. The equitable adjustment will be based upon any increase or decrease in the costs due solely to the variations above 115 percent or below 85 percent of the estimated quantity within the required dredging prism. Any equitable adjustment in the contract unit price will also apply to that part of the actual quantity of allowable over-depth material above 115 percent or below 85 percent of the estimated allowable over-depth quantity.

(b) If the quantity variation is such as to cause an increase in the time necessary for completion, the Contracting Officer or his/her designated representative shall upon receipt of a written request for an extension of time within 10 days from the beginning of such delay, or within such further period of time which may be granted by the Contracting Officer or his/her designated representative prior to the date of final settlement of the contract, ascertain the facts and make such adjustment for extending the completion date as in their judgment the findings justify.

(End of Clause)

1.8 WATER CONSERVATION

Water is one of our valuable natural resources. Accordingly, the Contractor shall be judicious in its use in the performance of the work as specified. Water needed for compaction of roadway and/or foundation materials, and dust control shall be obtained from uncontrolled stream flow instead of potable supply sources to the extent available and suitable as determined by the Contracting Officer or his/her designated representative.

(End of Clause)

1.9 LOCAL NOTICE TO MARINERS

(a) The Contractor shall coordinate Local Notice to Mariners with the U.S. Coast Guard (USCG) by contacting USCG District Five at (757) 398-6229 or, alternately, Sector North Carolina at (910) 772-2230. Contractor shall provide the dredging schedule and location by shoal/tangent/section.

(b) Should the Contractor, during dredging operations, encounter any objects on the channel bottom which could be a hazard to navigation, the Contractor shall notify the USCG immediately with location and other pertinent information necessary for the USCG to issue a Local Notice to Mariners. The Contractor shall provide copies of this information to the Contracting Officer or his/her designated representative.

1.10 NAVIGATION AIDS

There may be aids to navigation within the project boundaries. Some, or all, of such aids to navigation may need to be removed for the accomplishment of the contract work. Before the commencement of dredging, it is the responsibility of the Contractor to provide the U.S. Coast Guard (USCG) and any other responsible parties notification 5 weeks prior to needing a navigation aid moved. The USCG may need to bring vessels from out of state to move larger aids to navigation and the Contractor should request this service as soon as practicable, but in all cases, at least 5 weeks from the start of dredging. Any impacts to the work due to the inability of the Contractor to accomplish any needed movement of aids to navigation will not be the responsibility of the United States Government or of the Contracting Officer. Failure to notify the Coast Guard within the required timeframe may result in project delays.

The Contractor shall not remove, change the location of, obstruct, willfully damage, make fast to, or interfere with aids to navigation without express direction from the USCG. If the USCG determines they cannot respond to the Contractor's request, the USCG may request the Contractor to relocate the navigation aid(s) for dredging. The Contractor shall only relocate the navigation aid(s) and/or place the navigation aid(s) back to its charted position under the direct supervision of the USCG.

The USCG point of contact is the USCG North Carolina Aids to Navigation Officer at (252)-247-4525, or alternately, Sector North Carolina Waterways Management at (910) 772-2230.

1.11 SEAGOING BARGE ACT (1979 OCE)

The Seagoing Barge Act (46 U.S.C. et sq.) applies to this project. In the event the low bidder contemplates using plant that requires U.S. Coast Guard certification to comply with the Act, the low bidder shall within ten (10) calendar days after bid opening submit a copy of said certificate to the Contracting Officer or his/her designated representative. Failure to produce the certificate within the required time shall subject the bidder to a determination of nonresponsibility.

(End of Clause)

1.12 BULLETIN BOARD

Within one (1) calendar day after commencement of work under this contract, the Contractor shall provide at the job site a weatherproof, glass-covered bulletin board for displaying the Fair Employment poster, wage rates, posters and safety bulletins as noted in Section 01 35 26, paragraph DISPLAY OF SAFETY INFORMATION. The bulletin board shall be located in a conspicuous place, easily accessible to all employees, and legible copies of the aforementioned data shall be displayed until work under the contract is complete. No direct payment will be made for the bulletin board.

(End of Clause)

1.13 FINAL EXAMINATION AND ACCEPTANCE

As soon as practicable after the completion of the entire work or, if the work is divided into sections, or if any section which in the opinion of the Contracting Officer or his/her designated representative will not be subject to damage by further operations under the contract, such work will be thoroughly examined at the cost and expense of the Government by sounding or by sweeping, or both, as determined by the Contracting Officer or his/her designated representative. If any shoals, lumps, or the lack of contract depth are disclosed by this examination, the Contractor shall remove same by dredging the bottom with payment at the contract rate for (example: Unclassified Excavation, Anchorage Basin). The Contractor is only allowed to do dragging operations in lieu of dredging if approved by the Contracting Officer or his/her designated representative. The Contractor will be notified when soundings or sweepings are to be made and will be permitted to accompany the survey party. When the area is found to be in satisfactory condition, it will be accepted. If more than two sounding or sweeping operations by the Government over an area are necessary because of work for the removal of shoals disclosed by prior sounding or sweeping, the cost of such subsequent soundings or sweeping operations will be charged against the Contractor at the rate of (\$5,100.00) per day in which the Government plant is engaged in sounding or sweeping, is enroute to or from the site, or is held at or near the site for such operations.

As soon as practicable after the completion of the entire work or, if the work is divided into sections, or if any section which in the opinion of the Contracting Officer or his/her designated representative will not be subject to damage by further operations under the contract, such work will be thoroughly examined at the cost and expense of the Government by sounding or by sweeping, or both, as determined by the Contracting Officer or his/her designated representative. If any shoals, lumps, or the lack of contract depth are disclosed by this examination, the Contractor shall remove same by dredging the bottom with payment at the contract rate for

dredging. The Contractor is only allowed to do dragging operations in lieu of dredging if approved by the Contractor Officer. The Contractor will be notified when soundings or sweepings are to be made and will be permitted to accompany the survey party. When the area is found to be in satisfactory condition, it will be accepted. If more than two sounding or sweeping operations by the Government over an area are necessary because of work for the removal of shoals disclosed by prior sounding or sweeping, the cost of such subsequent soundings or sweeping operations will be charged against the Contractor at the rate of \$_____ per day in which the Government plant is engaged in sounding or sweeping, is enroute to or from the site, or is held at or near the site for such operations.

(End of Clause)

1.14 WORK PLAN

The Contractor shall submit a detailed work plan outlining the Contractor's proposed methods for the execution of all work under this contract. The work plan shall include a schedule that indicates the anticipated time frame to accomplish each definable feature of work within the time specified in the contract. The work plan shall provide an overall program for management of this project consisting of the following required plans:

a. The specific resources and equipment proposed for each definable feature of construction/dredging required by the contract. The Contractor shall describe and document all equipment proposed to demonstrate ability to perform the work in accordance with the proposed schedule, and shall include as a minimum the following information:

Dredges:

- Identification of the Dredge
- Total Horsepower and distribution
- Size of Suction and Discharge Lines
- Associated booster/pipeline equipment
- Estimated Pipeline Length(s) and Location(s) of booster pumps for this contract
- Scow Capacity in cubic yards
- Present location and condition
- Dredge Operation Reports for rock under comparable operating conditions. In addition, submit monthly summaries, to include daily rock production rates from these reports in cubic yards per day
- Dredge Operation Reports for non-rock under comparable operating conditions. In addition, submit monthly summaries, to include daily non-rock production rates from these reports in cubic yards per day
- Existing commitments of this equipment to other projects scheduled during the proposed contract duration

Other accompanying vessels and plant:

- Identification of the vessels
- HP/ capacity (as appropriate)
- Existing commitments of this equipment to other projects scheduled during the proposed contract duration

b. An accident prevention plan (APP) as required in Section 01 35 26 of the specifications.

The offered performance schedule will be incorporated into the contract and will become the required performance period for all contract purposes including assessment of liquidated damages.

1.15 PROGRESS SCHEDULE

Pursuant to the Contract Clause FAR 52.236-15, SCHEDULES FOR CONSTRUCTION CONTRACTS, a project schedule as described in this paragraph PROGRESS SCHEDULE shall be prepared and submitted. The Contractor shall provide the project schedule in the Precedence Diagram Method (PDM) using the Standard Data Exchange Format (SDEF). The project schedule shall be used to measure progress of the work, to evaluate potential time extensions and to provide a basis for all progress payments. It shall be in sufficient detail to properly monitor and manage the work and as a minimum shall include the following:

a. the work shall be divided into activities by acceptance section and phase of work (e.g. preconstruction structure and property condition surveys, blasting, dredging)

b. separate activities shall reflect each mobilization and demobilization of each major plant

c. activities shall be identified by associated bid item

d. all required and proposed submissions shall be included in the progress schedule

e. Government and other agency activities that could impact progress shall be shown (e.g. Government surveys, navigation aid relocations, etc.)

The schedule shall extend from NTP to the established contract completion date.

The initial progress schedule shall be included with the solicitation proposal and demonstrate that the proposed plant and resources are capable of performing the work as scheduled. Periodic schedule updates shall be provided monthly with each payment request, and whenever there is a change in logic or time extension. Each submission shall include the data disks containing the project schedule adhering to the SDEF format specified in ER 1-1-11, Appendix A; the earnings report indicating monthly and cumulative earnings; a narrative report with a description of the activities identifying the critical path(s), current or anticipated problems of delays and their impact, and proposed corrective actions; and the schedule reports containing activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date and total float. The schedule

reports shall be sorted as activity report, logic report listing preceding and succeeding activities for each activity, total float report listed in ascending order by early state date, early state sort and earning report. A network diagram shall be submitted with the initial submission and each update. The network diagram shall depict the order, sequence and interdependence of activities, shall clearly indicate milestone dates and projected early and late earnings.

1.16 CONTRACTOR FURNISHED GOVERNMENT OFFICE

The Contractor shall furnish separate office space at the construction site to be used by the Government as a Resident Engineer Office. The location and office shall be approved by the Contracting Officer or his/her designated representative. This office shall provide a minimum of 400 square feet of working space and be divided into at least two (2) rooms plus bathroom facilities. One (1) room shall provide a minimum of 150 square feet and the other room shall provide a minimum of 250 square feet. New office furniture shall be provided to include two flat top office desks with top measurements 60 by 30-inches; two office chairs with upholstered seats and backs; two rotary desk chairs with upholstered tilting seats and backs with arms, adjustable seat height and casters; one rotary office chair with upholstered tilt seat and back without arms, adjustable seat height and casters; one plan table, plan rack, rotary drafting chair with adjustable seat from 27-inches to 30-inches high, drafting table 36-inches high, top measurements 42-inches x 72-inches with adjustable top; three legal size metal filing cabinets with four drawers; two bookcases providing a minimum of 20 linear feet of shelf space; a water cooler and a refrigerator. Adequate office heating, air conditioning, and lighting shall be provided.

(a) All necessary utility services including water, electric, and sanitary services shall be installed and maintained by the Contractor at his expense, with the exception of telephone service, which will be installed and maintained at Government expense. The office facilities shall meet all applicable local and State codes and regulations. The office and equipment shall be fully operational and available to the Government no later than 30 days after receipt of the notice to proceed. Upon completion of the project and after the Government has vacated the office the facilities shall be removed from project properties or otherwise suitably disposed of by the Contractor. The cost for this office shall be included in the bid price for **bid item No. ___ of the BIDDING SCHEDULE.**

(b) The Contractor shall furnish daily janitorial services for the offices, laboratory and other buildings on the project site and perform normal maintenance of facilities and grounds as deemed necessary by the Contracting Officer or his/her designated representative during the entire life of the contract. Toilet facilities shall be kept clean and sanitary at all times. Services shall be performed at such a time and in such a manner to least interfere with the operations but will be accomplished during normal working hours. Services shall be accomplished to the satisfaction of the Contracting Officer or his/her designated representative. The Contractor shall also provide daily trash collection and cleanup of the buildings and adjacent outside areas, snow removal in season, and shall dispose of all discarded debris, aggregate samples and concrete test samples in a manner approved by the Contracting Officer or his/her designated representative. No separate payment will be made for these Contractor-furnished services, and all costs thereof shall be incidental to the various bid items of the contract.

(a) The Contractor shall furnish separate office space at the construction site to be used by the Government as a Resident Engineer Office. The location and office shall be approved by the Contracting Officer or his/her representative. This office shall provide a minimum of 250 square feet of working space and bathroom facility. New office furniture shall be provided to include one flat top office desk with top measurement 60 by 30-inches; one work table with top measurement 60 by 30 inches; two office chairs with upholstered seats and backs; one rotary desk chair with upholstered tilting seats and backs with arms, adjustable seat height and casters; one legal size metal filing cabinets with four drawers; one bookcase providing a minimum of 20 linear feet of shelf space; a linear feet of shelf space; a water cooler and a refrigerator. Adequate office heating, air conditioning, and lighting shall be provided.

(b) The Contractor shall furnish daily janitorial services for the offices, laboratory and other buildings on the project site and perform normal maintenance of facilities and grounds as deemed necessary by the Contracting Officer or his/her designated representative during the entire life of the contract. Toilet facilities shall be kept clean and sanitary at all times. Services shall be performed at such a time and in such a manner to least interfere with the operations but will be accomplished during normal working hours. Services shall be accomplished to the satisfaction of the Contracting Officer or his/her designated representative. The Contractor shall also provide daily trash collection and cleanup of the buildings and adjacent outside areas, snow removal in season, and shall dispose of all discarded debris, aggregate samples and concrete test samples in a manner approved by the Contracting Officer or his/her designated representative. No separate payment will be made for the office or these Contractor-furnished services, and all costs thereof shall be incidental to the various bid items of the contract.

(End of Clause)

1.17 ACCOMMODATIONS AND MEALS FOR INSPECTORS

(a) The Contractor shall furnish regularly to inspectors, for office purposes and sleeping purposes, when applicable, a suitable separate room onboard the dredge or other craft upon which they are employed. If no suitable office space is available thereon, the Contractor shall furnish suitable alternate accommodations ashore at a location approved by the Contracting Officer or his/her designated representative and furnish suitable transportation between the alternate accommodations and the dredge or other craft upon which they are employed.

(b) If the Contractor maintains an establishment for the subsistence of his own employees, he shall, when required, furnish to inspectors employed on the work, and to all Government agents who may visit the work on official business, meals of a quality satisfactory to the Contracting Officer or his/her designated representative. The meals furnished shall be paid for by the individual consuming the meal at a rate commensurate with the basic Government subsistence rate of: \$5.00 Breakfast; \$8.00 Lunch; \$13.00 Dinner.

(End of Clause)

1.18 RETAINAGE FOR UNTIMELY SUBMISSION OF SUBCONTRACTING REPORTS

(a) In accordance with Contract Clause 52.219-9, Small Business

Subcontracting Plan, and 52.219-16, Liquidated Damages - Subcontracting Plan, retainage will be withheld from progress payments in an amount sufficient to protect the Government's ability to assess liquidated damages in accordance with Clause 52.219-16 for the contractor's failure to timely submit Standard Form 294, Subcontracting Report for Individual Contracts, and Standard Form 295, Summary Subcontract Report, reports.

(b) The retainage will be determined in accordance with the following formula:

Total dollar amount for subcontracting to small business multiplied by percentage of actual progress on the contract shall be withheld from the next progress payment due after the Contractor fails to submit a required report. If one or more reports have been submitted before such failure, formula for determining the amount of retainage will be adjusted by deducting any amounts reported as subcontracted to small business from the total dollar amount proposed to be subcontracted and the difference multiplied by the percentage of actual progress.

(c) Subcontracting plans are not required--

(1) For contracts or contract modifications that will be performed entirely outside of any State, territory, or possession of the United States, the District of Columbia, and the Commonwealth of Puerto Rico; or

(2) For modifications to contracts that do not contain the clause 52.219-8, Utilization of Small Business Concerns (or equivalent prior DAR, FPR, or NASA clauses); e.g., contracts awarded before Pub. L. 95-507 and which are within the scope of the contract.

(End of Clause)

1.19 SHOP DRAWINGS AND MATERIALS SUBMITTAL

(a) Five (5) days prior to the preconstruction conference (see paragraph REQUIRED CONSTRUCTION MEETINGS), the Contractor shall complete and submit to the Contracting Officer or his/her designated representative, in duplicate, Submittal Register, listing all submittals and dates. In addition to those items listed on the Submittal Register, the Contractor will furnish submittals for any deviation from the plans or specifications. The scheduled need dates must be recorded on the document for each item for control purposes. In preparing the document, adequate time (minimum of 15 days) will be allowed for review and approval and possible resubmittal. Scheduling shall be coordinated with the approved progress schedule. The Contractor's Quality Control System Manager shall review the listing at least every 30 days and take appropriate action to maintain an effective system. Copies of updated or corrected listings shall be submitted to the Contracting Officer or his/her designated representative at least every 60 days in the quantity specified. Payment will not be made for any material or equipment which does not comply with contract requirements.

(b) Contractor submittals required by the Technical Provisions are indicated in those provisions and are listed on the Submittal Register furnished in Section 01 33 00.00 37 SUBMITTAL PROCEDURES. The list does not relieve the Contractor from furnishing submittals required elsewhere in the specifications, those inadvertently omitted from the listing; or from furnishing other submittals that the Government may deem necessary as

the work progresses.

(c) Normal review levels for required approvals are indicated by letter designations as follows:

Contractor Quality Control System Manager --- (CQC)
Area or Resident Engineer ----- (R)
Engineering Branch ----- (E)

The Government reserves the right to vary the review levels for (R) and (E) to its convenience.

(d) The Contractor shall use ENG Form 4025, furnished in Section 01 33 00.00 37 SUBMITTAL PROCEDURES, to transmit Shop Drawings, Equipment Data, Material Samples or Manufacturer's Certificate of Compliance to the Government.

(End of Clause)

1.20 SAMPLING, CERTIFICATES, AND TESTING

(a) General. Within 30 days after acknowledgment of Notice to Proceed, the Contractor shall submit to the Contracting Officer or his/her designated representative five (5) copies of a list of the items for which he proposes to furnish manufacturer's certificates and/or samples for inspection and testing. The list shall include, but is not limited to the following information:

- (1) Name of item
- (2) Specification paragraph covering this item
- (3) Date sample will be furnished
- (4) Delivery date of product
- (5) Items for which a certificate will be furnished

(b) Submittals. Any product or item mentioned in these specifications and required to meet Federal, ASTM, AASHTO, U. S. Army or Navy, AREMA, AWWA, and UL Specifications or Codes, specified herein with certain limiting or qualifying requirements, or any product or item which is required to be similar and equal to a specified product or item may require the submission, before delivery of the product or item to the job site, of one or more of the following:

- (1) Certificate by the manufacturer that the item meets the contract requirements.
- (2) Samples for inspection, comparison, and testing, including destructive tests.

(c) Sample delivery. Unless otherwise specified or authorized, all samples shall be delivered (without cost to the Government) to:

U.S. Army Engineer District, Wilmington
Corps of Engineers
ATTENTION: Civil Construction Section
or

Military Construction Section
69 Darlington Avenue
Wilmington, North Carolina 28403

U.S. Army Corps of Engineers
Raleigh Area Office
11409 Falls of the Neuse Road
Wake Forest, North Carolina 27587-11409

U.S. Army Corps of Engineers
AIWW Bridges Resident Office
Post Office Box 1269
107 Union Drive (Suite 101)
Washington, North Carolina 27889-1269

U.S. Army Corps of Engineers
Kerr Resident Office
5460 Buggs Island Road
Boydton, Virginia 23917

If required by the Contracting Officer or his/her designated representative, duplicate samples shall be shipped to the Wilmington District Office at no expense to the Government.

(d) Testing. All tests required in the Technical Provisions shall be made by and at the expense of the Contractor except those material tests specifically excluded which will be made by and at the expense of the Government. All instruments and personnel required for the required tests shall be furnished by the Contractor. The Government reserves the right to interrupt the work to make tests on all facets of concreting and other operations. These tests will be made as necessary to insure conformance to applicable specifications and drawings and will be made by and at the expense of the Government except Contractor sampling support as required by the Technical Provisions. In those instances where testing is specified to be made at the Government's expense, the cost of the initial testing will be at the Government's expense; however, any retesting due to failure of the materials to meet the requirements in the initial test shall be performed at the Contractor's expense. The retests shall be made at laboratories approved by the Contracting Officer or his/her designated representative. The costs of retests made at Government laboratories will be deducted from the total amount due the Contractor, at actual cost to the Government, unless otherwise specified.

(End of Clause)

1.21 CERTIFICATES OF COMPLIANCE
(1969 MAY OCE)

Any certificates required for demonstrating proof of compliance of materials with specification requirements shall be executed in 3 copies. Each certificate shall be signed by an official authorized to certify in behalf of the manufacturing company and shall contain the name and address of the Contractor, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Contractor from furnishing satisfactory material, if, after tests are performed on selected samples, the material

is found not to meet the specific requirements.

(End of Clause)

1.22 CONTRACTOR-PREPARED NETWORK ANALYSIS SYSTEM
(APR 1968)

The progress chart to be prepared by the Contractor pursuant to the Contract Clause entitled "SCHEDULES FOR CONSTRUCTION CONTRACTS" shall consist of a network analysis system as described below. In preparing this system the scheduling of construction is the responsibility of the Contractor. The requirement for the system is included to assure adequate planning and execution of the work and to assist the Contracting Officer or his/her designated representative in appraising the reasonableness of the proposed schedule and evaluating progress of the work.

(a) An example of one of the numerous acceptable types of network and analysis systems is shown in Appendix A of the Corps of Engineers Regulation ER 1-1-11, single copies of which are available to bona fide bidders on request. Other systems which are designed to serve the same purpose and employ the same basic principles as are illustrated in Appendix A will be accepted subject to the approval of the Contracting Officer or his/her designated representative.

(b) The system shall consist of diagrams and accompanying mathematical analyses. The diagrams shall show elements of the project in detail and the entire project in summary.

(1) Diagrams shall show the order and interdependence of activities and the sequence in which the work is to be accomplished as planned by the Contractor. The basic concept of a network analysis diagram will be followed to show how the start of a given activity is dependent on the completion of preceding activities and its completion restricts the start of following activities.

(2) Detailed network activities shown on a detailed or sub-network diagram shall include, in addition to construction activities, the submittal and approval of samples of materials and shop drawings, the procurement of critical materials and equipment, fabrication of special material and equipment and their installation and testing. All activities of the Government that affect progress, and contract required dates for completion of all or parts of the work will be shown. The detail of information shall be such that duration times of activities will range from three (3) to thirty (30) days with not over two percent (2%) of the activities exceeding these limits. The activities which comprise the following separate buildings and features shall be separately identifiable by coding or use of sub-networks or both:

Building or feature	Minimum number of activities
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The selection and number of activities shall be subject to the Contracting Officer or his/her designated representative's approval. Detailed networks, when summary networks are also furnished, need not be time scaled but shall be drafted to show a continuous flow from left to right with no arrows from right to left. The following information shall be shown on the diagrams for each activity: preceding and following event numbers, description of the activity, cost, and activity duration.

(3) Summary Network. If the project is of such size that the entire network cannot be readily shown on a single sheet, a summary network diagram shall be provided. The summary network diagram shall consist of a minimum of fifty activities and a maximum of one hundred and fifty activities, and shall be based on and supported by detailed diagrams. Related activities shall be grouped on the network. The critical path shall be plotted generally along the center of the sheet with channels with increasing float placed towards the top or bottom. The summary network shall be time scaled using units of approximately one-half inch equals one week or other suitable scale approved by the Contracting Officer or his/her designated representative. Weekends and holidays shall be indicated. Where slack exists, the activities shall be shown at the time when they are scheduled to be accomplished.

(4) The mathematical analysis of the network diagram shall include a tabulation of each activity shown on the detailed network diagrams. The following information will be furnished as a minimum for each activity:

- (i) preceding and following event numbers (numbers shall be selected and assigned so as to permit identification of the activities with bid items);
- (ii) activity description;
- (iii) estimated duration of activities (the best estimate available at time of computation);
- (iv) earliest start date (by calendar date);
- (v) earliest finish date (by calendar date);
- (vi) scheduled or actual start date (by calendar date);
- (vii) scheduled or actual finish date (by calendar date);
- (viii) latest start date (by calendar date);
- (ix) latest finish date (by calendar date);
- (x) slack or float;
- (xi) monetary value of activity;
- (xii) responsibility for activity (Prime Contractor, subcontractors, suppliers, Government, etc.);
- (xiii) manpower required;
- (xiv) percentage of activity completed;
- (xv) Contractor's earnings based on portion of activity completed; and
- (xvi) bid item of which activity is a part.

(5) The program or means used in making the mathematical computation shall be capable of compiling the total value of completed and partially completed activities and subtotals from separate buildings or

feature listed in paragraph (b)(2).

(6) In addition to the tabulation of activities, the computation will include the following data:

(i) identification of activities which are planned to be expedited by use of overtime or double shifts to be worked including Saturdays, Sundays and holidays;

(ii) on-site manpower loading schedule;

(iii) a description of the major items of construction equipment planned for operations of the project. (The description shall include the type, number of units and unit capacities. A schedule showing proposed time equipment will be on the job keyed to activities on which equipment will be used shall be provided); and

(iv) where portions of the work are to be paid by unit costs, the estimated number of units in an activity which was used in developing the total activity cost.

(7) The analysis shall list the activities in sorts or groups as follows:

(i) by the preceding event number from lowest to highest and then in the order of the following event number;

(ii) by the amount of slack, then in order of preceding event number;

(iii) by responsibility in order of earliest allowable start dates; and

(iv) in order of latest allowable start dates, then in order of preceding event numbers, and then in order of succeeding event numbers.

(c) Submission and approval of the system shall be as follows:

(1) A preliminary network defining the Contractor's planned operations during the first sixty (60) calendar days after receipt of Notice to Proceed will be submitted within ten (10) days. The Contractor's general approach for the balance of the project shall be indicated. Cost of activities expected to be completed or partially completed before submission and approval of the whole schedule should be included.

(2) The complete network analysis consisting of the detailed network mathematical analysis (on-site manpower loading schedule, equipment schedule) and network diagrams shall be submitted within forty (40) calendar days after receipt of Notice to Proceed.

(d) The Contractor shall participate in a review and evaluation of the proposed network diagrams and analysis by the Contracting Officer or his/her designated representative. Any revisions necessary as a result of this review shall be resubmitted for approval of the Contracting Officer or his/her designated representative within ten (10) calendar days after the conference. The approved schedule shall then be the schedule to be used by the Contractor for planning, organizing and directing the work and

for reporting progress. If the Contractor thereafter desires to make changes in his method of operating and scheduling he shall notify the Contracting Officer or his/her designated representative in writing stating the reasons for the change. If the Contracting Officer or his/her designated representative considers these changes to be of a major nature he may require the Contractor to revise and submit for approval, without additional cost to the Government, all or the affected portion of the detailed diagrams and mathematical analysis and the summary diagram to show the effect on the entire project. A change may be considered of a major nature if the time estimated to be required or actually used for an activity or the logic of sequence of activities is varied from the original plan to a degree that there is a reasonable doubt as to the effect on the contract completion date or dates. Changes which affect activities with adequate slack time shall be considered as minor changes, except that an accumulation of minor changes may be considered a major change when their cumulative effect might affect the contract completion date.

(e) The Contractor shall submit at intervals of fifteen (15) calendar days a report of the actual construction progress by updating the mathematical analyses. Revisions causing changes in the detailed network shall be noted on the summary network, or a revised issue of affected portions of the detailed network furnished. The summary network shall be revised as necessary for the sake of clarity. However, only the initial submission or completed revisions need be time scaled. Subsequent minor revisions need not be time scaled.

(f) The report shall show the activities or portions of activities completed during the reporting period and their total value as basis for the Contractor's periodic request for payment. Payment made pursuant to the Contract Clause entitled "PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS" will be based on the total value of such activities completed or partially completed after verification by the Contracting Officer or his/her designated representative. The report will state the percentage of the work actually completed and scheduled as of the report date and the progress along the critical path in terms of days ahead or behind the allowable dates. If the project is behind schedule, progress along other paths with negative slack shall also be reported. The Contractor shall also submit a narrative report with the updated analysis which shall include but not be limited to a description of the problem areas, current and anticipated, delaying factors and their impact, and an explanation of corrective actions taken or proposed.

(g) Sheet size of diagrams shall be 30 by 42 inches. Each updated copy shall show a date of the latest revision.

(h) Initial submittal and complete revisions shall be submitted in six (6) copies.

(i) Periodic reports shall be submitted in four (4) copies.

(End of Clause)

1.23 REQUIRED CONSTRUCTION MEETINGS

(a) In addition to meetings required elsewhere in the specifications, the Contractor and any Subcontractors identified by the Contracting Officer's Representative shall be required to attend a preconstruction meeting (after award of the contract but before

Commencement of Work) and a post construction meeting (after final acceptance of the work but before final payment is made). The Contractor and identified Subcontractors shall meet with Corps of Engineers personnel at a time and place determined by the Contracting Officer's Representative.

(b) At the preconstruction conference, the Contractor shall be oriented with respect to Government procedures and line of authority in contractual, administrative, and construction matters. Additionally, a schedule of required submittals will be discussed.

(c) Five (5) days prior to the preconstruction conference, the Contractor shall submit the following items:

Certificate of Insurance
Quality Control Plan (see Section 01 45 00.00 10
QUALITY CONTROL, for additional information)
Certificate of Completion of Corps CQC Course
Preliminary Submittal Register (ENG Form 4288 exclusive of
Contractor submittal dates)
Letter Appointing Superintendent (see Contract Clause
entitled Superintendence by the Contractor, 52.236-6)
List of Subcontractors

(d) The letter of record will be written documenting all items discussed at the conference and a copy will be furnished by the Contracting Officer's Representative to all in attendance.

(End of Clause)

1.24 SURVEY DATA

The Contractor shall maintain complete and accurate field notes, sketches, recordings and computations required in establishing the necessary horizontal and vertical control. All survey data shall be recorded in accordance with accepted standards and as approved by the Contracting Officer or his/her designated representative. All the above data shall be available at all times during the progress of the work for ready examination and use by the Contracting Officer or his/her designated representative. Upon request of the Contracting Officer or his/her designated representative, the Contractor shall furnish a copy of above survey data.

(End of Clause)

1.25 "AS-BUILT" RECORD DRAWINGS

(a) The Contractor shall be responsible for maintaining in good condition one set of reproducible as-built drawings and five copy sets, including system layout drawings and field wiring diagrams. Drawings shall be "D" 34 by 22 inches, drawn to the same scale as the contract drawings, with title block similar to the contract drawings. Reproducible drawings shall be on mylar film. The Contractor shall keep a careful and neat record of all deviations, field changes and modifications from the original contract drawings which are made to each phase of construction as the work progresses. The Contractor is responsible for noting all changes and corrections on these prints promptly as in-place construction activities occur, but in no case less often than on a weekly basis. In addition to the above, the following shall be included:

(1) Actual location of all Contractor installed subsurface utility lines. Type of materials actually installed, major sizes of lines, etc. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered or obscured, the record drawings shall show, by offset dimensions to two permanently fixed surface features, both ends of each run and each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensions along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

(2) Any shop drawings which constitute part of the design shall be included with the record drawings.

(3) The manufacturer and model number of all major items of equipment shall be shown on the record drawings.

(4) Upon completion of all construction, the Contractor will delete by notation all references to features not constructed.

(b) These annotated prints shall be certified as to their correctness by the signature of the Contractor and turned over to the Contracting Officer or his/her designated representative not later than ten (10) days after final acceptance of the work by the Government. Marked up prints shall be reviewed for approval by the Contracting Officer or his/her designated representative and returned for corrections as necessary.

(End of Clause)

1.26 FINISH MATERIAL SUBMITTALS

All finish items requiring submittal for approval shall be packaged by the Contractor to form one coordinated submittal for interior finishes and one coordinated and separate submittal for exterior finishes. Each submittal shall clearly convey colors, textures and finishes proposed to permit a complete review on how the finishes interact.

(End of Clause)

1.27 ASBESTOS PERMIT AND NOTIFICATION

Prior to beginning any demolition or renovation of existing buildings, the Contractor shall submit notification to the appropriate state agency by completing there "Asbestos Permit Application and Notification for Demolition/Renovation" form. State law requires notification whether or not asbestos is present. A copy of the state response shall be submitted to the Government for information.

The following state agencies require notification:

State of North Carolina
Department of Health and Natural Resources
Asbestos Hazard Management Branch
Post Office box 27687
Raleigh, North Carolina 27611-7687
(919) 773-0820

Commonwealth of Virginia
Department of Labor and Industry

205 North 4th Street
Post Office Box 12064
Richmond, Virginia 23241
(804) 786-2376

(End of Clause)

1.28 IDENTIFICATION OF GOVERNMENT-FURNISHED PROPERTY

The Government will furnish to the Contractor the property identified in the Schedule below to be incorporated or installed into the work or used in performing the contract. The listed property will be furnished at the _____ (PROJECT LOCATION). The Contractor is required to accept delivery, pay any demurrage or detention charges, and unload transport the property to the job site at its own expense. When the property is delivered, the Contractor shall verify its quantity and condition and acknowledge receipt in writing to the Contracting Officer or his/her designated representative. The Contractor shall also report in writing to the Contracting Officer or his/her designated representative within 24 hours of delivery any damage to or shortage of the property as received. All such property shall be installed or incorporated into the work at the expense of the Contractor, unless otherwise indicated in this contract.

<u>Item No.</u>	<u>Quantity</u>	<u>Designation</u>	<u>Description</u>
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(End of Clause)

1.29 AGGREGATE SOURCES
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(a) Concrete aggregates can be produced from the approved sources listed below:

(1) Sources of fine aggregate. (List the sources in an appropriate manner.)

(2) Sources of coarse aggregate. (List the sources in an appropriate manner.)

(b) Concrete aggregates may be furnished from any of the above listed sources or at the option of the Contractor may be furnished from any other sources designated by the Contractor and approved by the Contracting Officer or his/her designated representative, subject to the conditions hereinafter stated.

(c) After the award of the contract, the Contractor shall designate in writing only one source or combination of sources from which he proposes to furnish aggregates. If the Contractor proposes to furnish aggregates from a source or from sources not listed above he may designate only a single source or single combination of sources for aggregates. Samples for acceptance testing shall be provided as required by SECTION _____, of the Technical Provisions. If a source for coarse or fine aggregate so designated by the Contractor is not approved for use by the Contracting Officer or his/her designated representative, the Contractor may not submit for approval other sources but shall furnish the coarse or fine aggregate, as the case may be, from a listed approved

source at no additional cost to the Government.

(d) Listing of a concrete aggregate source is not to be construed as approval of all material from the source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels, when such materials are unsatisfactory for concrete aggregate as determined by the Contracting Officer or his/her designated representative. Materials produced from an approved source shall meet all the requirements of SECTION _____, of the Technical Provisions of these specifications.

(End of Clause)

1.30 WORK IN QUARANTINED AREA

USACE and the U.S. Department of Agriculture (USDA) have a compliance agreement requiring measures to prevent the spread of certain plant pests that may be present in the soil (USACE ER 1110-1-5). Major portions of all southeastern states are in a quarantine area for such pests, including the imported fire ant. In addition, adjacent states to the north have introduced infestations resulting from movement of soil from infested southeastern states. The Contractor shall thoroughly clean all construction equipment and tools at the previous job site in a manner that ensures that these implements are free from residual soil, egg deposits from plant pests, noxious weeds, and plant seeds. Equipment shall be cleaned using water under pressure, and hand tools shall be thoroughly cleaned by brushing or other means to remove all soil. In addition, all construction equipment and hand tools used for this USACE contract shall be thoroughly cleaned by the Contractor before they are removed from this job site. The Contractor shall consult with the USDA jurisdictional office for additional cleaning requirements that may be necessary.

(End of Clause)

1.31 FINAL AND CONDITIONAL ACCEPTANCE OF GRASSING

When, upon completion of the final construction inspection, the work is found to comply fully with contract plans, specifications, change orders, and modifications, the Contracting Officer or his/her designated representative will give final acceptance, provided a satisfactory stand of grass has been obtained. If, due to the season, satisfactory life and growth of grass cannot be determined when all work is completed, the Contracting Officer or his/her designated representative shall give the Contractor written notice of conditional acceptance. This notice of conditional acceptance will relieve the Contractor of further construction or maintenance work except as noted until the next growing season, at which time he will be required to produce a living and satisfactory stand of grass and apply water and/or fertilizer as required by the Contracting Officer or his/her designated representative to produce a grass cover in full compliance with the intent of these specifications. The Contractor shall maintain adequate erosion control measures during periods of conditional acceptance of grassing.

(End of Clause)

1.32 ACCEPTANCE

(a) Partial Acceptance: If at any time during the prosecution of the project the Contractor completes a portion of the project, such as a bench

cut, in its entirety, he may ask the Contracting Officer or his/her designated representative to make final inspection of such work. If the Contracting Officer or his/her designated representative finds upon inspection that the work conforms to the requirements of the Contract and that acceptance is in the interest of the Government, he may accept the work as being completed, and the Contractor will be relieved of further responsibility for the work, except as noted in paragraph FINAL AND CONDITIONAL ACCEPTANCE OF SEEDED PLANTING and as specified in paragraph Contractor's Responsibility for Work. Partial acceptance shall in no way void or alter any terms of the Contract.

If any damage attributable to causes beyond the control of the Contractor is sustained by the accepted section or portion of the project, the Contracting Officer or his/her designated representative may authorize the Contractor to make necessary repairs as a change to the contract.

(b) Final Acceptance: Upon receipt of a written notice from the Contractor of presumptive completion of the entire project, the Contracting Officer Representative will make an inspection. If all work specified in the Contract has been completed, the inspection will constitute the final inspection and the Contracting Officer or his/her designated representative will make the final acceptance. The Contractor will be notified of final acceptance in writing within 5 days.

If the inspection discloses that any work, in whole or in part, is incomplete or unacceptable, the Contractor shall immediately correct the deficiency. Upon completion or correction of the work, another inspection will be made that will constitute the final inspection. In such event, the Contracting Officer or his/her designated representative will make the final acceptance and the Contractor will be notified of final acceptance in writing within 5 days. In any event, the Contractor shall maintain the project until final acceptance except under conditions that may be specifically exempted.

(End of Clause)

1.33 NCDOT SPECIFICATIONS

The North Carolina Department of Transportation (NCDOT) "Standard Specifications for Roads and Structures English," (hereinafter referred to as the Standard Specifications) applies to this work when so referenced.

(End of Clause)

1.34 DEFINITIONS FOR NCDOT SPECIFICATIONS

Wherever in the North Carolina Department of Transportation "Standard Specifications for Roads and Structures" or on the drawings the following terms are used, the intent shall be as indicated below unless otherwise modified within the specifications:

- State - - - - - U. S. Government
- Department or Department of
- Transportation - - - - - Corps of Engineers
- Engineer or Chief Engineer- - - - - Contracting Officer,
- Corps of Engineers
- Materials and Test Unit - - - - - Corps of Engineers
- Division of Highways- - - - - Corps of Engineers
- Board or Board of Transportation- - - - - Corps of Engineers

Where NCDOT materials and test unit requirements are referenced in these specifications, they shall be taken as such and not Corps of Engineers Standards unless otherwise stated.

(End of Clause)

1.35 ADDITIONAL SURVEY AND SURVEY PERSONNEL REQUIREMENTS

(a) Survey personnel. All quantity surveys required by the Contractor, except those for any periods for which progress payments are requested, shall be made by personnel of a professional engineering and/or surveying firm experienced in the practice of such work including Global Positioning Systems (GPS) surveys. The survey personnel shall have the following minimum qualifications.

(1) Each party chief shall be a Professional Land Surveyor and shall be proficient in the operation of precise and semi-precise instruments. They shall be capable of running horizontal and vertical control of 2nd order accuracy. In the event it is considered advantageous to employ a party chief who is not a Professional Land Surveyor, detailed qualifications of the individual shall be submitted to the Contracting Officer or his/her designated representative for review and approval.

(2) Instrument men shall be proficient in the operation of precise and semi-precise instruments including transit, level, and alidade, and shall prepare all survey notes in a firm and legible manner.

(3) Rodman and chainman. At least one rodman and one chainman, with a minimum of six months prior experience each, shall be assigned to each survey part.

(4) Surveying technicians shall be familiar with all phases of surveys and the North Carolina State plane coordinate system. Also they shall be well versed in the computation and adjustment of horizontal and vertical control of 2nd and 3rd order survey.

(b) Original and final cross sections. Original ground surveys shall be taken prior to any earth moving operations. Final-in-place cross sections shall be taken after grading has been accomplished to the lines and grades required by the plans and specifications. All original and final cross sections made for payment purposes shall be taken on an interval not to exceed 100 feet. The Contractor shall provide original cross sections to the Contracting Officer or his/her designated representative a minimum of 7 days prior to commencement of earth moving operations. Final as-built cross sections shall be provided to the Contracting Officer or his/her designated representative upon completion of work.

(1) Deliverables. The Contractor shall provide ASCII data files containing tab delimited, x,y,z coordinates, point numbers, feature descriptions, etc., for the cross sections, break lines, and spot elevations that were surveyed. Additionally, the Contractor shall provide tab delimited ASCII files of xyz random points data and tab delimited ASCII file of x, y, z, per order breakline point data. The Contractor shall perform adequate quality control to assure there are neither redundant points between the random point file and break line file nor conflicting information between these files. The Contractor shall submit a Bentley InRoads (.dtm) file, version 8xM format. The Contractor shall

also submit a Bentley Microstation (.dgn) file displaying all planimetric features mapped in North Carolina NAD 83 state plane coordinates (feet). Contouring shall be generated from the surface model files with appropriate contour smoothing and shall be included in the Microstation graphics (.dgn) file. The Contractor shall perform adequate quality control to assure contours do not cross. The graphics (.dgn) file shall be a three dimensional file with contours, elevation shots at the true elevation, spillway structures with description and inverts, control points, vegetation lines and other similar features. A Government supplied seed file will be provided. All work shall conform to the A/E/C Standards. Files shall be submitted on a compact disc or via electronic mail. Files for the final as-built surveys shall be provided to the Contracting Officer or his/her designated representative upon completion of work.

(2) Metadata Record. A metadata record for all as-built surveys shall be created using Corpsmet 95. Appropriate information shall be entered in all required fields. The metadata record shall be submitted on compact disc or via electronic mail along with each spatial data deliverable.

(End of Clause)

1.36 PLANT LOCATION

The Contractor's plant shall be arranged and located in areas approved by the Contracting Officer or his/her designated representative. This requirement includes the construction plant; offices; shop and storage buildings; housing facilities and all other equipment and materials needed to construct the project.

(End of Clause)

1.37 PLANT

(a) The Contractor agrees to keep on the job sufficient plant to meet the requirements of the work. The plant shall be in satisfactory operating condition, and capable of safely and efficiently performing the work as set forth in these specifications, and the plant shall be subject to inspection by the Contracting Officer or his/her designated representative at all times.

(b) Dredging by mechanical dredge (clamshell, draglines or dipper) or pipeline dredge with spider barge disposal equipment will be allowed in the contract. Dredged performing work seaward of the COLREGS Demarcation Line shall be by ocean certified

(c) All scows must be kept in good condition, the coamings repaired and the pockets provided with proper doors or appliances to prevent leakage of material.

(d) All pipelines for hydraulic machines must be kept in good condition at all times and any leaks or breaks along their length must be promptly and properly repaired.

(e) No reduction in the capacity of the plant employed on the work shall be made except by written permission of the Contracting Officer or his/her designated representative. The measure of the "capacity of the plant" shall be its actual performance on the work to which these

specifications apply.

(f) Dredging seaward of the COLREGS Demarcation Line shall be by ocean certified hopper dredge and/or ocean certified hydraulic pipeline dredge. Special requirements for hopper dredges, such as turtle deflector devices, inflow baskets, hopper dredge operation, observers, and protocol for recording and reporting the taking of any sea turtle or sturgeon parts, are described in Section 01 57 19: TEMPORARY ENVIRONMENTAL CONTROLS.

(g) All pipelines for hydraulic machines must be kept in good condition at all times and any leaks or breaks along their length must be promptly and properly repaired.

(h) No reduction in the capacity of the plant employed on the work shall be made except by written permission of the Contracting Officer or his/her designated representative. The measure of the "capacity of the plant" shall be its actual performance on the work to which these specifications apply.

(End of Clause)

1.38 PUBLIC CONVENIENCE AND SAFETY

1.38.1 Roads To Be Closed

No road shall be closed to the public by the Contractor until construction of the new facilities infringe upon the public safety or until construction of the new facilities obliterate the existing facilities. The Contractor shall obtain the Contracting Officer's approval before closing any roads. Barricades, danger, warning and detour signs, as required, shall be erected before closing any roads.

1.38.2 Storage of Materials

Materials and equipment shall not be stored within roadway rights-of-way or in such a manner as to pose possible danger or obstruction to the traveling public.

(End of Clause)

1.39 MAINTENANCE DURING CONSTRUCTION

From the first day any work is done, the Contractor shall maintain in an equally satisfactory condition all of the items of work covered by the contract until they are finished, placed in service unfinished, or until all of the work is finally accepted. This maintenance shall be continuous and effective work prosecuted day by day with adequate equipment to the end that roadway and structures are kept in satisfactory and acceptable condition. The Contractor shall be responsible for maintaining all barricades, danger, warning, and detour signs and lights as specified hereinafter. When no pay item for such maintenance is shown in the Bidding Schedule, the cost of maintenance shall be included in the price bid for other pay items, and no separate payment will be made.

1.39.1 Maintenance When Work is Suspended

Maintenance when work is suspended. If construction is suspended for any reason, the Contractor shall place the work in a condition satisfactory to the Contracting Officer or his/her designated representative prior to the initiation of the suspension. The Contractor shall maintain the suspended

work in that condition throughout the period of the suspension. The Contractor shall cease further construction work on the suspended work during the period of the suspension.

1.39.2 Final Mowing

When the work is otherwise completed, and before it is finally accepted, the Contractor shall give the seeded areas a final mowing, as directed by the Contracting Officer or his/her designated representative.

1.39.3 Spilled Materials

The Contractor shall not allow spilled materials to remain on the highways. Spillage sufficient to create a traffic hazard shall be removed immediately. Other light spillage shall be removed daily.

(End of Clause)

1.40 INSPECTION

The Contractor shall furnish, on the request of the Contracting Officer or his/her designated representative, suitable transportation from all points on shore designated by the Contracting Officer or his/her designated representative to and from the various pieces of plant, and to and from all work locations. Should the Contractor refuse, neglect, or delay compliance with this requirement, a vessel may be furnished and maintained by the Contracting Officer or his/her designated representative and the cost thereof will be deducted from any amounts due or to become due the Contractor.

(End of Clause)

The Contractor shall be required:

(a) To furnish, in a time manner on the request of the Contracting Officer or his/her designated representative or any Government inspector, the use of such boats, boatmen, laborers, and material forming a part of the ordinary and usual equipment and crew as may be reasonably necessary in inspecting the work. However, the Contractor shall not be required to furnish such facilities for the surveys prescribed in the clause entitled "FINAL EXAMINATION AND ACCEPTANCE".

(b) To furnish, in a time manner on the request of the Contracting Officer or his/her designated representative or any Government inspector, suitable transportation from all points onshore designated by the Contracting Officer or his/her designated representative to and from the various pieces of plant, and to and from all work locations.

Should the Contractor refuse, neglect, or delay compliance with these requirements, the specific facilities may be furnished and maintained by the Contracting Officer or his/her designated representative and the cost thereof will be deducted from any amounts due or to become due the Contractor.

(End of Clause)

1.41 SIGNAL LIGHTS

The Contractor shall display signal lights and conduct his operations in

accordance with the General Regulations of the Department of the Army and the Coast Guard governing lights and day signals to be displayed by towing vessels, tows on which no signals can be displayed, vessels working on wrecks, dredges, and vessels engaged in laying cables or pipes or vessels involved in submarine or bank protection operations. The Contractor must also be in accordance with those regulations governing lights to be displayed on dredge pipeline and day signals to be displayed by vessels of more than 65 feet in length moored or anchored in a fairway or channel and the passing by other vessels of floating plant working navigable channels, as approved by the Secretary of the Army and Commandant, U.S. Coast Guard.

(End of Clause)

1.42 PARTNERING

In order to most effectively accomplish this contract, the Government proposes to form a cohesive partnership with the Contractor and its subcontractors. This partnership would strive to draw on the strengths of each organization in an effort to achieve a quality project done right the first time, within budget and on schedule. Integral to the partnership would be a joint Contractor/Government effort to settle any disputes that may arise without costly and time consuming litigation. To that end, a non-binding procedure such as the Alternate Dispute Resolution process could be developed and agreed upon by both parties when it is determined to be necessary. This partnership would be bilateral in make-up and participation will be totally voluntary. Any cost associated with developing this partnership will be agreed to by both parties and will be shared equally with no change in contract price.

(End of Clause)

1.43 LOAD RESTRICTIONS

The Contractor shall comply with all legal load restrictions in the hauling of materials on public roads beyond the limits of the project. A special permit will not relieve the Contractor of liability for damage which may result from such hauling. The Contractor shall not operate equipment of such weight or so loaded as to cause damage to drainage structures or the roadway, or to any other type of improvement, either completed or under construction. Hauling of materials over the existing surface shall be limited as directed, and in no case shall legal load limits be exceeded unless permitted in writing. The Contractor shall repair, at his own expense, all damage to the work caused by his equipment.

(End of Clause)

1.44 BARRICADES, DANGER, WARNING, AND DETOUR SIGNS

The Contractor shall provide, erect, and maintain all necessary traffic control devices in substantial conformance to Part VI of the 1988 "Manual on Uniform Traffic Control Devices for Streets and Highways" as published by the U.S. Department of Transportation, Federal Highway Administration, and available from AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO), U. S. DEPARTMENT OF TRANSPORTATION (DOT). This requirement shall include flagman as shown in the manual when necessary and the use of electric flashers as conditions of construction may require during hours of darkness. The Contractor shall take all necessary precautions for protection of the work and for the safety of the

public at or near the site of construction. Signing, barricades, lights, and other devices shall be well maintained and repositioned or removed as the progress of the work requires. No substandard, poorly maintained device will be acceptable. Particular attention shall be given to the following:

1.44.1 Removal of Barricades And Warning Signs

As soon as construction advances to the extent that temporary barricades, and signs such as "Detour", "One Way Traffic," etc. are no longer needed to inform the traveling public, such signs shall be removed promptly.

1.44.2 Replacement of Signs

When new work is necessary during any period of construction or maintenance, necessary signs shall be replaced as are needed to adequately warn and protect the public in accordance with the provisions outlined above. As soon as the project has been accepted for maintenance, all temporary barricades and warning signs shall be removed promptly.

1.44.3 Cost of Protective Devices

Unless otherwise shown in the Bidding Schedule, the cost of furnishing, erecting, maintaining, and removing protective devices will not be paid for as separate bid items. Where the Contractor is required to perform any of these functions, the cost thereof shall be included in the overall bid submitted. Ownership of the temporary warning devices shall remain with the Contractor provided the devices are removed promptly after completion of the work as specified above. If such warning devices are left in place for more than 30 days after the specified time for removal, the Government shall have the right to remove such devices and to claim possession thereof.

(End of Clause)

1.45 PROTECTION OF EXISTING FACILITIES

The Contractor will not be responsible for any alterations to existing structures or utilities except those made by him for his convenience. The Contractor shall protect all existing structures, including bridges, roadway embankments, utilities and improvements from damage, and, in the event of damage as a result of his operations, the Contractor shall be responsible for their repair, restoration, or for all cost of damage resulting therefrom. In addition, the Contractor shall be responsible for any damage to bridge or culvert structures or railway embankments or track caused by the unauthorized excavation or excavation beyond the project dimensions shown on the plans. If the Contractor elects to have alterations made to any existing structure, utility or other improvements for his convenience, he shall make arrangements with the owner of the facility for such alterations and the agreement shall be reviewed and approved by the Contracting Officer or his/her designated representative prior to their alteration.

(End of Clause)

1.46 PLANT LAYOUT DRAWINGS
(1965 APR OCE)

Drawings, in triplicate, showing the layout of the plant the Contractor

proposes to use on the work shall be submitted by the Contractor for review by the Contracting Officer. The drawings shall show the locations of the principal components of the construction plant; offices; shop and storage buildings; housing facilities, if any; and storage areas and yards which the Contractor proposes to construct at the site of the work and elsewhere. The Contractor shall also furnish for review by the Contracting Officer drawings, in triplicate, showing the general features of his aggregate processing plant; aggregate transporting, storage and reclaiming facilities; aggregate rinsing and dewatering plant, if required; coarse aggregate rescreening plant, if required; concrete batching and mixing plant; concrete conveying and placing plant; and when precooling of concrete is required, the cooling plant. The drawings shall appropriately show the capacity of each major feature of the plant including the rated capacity of the aggregate production plant in tons per hour of fine and coarse aggregates; rated capacity of the aggregate transporting, storage and reclaiming facilities; volume of aggregate storage; capacity of cement and pozzolan storage; rated capacity of the concrete batching and mixing plant in cubic yards per hour; rated capacity of the concrete transporting and placing plant in cubic yards per hour; and when used rated capacity of plant for precooling of concrete. Drawings in triplicate showing any changes in plant made during design and erection or after the plant is in operation shall be submitted to the Contracting Officer or his/her designated representative for review. Two sets of the drawings will be retained by the Contracting Officer or his/her designated representative and one set will be returned to the Contractor with comments.

(End of Clause)

1.47 HAUL ROADS
(1985 HQ USACE)

Whenever practical, one-way haul roads shall be used on this contract. Haul roads built and maintained for this work shall comply with the following:

(a) One-way haul roads for off-the road equipment; e.g., belly bumps, scrapers, and off-the-road trucks shall have a minimum usable width of 25 ft. One-way haul roads for over-the-road haulage equipment only (e.g., dump trucks, etc.) may be reduced to a usable width of 15 ft.

When the Contracting Officer or his/her designated representative determines that it is impractical to obtain the required width for one-way haul roads (e.g., a road on top of a levee), a usable width of not less than 10 ft. may be approved by the Contracting Officer or his/her designated representative, provided a positive means of traffic control is implemented. Such positive means shall be signs, signals, and/or signalman and an effective means of speed control.

(b) Two-way haul roads for off-the-road haulage equipment shall have usable width of 60 ft. Two-way haul roads for over-the-road haulage equipment only may be reduced to a usable width of 30 ft.

(c) Haul roads shall be graded and otherwise maintained to keep the surface free from potholes, ruts, and similar conditions that could result in unsafe operation.

(d) Grades and curves shall allow a minimum sight distance of 200 ft. for one-way roads and 300 ft. for two-way roads. Sight distance is

defined as the centerline distance an equipment operator (4.5 ft. above the road surface) can see an object 4.5 ft. above the road surface. When conditions make it impractical to obtain the required sight distance (e.g., ramps over levees), a positive means of traffic control shall be implemented.

(e) Dust abatement shall permit observation of objects on the roadway at a minimum distance of 300 ft.

(f) Haul roads shall have the edges of the usable portion marked with posts at intervals of 50 ft. on curves and 200 ft. maximum elsewhere. Such markers shall extend 6 ft. above the road surface and, for nighttime haulage, be provided with reflectors in both directions.

(End of Clause)

1.48 ASBESTOS - (Occupational Health and Environment)

(a) THE CONTRACTOR IS WARNED THAT EXPOSURE TO AIRBORNE ASBESTOS HAS BEEN ASSOCIATED WITH FOUR DISEASES: LUNG CANCER, CERTAIN GASTROINTESTINAL CANCERS, PLURAL OR PERITONEAL MESOTHELIOMA AND ASBESTOS. Studies indicate there are significantly increased health dangers to persons exposed to asbestos who smoke and further, to family members and other persons who become indirectly exposed as a result of the exposed worker bringing asbestos-laden work clothing home to be laundered.

(b) The Contractor is advised that friable and/or nonfriable asbestos containing material has been identified in area(s) where contract work is to be performed. Friable asbestos containing material means any material that contains more than 1 percent asbestos by weight that hand pressure can crumble, pulverize or reduce to powder when dry. Nonfriable asbestos containing materials do not release airborne asbestos fiber during routine handling and end-use. However, excessive fiber concentrations may be produced during uncontrolled abrading, sanding, drilling, cutting, machining, removal, demolition or other similar activities.

(c) Care must be taken to avoid releasing, or causing to be released, asbestos fibers into the atmosphere where they may be inhaled or ingested. The Occupational Safety and Health Administration (OSHA) has set standards at 29 CFR 1910.1001, for exposure to airborne concentrations of asbestos fibers, methods of compliance, medical surveillance, housekeeping procedures and other measures that must be taken when working with or around asbestos containing materials which release airborne asbestos fibers at concentrations in excess of those established. 29 CFR 1926.58 has been identified as applicable to construction (29 CFR 1926.55 gases, vapors, fumes, dusts and mists). The Environmental Protection Agency (EPA) has established standards at 40 CFR 61.40-40 CFR 61.156 for the control of asbestos emissions to the environment and the handling and disposal of asbestos wastes.

(d) When contract work activities are carried out in locations where the potential exists for exposure to airborne asbestos fibers as described in (b) or where asbestos waste will be generated, the contractor shall assure that all measures necessary to provide effective protection to persons from exposure to asbestos fibers and prevention of contamination to property, materials, supplies, equipment and the internal and external environment are effectively instituted.

(e) As a minimum, the contractor shall comply with the provisions of 29 CFR 1926.58 and 1926.55; 49 CFR 172.101, 172.200-204, 172.316, 49 CFR 173.1090; 40 CFR 61.40-61.156; any state implementing hazardous waste regulation that regulates asbestos as a hazardous waste under the Resources Conservation and Recovery Act (RCRA) requirements and any other applicable federal, state or local requirements.

(f) In addition to the information required in Section 01 35 26, the Contractors Accident Prevention Plan must also fully address the following topics, and at the Contractor's option may include additional information as applicable.

(1) Medical Surveillance: (29 CFR 1926.58(m)).

(2) Employee training: Prior to beginning work in asbestos containing material area(s) (29 CFR 1926.58 and 29 CFR 1910.134).

(3) Respiratory protection: (29 CFR 1926.58(h) and 29 CFR 1910.134).

(4) Personal protective clothing and equipment: (29 CFR 1926.58(i)).

The use of compressed air to remove asbestos from workers' clothing is prohibited. The contractor shall specify the type of change room, wash facilities and laundering facilities as applicable.

(5) Airborne asbestos monitoring: (29 CFR 1926.58(f)). Specify the monitoring and analytical procedures to be used prior to, during, and after completion of contract in areas where asbestos containing materials are located. All asbestos monitoring shall be conducted under the guidance of an industrial hygienist certified by the American board of Industrial Hygiene. Samples shall be analyzed by an American Industrial Hygiene Association (AIHA) accredited laboratory proficient in the analysis of asbestos and asbestos containing materials. Turn around time from end of sampling period to review of results of analyses by Contractor shall be no longer than 72 hours.

(6) Housekeeping: (29 CFR 1926.58(l)). Dry sweeping of contract work areas contaminated with asbestos containing material is prohibited. The Contractor shall specify methods and materials used to package asbestos containing waste and plan to control any accidental airborne release or spill of asbestos containing material.

(7) Methods of Compliance: (29 CFR 1926.58(g)). Contractor shall include procedures relating to engineering controls, local exhaust ventilation, particular tools to be used and work practices (1926.58(g)). Specify methods, materials and equipment to be used to prevent asbestos contamination to property, materials, supplies, equipment and the internal and external environment during maintenance, renovation or other contract activities. Local exhaust ventilation equipment including power operated tools equipped with local exhaust ventilation shall conform with the Standard Fundamentals Governing the Design and operation of Local Exhaust Systems ANSI Z9.2 latest revised edition. Describe the type of high-efficiency filtered (HEPA) vacuum cleaners that shall be used to vacuum asbestos containing materials. Describe methods and materials to be used to assure all asbestos containing material will be thoroughly wetted by use of a wetting agent and water before removal and that airborne asbestos dust will be kept to a minimum.

(8) Methods and materials to be used to decontaminate any property, materials, supplies, equipment and the environment if asbestos contamination results. (29 CFR 1926.58(g)).

(9) Recordkeeping procedures. (29 CFR 1926.58(n) and 1910.20).

(10) Specific description of type of packaging, marking and shipping conveyances to be used to transport asbestos containing waste from the generation point to a storage or disposal facility in compliance with Department of Transportation requirements. (49 CFR 172.101, 172.200-204, 176.316, 173-1090).

(11) Emergency procedures that would be taken if an accident or spill of asbestos containing materials occurs during the transport of asbestos containing waste. (40 CFR 61.140-40 CFR 61.156).

(12) Methods and equipment used to off load and bury asbestos containing waste to control airborne emissions at the burial site. (40 CFR 61.140-40 CFR 61.156).

(g) The Contractor shall complete and return to the Contracting Officer or his/her designated representative within 15 working days after the completion of all airborne asbestos monitoring conducted under this contract, a "Summarization of Airborne Asbestos Sampling Results" form provided by the Government (see Attachment 1). NOTE: This completed summarization form is to be used by the US Army Corps of Engineers for statistical information purposes and does not relieve the contractor from his recordkeeping requirements as described in 29 CFR 1926.58(n) and 29 CFR 1910.20.

(End of Clause)

1.49 RESPONSIBILITY FOR BORROW AREA ACCESS ROAD

Borrow pit locations are shown on the plans. The Contractor shall construct and maintain any access roads required to the pit and when directed by the Contracting Officer or his/her designated representative, obliterate same. No separate payments will be made for construction, maintenance or obliteration of any access roads to, or haul roads from, the pits. All cost shall be included in cost of material removed from the pit and acceptably placed in the project.

(End of Clause)

1.50 CONTRACT AREA AND TRESPASSING

Property owners have signed easements which will allow the Contractor to enter and perform the work required by these specifications upon all land lying within the right-of-way limits shown on the drawings. The Contractor's operation shall be confined solely to those areas for which permission has been granted by the owners to enter. The Contractor shall cut only such timber as may be necessary for the prosecution of the work. The Contractor shall not inflict damage upon land outside the contract area by unwarranted entry upon, passage through, or disposal of material on such land. The Contractor may make a separate agreement with any other party, regarding the use of, or right to, lands or facilities outside the contract area. If such an agreement is made, it shall be in writing and a copy shall be furnished the Contracting Officer or his/her designated

representative. The Contractor shall hold and save the Government, its officers, and agents free from liability of any nature or kind arising from any trespassing or damage occasioned by his operations.

(End of Clause)

1.51 COORDINATION WITH OTHER CONTRACTORS

Other Contractors may be working in the vicinity during the time period of this contract. The Contractor shall coordinate the contract operations with other Contractors in the area as needed to avoid conflicts and delays.

A major rehabilitation project is currently underway and other Contractors will be working in the immediate vicinity during the entire period of this contract. The Contractor shall coordinate contract operations with other Contractors in the area as needed to avoid conflicts and delays. Any potential delays due to conflicts with other contractors shall be reported to the Contracting Officer's Representative immediately.

(End of Clause)

1.52 WORK DAYS AND HOURS

example: John H. Kerr Powerhouse

The Contractor's working hours shall be limited to the following:

Monday thru Thursday, 0700 to 1630 hours

Every other Friday, 0700 to 1530 hours

Unless approved by the Contracting Officer's Representative. The specific dates for the Fridays when work is not permitted will be provided to the contractor at the pre-construction meeting by the Contracting Officer's Representative.

(End of Clause)

1.53 EQUIPMENT TESTING AND INSTRUCTION

(a) The Contractor shall perform full-scale operational testing for a period of 60 days to ensure that each individual piece of equipment and all equipment systems installed under this contract are functioning properly. Tests shall be made in presence of the Contracting Officer's Representative and shall be made using all fluids, solutions, and materials required for actual operation with the exception that clear water will be used for testing components of the wastewater systems which handle wastewater or treated effluents under normal operation.

The Contractor shall notify the Contracting Officer's Representative a minimum of two working days prior to the date that testing is scheduled to begin so that the Contracting Officer's Representative can be present to observe critical phases of testing.

The above sentence is to be used when the required period is so long that it would be unreasonable for the Contracting Officer's Representative or his representative to be present for the full duration of testing. If only a few hours of operational testing are required, it should be done in the presence of the Contracting Officer's Representative.

(b) The Contractor shall make any necessary adjustment to and retest any equipment which fails to perform satisfactorily and in accordance with the contract requirements. The Contractor shall continue to adjust and retest the equipment at no additional cost to the Government until suitable results are obtained.

(c) Portions of the work which include any piece of equipment will not be accepted as substantially complete before the equipment is fully operational both individually and as part of any system in which the piece of equipment is a component.

(d) No less than ninety (90) days prior to the anticipated date of Government acceptance of the work, the Contractor shall furnish a list of spare parts recommended by the equipment manufacturer to be kept on hand at all times by the operator.

(e) No more than thirty (30) days prior to the date the Government takes possession of the work, the Contractor shall make arrangements with the Contracting Officer's Representative to train the anticipated operator of the equipment. As a minimum, the Contractor shall furnish a manufacturer's representative, supplier, or other person thoroughly familiar with the equipment for hours at the site to demonstrate the operation of the equipment to the operator and answer questions pertaining to the equipment. The Contractor shall provide written operational instructions, including a troubleshooting guide, for each system and/or piece of equipment, as applicable, and a list of sources for spare parts and repairs.

(f) The requirements of this paragraph are in addition to any testing and instructional requirements of the technical provisions.

(g) No separate payment will be made to the Contractor for fulfilling the requirements of this section. The work shall be considered incidental to the installation of the various equipment systems.

(End of Clause)

1.54 UNDERWATER DIVING OPERATIONS

All underwater diving activities shall be performed in compliance with EM 385-1-1, dated 30 November 2014.

(End of Clause)

1.55 ENVIRONMENTAL SENSITIVE AREA

The contractor shall be aware that this contract work lies within an environmental sensitive area which may contain significant archaeological resources which must be preserved and not disturbed, if possible. The contractor shall be required to stop work and immediately notify the Contracting Officer or his/her designated representative upon the unearthing and/or discovery of what appear to be archaeological resources. The contractor will be allowed to move to another work area until such time that any archaeological data can be recovered from the particular discovered area. The contractor will not be allowed to return to the affected area until the Contracting Officer or his/her designated representative has given approval. The general location of a known environmental sensitive area within the immediate construction area is identified on the plans. The contractor will be prohibited from doing any

work within this area, except the actual construction of the walkway. No other equipment will be allowed in the environmental sensitive area. Construction within environmental sensitive area will be strictly limited to the construction limits shown in the drawings. No track type equipment will be allowed within environmental sensitive area. The contractor will take all reasonable steps to ensure that the lightest duty and minimum size equipment consistent with the required construction be used within the environmental sensitive area. The contractor shall notify the Contracting Officer or his/her designated representative at least 14 days prior to the start of any ground disturbing activities within the environmental sensitive area. The Government will appoint an archaeologist to monitor the construction within the environmental sensitive area and elsewhere. The contractor will be required to appoint a representative to act as a point-of-contact for archaeological monitoring.

(End of Clause)

1.56 CONTRACT DRAWINGS AND SPECIFICATIONS
(AUG 2000) DFARS 252.236-7001

(a) The Government will provide to the Contractor, without charge, 2 CDs, one (1) set of full-size contract drawings, one(1) set of half-size contract drawings and two (2) sets of contract specifications, except publications incorporated into the technical provisions by reference, in electronic or paper media as chosen by the Contracting Officer or his/her designated representative.

(b) The Contractor shall-

(1) Check all drawings furnished immediately upon receipt;

(2) Compare all drawings and verify the figures before laying out the work;

(3) Promptly notify the Contracting Officer or his/her designated representative of any discrepancies;

(4) Be responsible for any errors that might have been avoided by complying with this paragraph (b); and

(5) Reproduce and print contract drawings and specifications as needed.

(c) In general--

(1) Large-scale drawings shall govern small-scale drawings; and

(2) The Contractor shall follow figures marked on drawings in preference to scale measurements.

(d) Omissions from the drawings or specifications or the misdescription of details of work that are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

(e) The work shall conform to the specifications and the contract drawings identified in Section 00 01 15 LIST OF DRAWINGS.

(End of Clause)

CONTRACT DRAWINGS AND SPECIFICATIONS (AUG 2000)
(AUG 2000) DFARS 252.236-7001(a)

(a) The Government will provide to the Contractor, without charge, one set of contract drawings and specifications, except publications incorporated into the technical provisions by reference, in electronic or paper media as chosen by the Contracting Officer.

(b) The Contractor shall-

- (1) Check all drawings furnished immediately upon receipt;
- (2) Compare all drawings and verify the figures before laying out the work;
- (3) Promptly notify the Contracting Officer of any discrepancies;
- (4) Be responsible for any errors that might have been avoided by complying with this paragraph (b); and
- (5) Reproduce and print contract drawings and specifications as needed.

(c) In general--

- (1) Large-scale drawings shall govern small-scale drawings; and
- (2) The Contractor shall follow figures marked on drawings in preference to scale measurements.

(d) Omissions from the drawings or specifications or the misdescription of details of work that are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

(e) The work shall conform to the specifications and the contract drawings identified in Section 00 01 15 LIST OF DRAWINGS.

(End of clause)

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

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SECTION 01 14 00

WORK RESTRICTIONS
11/11

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 State

"State" when used in reference to states of the United States also includes the Territory of Guam.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Contact Personnel; G

1.3 SPECIAL SCHEDULING REQUIREMENTS

- a. Have materials, equipment, and personnel required to perform the work at the site prior to the commencement of the work.
- b. The Contractor must conduct his operations so as to cause the least possible interference with normal operations of the activity.
- c. Permission to interrupt any Activity roads, railroads, or utility service must be requested in writing a minimum of 15 calendar days prior to the desired date of interruption.
- d. The work under this contract requires special attention to the scheduling and conduct of the work in connection with existing operations. Identify on the construction schedule each factor which constitutes a potential interruption to operations.

1.4 CONTRACTOR ACCESS AND USE OF PREMISES

1.4.1 Activity Regulations

Ensure that Contractor personnel employed on the Activity become familiar with and obey Activity regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. To minimize traffic congestion, delivery of materials must be outside of peak traffic hours (6:30 to 8:00 a.m. and 3:30 to 5:00 p.m.) unless otherwise approved by the Contracting Officer. Wear hard hats in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. Mark Contractor

equipment for identification.

1.4.1.1 Subcontractors and Personnel Contacts

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

1.4.1.2 Identification Badges and Installation Access

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

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

- (1) Delivery companies submitting NCACS applications must only be granted access if the prime Contractor has included the company on a participant's spreadsheet provided in advance to the Contracting Officer. This form must be provided by the Government upon request.
- (2) Delivery companies NOT participating in NCACS must have documentation identifying the destination location (building no., street, etc.), Project title, Contract No., Prime Contractor organization, Bill of Lading & Proof of Citizenship. Otherwise, no access will be allowed.
- (3) For those companies that do not have a bill of lading or proof of citizenship the prime contractor must fill out the Short Term Visitor Request form and provide to the Contracting

Officer no less than 5 workdays prior to the delivery date.

- b. One-Day Passes: Participation in the NCACS is not mandatory, and if the Contractor chooses to not participate, the Contractor's personnel will have to obtain daily passes, be subject to daily mandatory vehicle inspection, and will have limited access to the installation. The Government will not be responsible for any cost or lost time associated with obtaining daily passes or added vehicle inspections incurred by non-participants in the NCACS.

1.4.1.3 Employee List

The Contractor must provide to the Contracting officer, in writing, the names of two designated representatives authorized to request personnel and vehicle passes for employees and subcontractor's employees prior to commencement of work under this contract. The Contractor must adhere to the requirements of "Important Clarifications - Contractors - How to Gain Access," dated 31 October 1995, in obtaining access to the Naval Air Station complex for the life of the contract. A copy of these requirements will be provided at the preconstruction meeting.

1.4.1.4 Personnel Entry Approval

Failure to obtain entry approval will not affect the contract price or time of completion.

1.4.1.5 No Smoking Policy

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

1.4.2 Working Hours

Regular working hours must consist of an 8 1/2 hour period between 7 a.m. and 3:30 p.m., Monday through Friday, and 7 a.m. to 11 p.m. on Saturday, excluding Government holidays.

1.4.3 Work Outside Regular Hours

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

1.4.4 Occupied and Existing Buildings

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

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

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

Relocate movable furniture approximately 6 feet away from the Contractor's working area as required to perform the work, protect the furniture, and replace the furniture in its original location upon completion of the work. Leave attached equipment in place, and protect it against damage, or temporarily disconnect, relocate, protect, and reinstall it at the completion of the work.

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

1.4.5 Utility Cutovers and Interruptions

- a. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required paragraph WORK OUTSIDE REGULAR HOURS.
- b. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.
- c. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, compressed air, are considered utility cutovers pursuant to the paragraph WORK OUTSIDE REGULAR HOURS.
- d. Operation of Station Utilities: The Contractor must not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor must notify the Contracting Officer giving reasonable advance notice when such operation is required.
- e. Connection to Existing Sanitary Sewer Line: Provide positive verification that the existing line conveys sanitary sewer; verify line is not incorrectly connected to a storm drain. Obtain Installation's Sanitary Sewer Connection Permit 2 weeks prior to connection.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

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PRICE AND PAYMENT PROCEDURES
11/11

PART 1 GENERAL

1.1 REFERENCES

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

U.S. ARMY CORPS OF ENGINEERS (USACE)

EP 1110-1-8 (2016) Construction Equipment Ownership
and Operating Expense Schedule

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Earned Value Report; G

1.3 EARNED VALUE REPORT

1.3.1 Data Required

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

1.3.2 Schedule Instructions

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

1.3.3 Real Property Assets

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

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

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

1.3.4 Schedule Requirements for HVAC TAB

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

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

Government. The report is reviewed, and approved, after ensuring compliance with the pre-field engineering report scope of work.

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

1.4 CONTRACT MODIFICATIONS

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

1.5 CONTRACTOR'S INVOICE AND CONTRACT PERFORMANCE STATEMENT

1.5.1 Content of Invoice

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

- a. The Contractor's invoice, furnished by the Government, showing in summary form, the basis for arriving at the amount of the invoice. Invoice shall include certification by Contractor and Quality Control (QC) Manager.
- b. The Earned Value Report from the cost-loaded NAS, showing in detail: the estimated cost, percentage of completion, and value of completed performance for each of the construction categories stated in this contract.
- c. Updated Project Schedule and reports required by the contract.
- d. Contractor Safety Self Evaluation Checklist.
- e. Other supporting documents as requested.
- f. Updated copy of submittal register.
- g. Invoices not completed in accordance with contract requirements will be returned to the Contractor for correction of the deficiencies.

1.5.2 Submission of Invoices

If DFARS Clause 252.232-7006 Wide Area WorkFlow Payment Instructions is included in the contract, provide the documents listed in paragraph CONTENT OF INVOICE in their entirety as attachments in Wide Area Work Flow (WAWF) for each invoice submitted. The maximum size of each WAWF attachment is two megabytes, but there are no limits on the number of attachments. If a document cannot be attached in WAWF due to system or size restriction, provide it as instructed by the Contracting Officer.

1.5.3 Final Invoice

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

1.6 PAYMENTS TO THE CONTRACTOR

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

1.6.1 Obligation of Government Payments

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

- a. Reasonable deductions due to defects in material or workmanship;
- b. Claims which the Government may have against the Contractor under or in connection with this contract;
- c. Unless otherwise adjusted, repayment to the Government upon demand for overpayments made to the Contractor; and
- d. Failure to provide up to date record drawings not current as stated in Contract Clause "FAC 5252.236-9310, Record Drawings."

1.6.2 Payment for Onsite and Offsite Materials

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

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

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

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PROJECT SCHEDULE
02/15

PART 1 GENERAL

1.1 REFERENCES

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

AACE INTERNATIONAL (AACE)

AACE 29R-03	(2011) Forensic Schedule Analysis
AACE 52R-06	(2006) Time Impact Analysis - As Applied in Construction

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1-1-11	(1995) Administration -- Progress, Schedules, and Network Analysis Systems
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preliminary Project Schedule; G
Initial Project Schedule; G
Periodic Schedule Update; G

1.3 SCHEDULE PREPARER

Authorize a representative to prepare the schedule and update and produce reports. The authorized representative shall have at least 2 years experience scheduling construction projects similar in size and nature to this project with scheduling software that meets the requirements of this Section. Representative shall have a comprehensive knowledge of CPM scheduling principles and application.

PART 2 PRODUCTS

2.1 SOFTWARE

The software used to produce and update the required schedules shall meet

the requirements of this Section.

2.1.1.1 Government Default Software

The Government intends to use Primavera P6.

2.1.1.2 Contractor Software

Scheduling software used by the contractor shall be commercially available from the software vendor for purchase with vendor software support agreements available. The software routine used to create the required sdef file shall be created and supported by the software manufacturer.

2.1.1.2.1 Primavera

If Primavera P6 is being used, request a backup file template (.xer) from the Government, if one is available, prior to building the schedule. The following settings are mandatory and required in all schedule submissions to the Government:

- a. Activity Codes shall be Project Level, not Global or EPS level.
- b. Calendars shall be Project Level, not Global or Resource level.
- c. Activity Duration Types shall be set to "Fixed Duration & Units".
- d. Percent Complete Types shall be set to "Physical".
- e. Time Period Admin Preferences shall remain the default "8.0 hr/day, 40 hr/week, 172 hr/month, 2000 hr/year". Set Calendar Work Hours/Day to 8.0 Hour days.
- f. Set Schedule Option for defining Critical Activities to "Longest Path".
- g. Set Schedule Option for defining progressed activities to "Retained Logic".
- h. Set up cost loading using a single lump sum resource. The Price/Unit shall be \$1/hr, Default Units/Time shall be "8h/d", and settings "Auto Compute Actuals" and "Calculate costs from units" selected.
- i. Activity ID's shall not exceed 10 characters.
- j. Activity Names shall have the most defining and detailed description within the first 30 characters.

2.1.1.2.2 Other Than Primavera

If the Contractor chooses software, other than Primavera P6, that is compliant with this Section, provide for the Government's use 2 licenses, 2 computers, and training for 2 Government employees in the use of the software. These computers shall be stand-alone and not connected to Government network. Computers and licenses will be returned at project completion.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Prepare for approval a Project Schedule, as specified herein, pursuant to FAR Clause 52.236-15, SCHEDULE FOR CONSTRUCTION CONTRACTS. Show in the schedule the proposed sequence to perform the work and dates contemplated for starting and completing the schedule activities. The scheduling of the entire project, including the design and construction sequences, is required. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers Designers, subcontractors, and suppliers working on the project shall also contribute in developing and maintaining an accurate project schedule. Provide a schedule that is a forward planning as well as a project monitoring tool. Use the Critical Path Method (CPM) of network calculation to generate all Project Schedules. Prepare each Project Schedule using the Precedence Diagram Method (PDM).

3.2 BASIS FOR PAYMENT AND COST LOADING

The schedule is the basis for determining contract earnings during each update period and therefore the amount of each progress payment. The aggregate value of the activities coded to a Contract Line Item Number (CLIN) shall equal the value of the CLIN.

3.2.1 Activity Cost Loading

Activity cost loading shall be reasonable and without front-end loading. Provide additional documentation to demonstrate reasonableness if requested by the Contracting Officer.

3.2.2 Withholdings / Payment Rejection

Failure to meet the requirements of this Section may result in the disapproval of the schedules or updates and subsequent rejection of payment requests until requirements are met.

If the Contracting Officer directs schedule revisions and those revisions have not been included in subsequent Project Schedule revisions or updates, the Contracting Officer may withhold 10 percent of pay request amount for each payment period until such revisions to the project schedule have been made.

3.3 PROJECT SCHEDULE DETAILED REQUIREMENTS

3.3.1 Level of Detail Required

Develop the Project Schedule to the appropriate level of detail to address major milestones and to allow for satisfactory project planning and execution. Failure to develop the Project Schedule to an appropriate level of detail will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

3.3.2 Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities shall have Original

Durations (OD) greater than 20 work days or 30 calendar days.

3.3.3 Design and Permit Activities

Include design and permit activities with the necessary conferences and follow-up actions and design package submission dates. Include the design schedule in the project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific contract period. Provide at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. Also include review and correction periods associated with each item.

3.3.4 Procurement Activities

Include activities associated with the critical submittals and their approvals, procurement, fabrication, and delivery of long lead materials, equipment, fabricated assemblies, and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days.

3.3.5 Mandatory Tasks

Include the following activities/tasks in the initial project schedule and all updates.

- a. Submission, review and acceptance of SD-01 Preconstruction Submittals (individual activity for each).
- b. Submission, review and acceptance of features require design completion
Submission, review and acceptance of design packages.
- c. Submission of mechanical/electrical/information systems layout drawings.
- d. Long procurement activities
- e. Submission and approval of O & M manuals.
- f. Submission and approval of as-built drawings.
- g. Submission and approval of DD1354 data and installed equipment lists.
- h. Submission and approval of testing and air balance (TAB).
- i. Submission of TAB specialist design review report.
- j. Submission and approval of fire protection specialist.
- k. Submission and approval of Building Commissioning Plan, test data, and reports. Develop the schedule logic associated with testing and commissioning of mechanical systems to a level of detail consistent with the Contract commissioning requirements. Building testing and commissioning tasks shall be completed prior to submission of building commissioning report and subsequent Contract completion.
- l. Air and water balancing.
- m. Building commissioning - Functional Performance Testing.

- n. Controls testing plan submission.
- o. Controls testing.
- p. Performance Verification testing.
- q. Other systems testing, if required.
- r. Contractor's pre-final inspection.
- s. Correction of punch list from Contractor's pre-final inspection.
- t. Government's pre-final inspection.
- u. Correction of punch list from Government's pre-final inspection.
- v. Final inspection.

3.3.6 Government Activities

Show Government and other agency activities that could impact progress. These activities include, but are not limited to: approvals, acceptance, design reviews, environmental permit approvals by State regulators, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

3.3.7 Standard Activity Coding Dictionary

Use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11. This exact structure is mandatory. Develop and assign the Activity Codes to activities as detailed herein. A template SDEF compatible schedule backup file is available on the QCS web site: <http://rms.usace.army.mil>.

The SDEF format is as follows:

Field	Activity Code	Length	Description
1	WRKP	3	Workers per day
2	RESP	4	Responsible party
3	AREA	4	Area of work
4	MODF	6	Modification Number
5	BIDI	6	Bid Item (CLIN)
6	PHAS	2	Phase of work
7	CATW	1	Category of work
8	FOW	20	Feature of work*

*Some systems require that FEATURE OF WORK values be placed in several activity code fields. The notation shown is for Primavera P6. Refer to the specific software guidelines with respect to the FEATURE OF WORK field requirements.

3.3.7.1 Workers Per Day (WRKP)

Assign Workers per Day for the field construction and direct work activities, if directed by the Contracting Officer. Workers per day shall be the average number of workers expected each day to perform a task for the duration of that activity.

3.3.7.2 Responsible Party Coding (RESP)

Assign responsibility code for activities to the Prime Contractor, subcontractor, or Government agency responsible for performing the activity.

- a. Activities coded with a Government Responsibility code include, but are not limited to: Government approvals, Government design reviews, environmental permit approvals by State regulators, Government Furnished Property/Equipment (GFP) and NTP) for phasing requirements.
- b. Activities cannot have more than one Responsibility Code. Examples of acceptable activity code values are: DOR (for the designer of record); ELEC (for the electrical subcontractor); MECH (for the mechanical subcontractor); and GOVT (for USACE).

3.3.7.3 Area of Work Coding (AREA)

Assign Work Area code to activities based upon the work area in which the activity occurs. Define work areas based on resource constraints or space constraints that would preclude a resource, such as a particular trade or craft work crew from working in more than one work area at a time due to restraints on resources or space. Examples of Work Area Coding include different areas within a floor of a building, different floors within a building, and different buildings within a complex of buildings. Activities cannot have more than one Work Area Code.

Some activities do not require a Work Area code. A lack of Work Area coding indicates the activity is not resource or space constrained.

3.3.7.4 Modification Number (MODF)

Assign a Modification Number Code to an activity or sequence of activities added to the schedule as a result of a Contract Modification, when approved by Contracting Officer. Key the Code values to the Government's modification numbering system. An activity can have only one Modification Number Code.

3.3.7.5 Bid Item Coding (BIDI)

Assign a Bid Item Code to the activities, using the CLIN to which the activity belongs, even when an activity is not cost loaded. An activity can have only one BIDI Code.

3.3.7.6 Phase of Work Coding (PHAS)

Assign Phase of Work Code to all activities. Examples of phase of work are design phase, procurement phase, and construction phase, procurement phase and construction phase. Each activity can have only one Phase of Work code.

- a. Code fast-track design and construction phases proposed to allow

filtering and organizing the schedule by fast-track design and construction packages.

- b. If the Contract specifies phasing with separately defined performance periods, identify a Phase Code to allow filtering and organizing the schedule accordingly.

3.3.7.7 Category of Work Coding (CATW)

Assign a Category of Work Code to all activities. Category of Work Codes include, but are not limited to design, design submittal, design reviews, review conferences, permits, construction submittals, procurement, fabrication, weather sensitive installation, non-weather sensitive installation, start-up, and testing activities. Each activity can have only one Category of Work Code.

3.3.7.8 Feature of Work Coding (FOW)

Assign a Feature of Work Code to appropriate activities based on the Definable Feature of Work to which the activity belongs based on the approved quality control plan.

Definable Feature of Work is defined in Section 01 45 00.00 10 QUALITY CONTROL. An activity can have only one Feature of Work Code.

3.3.8 Contract Milestones and Constraints

Milestone activities shall be used for significant project events including, but not limited to, project phasing, project start and end activities, and interim completion dates. The use of artificial float constraints such as "zero free float" or "zero total float" are prohibited.

Mandatory constraints that ignore or affect network logic are prohibited. No constrained dates are allowed in the schedule other than those specified herein. Submit additional constraints to the Contracting Officer for approval on a case-by-case basis.

3.3.8.1 Project Start Date Milestone and Constraint

The first activity in the project schedule shall be a start milestone titled "NTP Acknowledged," which shall have a "Start On" constraint date equal to the date that the NTP is acknowledged.

3.3.8.2 End Project Finish Milestone and Constraint

The last activity in the schedule shall be a finish milestone titled "End Project".

The project schedule shall be constrained to the Contract Completion Date in such a way that if the schedule calculates an early finish, then the float calculation for "End Project" milestone reflects positive float on the longest path. If the project schedule calculates a late finish, then the "End Project" milestone float calculation reflects negative float on the longest path. The Government is under no obligation to accelerate Government activities to support a Contractor's early completion.

3.3.8.3 Interim Completion Dates and Constraints

Constrain contractually specified interim completion dates to show negative float when the calculated late finish date of the last activity in that phase is later than the specified interim completion date.

3.3.8.3.1 Start Phase

Use a start milestone as the first activity for a project phase. The start milestone shall be called "Start Phase X" where "X" refers to the phase of work.

3.3.8.3.2 End Phase

Use a finish milestone as the last activity for a project phase. Call the finish milestone "End Phase X" where "X" refers to the phase of work.

3.3.9 Calendars

Schedule activities on a calendar to which the activity logically belongs. Develop calendars to accommodate Contract-defined work periods, such as a 7-day calendar for Government Acceptance activities, concrete cure times, etc. Develop the default calendar to match the physical work plan with non-work periods identified including weekends and holidays. Develop and assign seasonal calendars to seasonally affected activities.

If an activity is weather-sensitive, assign it to a calendar showing non-work days on a monthly basis, with the non-work days selected at random across the weeks of the calendar, using the anticipated days provided in Contract Clause TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER. The assignment of the non-work days should be over a 7-day week since weather records are compiled on 7-day weeks, which will cause some of the weather related non-work days to fall on weekends.

3.3.10 Open Ended Logic

Only 2 open ended activities are allowed: the first activity "NTP Acknowledged" shall have no predecessor logic, and the last activity "End Project" shall have no successor logic.

Predecessor open-ended logic may be allowed in a time impact analysis upon the Contracting Officer's approval.

3.3.11 Default Progress Data Disallowed

Actual Start and Finish dates shall not automatically update with default mechanisms included in the scheduling software. Updating of the percent complete and the remaining duration of an activity shall be independent functions. Disable program features that calculate one of these parameters from the other. Activity Actual Start (AS) and Actual Finish (AF) dates assigned during the updating process shall match those dates provided in the Contractor Quality Control Reports. Failure to document the AS and AF dates in the Daily Quality Control report will result in disapproval of the Contractor's schedule.

3.3.12 Out-of-Sequence Progress

Activities that have progressed before the preceding logic has been satisfied (Out-of-Sequence Progress) will be allowed only on a

case-by-case basis, subject to Government approval. Propose logic corrections to eliminate Out-of-Sequence Progress or justify not changing the sequencing for approval prior to submitting an updated project schedule. Address Out-of-Sequence Progress and logic changes in the Narrative Report and in the periodic schedule update meetings.

3.3.13 Added and Deleted Activities

Do not delete activities from the project schedule or add new activities to the schedule without approval from the Contracting Officer. Activity ID and description changes are considered new activities and shall not be changed without Contracting Officer approval.

3.3.14 Original Durations

Activity Original Durations (OD) shall be reasonable to perform the work item. OD changes are prohibited unless justification is provided to and approved by the Contracting Officer.

3.3.15 Leads, Lags, and Start to Finish Relationships

Lags shall be reasonable as determined by the Government and not used in place of realistic original durations, shall not be in place to artificially absorb float, or to replace proper schedule logic. Leads (negative lags) and Start to Finish (SF) relationships are prohibited.

3.3.16 Retained Logic

Schedule calculations shall retain the logic between predecessors and successors ("retained logic" mode) even when the successor activity starts and the predecessor activity has not finished (out-of-sequence progress). Software features that, in effect, sever the tie between predecessor and successor activities when the successor has started and the predecessor logic is not satisfied ("progress override") shall not be allowed.

3.3.17 Percent Complete

Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be declared 100 percent complete to allow for proper schedule management.

3.3.18 Remaining Duration

Update the remaining duration for each activity based on the number of estimated work days necessary to complete the activity. Remaining duration may not mathematically correlate with percentage found under Paragraph "Percent Complete", above.

3.3.19 Cost Loading of Closeout Activities

Cost load the "Correction of punch list items from Government pre-final inspection" activities not less than 1 percent of the present Contract value. Activities may be declared 100 percent complete upon the Government's verification of completion and correction of the punch list work identified during Government pre-final inspection(s).

3.3.19.1 As-Built Drawings

If there is no separate CLIN for as-built drawings, cost load the "Submission and approval of as-built drawings" activity not less than \$35,000 or 1 percent of the present Contract value, whichever is greater, up to \$200,000. Activity will be declared 100 percent complete upon the Government's approval.

3.3.19.2 O & M Manuals

Cost load the "Submission and approval of O & M manuals" activity not less than \$20,000. Activity will be declared 100 percent complete upon the Government's approval of all O & M manuals.

3.3.20 Anticipated Adverse Weather

This Paragraph is applicable to contracts with Contract Clause TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER. Reflect the number of anticipated adverse weather delays allocated to a weather-sensitive activity in the activity's calendar.

3.3.21 Early Completion Schedule and the Right to Finish Early

An Early Completion Schedule is an Initial Project Schedule (IPS) that indicates the scope of the required contract work will be completed before the contractually required completion date.

- a. No IPS indicating an Early Completion will be accepted without being fully resource-loaded (including crew sizes and manhours) and the Government agreeing that the schedule is reasonable and achievable.
- b. The Government is under no obligation to accelerate its own work items to ensure that the early completion is met nor is it responsible to modify incremental funding (if applicable) for the project to meet the Contractor's accelerated work.

3.4 PROJECT SCHEDULE SUBMISSIONS

Provide the submissions as described below. The data CD/DVD, reports, and network diagrams required for each submission are contained in Paragraph SUBMISSION REQUIREMENTS. If the Contractor fails or refuses to furnish the information and schedule updates as set forth, the Contractor will be deemed not to have provided an estimate upon which a progress payment can be made.

Review comments made by the Government on the schedules do not relieve the Contractor from compliance with the Contract.

3.4.1 Preliminary Project Schedule Submission

Within 15 calendar days after the NTP is acknowledged, submit the Preliminary Project Schedule defining the planned operations detailed for the first 90 calendar days for approval. The approved Preliminary Project Schedule will be used for payment purposes not to exceed 90 calendar days after NTP. Completely cost load the Preliminary Project Schedule to balance the CLINS shown on the Price Schedule. The Preliminary Project Schedule may be summary in nature for the remaining performance period. It shall be early start and late finish constrained and logically tied as specified. The Preliminary Project Schedule forms the basis for the

Initial Project Schedule specified herein and shall include all of the required plan and program preparations, submissions and approvals identified in the contract (for example, Quality Control Plan, Safety Plan, and Environmental Protection Plan) as well as design activities, planned submissions of early design packages, permitting activities, design review conference activities, and other non-construction activities intended to occur within the first 90 calendar days. Government acceptance of the associated design packages and other specified Program and Plan approvals shall occur prior to planned construction activities. Activity code activities that are summary in nature after the first 90 calendar days with Bid Item code (BIDI), Responsibility Code (RESP), and Feature of Work code (FOW).

3.4.2 Initial Project Schedule Submission

Submit the Initial Project Schedule for approval within 42 calendar days after NTP is issued. The schedule shall demonstrate a reasonable and realistic sequence of activities which represent the work through the entire Contract performance period. In the design-build schedule, include detailed design and permitting activities, including but not limited to, identification of individual design packages, design submission, reviews and conferences; permit submissions and required Government actions; and long lead item acquisition prior to design completion. Also cover in the preliminary design-build schedule the entire construction effort with as much detail as is known at the time but, as a minimum, include the construction start and completion milestones, and detailed construction activities through the dry-in milestone, including activity coding and cost loading. The remaining construction, including cost loading, may be scheduled summary in nature. As the design proceeds and design packages are developed, fully detail the remaining construction activities concurrent with the monthly schedule updating process. Constrain construction activities by Government acceptance of associated designs. When the design is complete, incorporate the remaining detailed construction activities, planned to occur after the dry-in milestone, into the then-approved schedule update. No payment will be made for work items not fully detailed in the Project Schedule.

3.4.2.1 Design Package Schedule Submission

With each design package submitted to the Government, submit a fragment schedule, extracted from the then-current schedule, which covers the activities associated with that Design Package including construction, procurement, and permitting activities.

3.4.3 Periodic Schedule Updates

Update the Project Schedule on a regular basis, monthly at a minimum. Provide a draft Periodic Schedule Update for review at the schedule update meetings as prescribed in Paragraph PERIODIC SCHEDULE UPDATE MEETINGS, below. These updates will enable the Government to assess Contractor's progress. Update the schedule to include detailed construction activities as the design progresses, but not later than the submission of the final un-reviewed design submission for each separate design package. The Contracting Officer may require submission of detailed schedule activities for distinct construction that is started prior to submission of a final design submission, if such activity is authorized.

- a. Update information, including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD), and Percent Complete, is subject

to the approval of the Government at the meeting.

- b. AS and AF dates shall match the dates reported on the Contractor's Quality Control Report for an activity start or finish.

3.5 SUBMISSION REQUIREMENTS

Submit the following items for the Preliminary Schedule, Initial Schedule, and every Periodic Schedule Update throughout the life of the project:

3.5.1 Data CD/DVDs

Provide 2 sets of data CD/DVDs containing the current project schedule, previously submitted schedules in the format of the scheduling software (e.g. .xer), the Narrative Report, and the required Schedule Reports. Label each CD/DVD with the type of schedule (Preliminary, Initial, Update), full Contract number, data date, and file name. Each schedule shall have a unique file name and use project-specific settings.

3.5.2 Narrative Report

Provide a Narrative Report with each schedule submission. The Narrative Report is expected to communicate to the Government the thorough analysis of the schedule output and the plans to compensate for problems, either current or potential, which are revealed through that analysis. At a minimum:

- a. Identify and discuss the work scheduled to start in the next update period.
- b. Describe activities along the 2 most critical paths where the total float is less than or equal to 20 work days.
- c. Describe current and anticipated problem areas, delaying factors, their impact, and an explanation of corrective actions taken or required to be taken.
- d. Identify and explain why activities based on their calculated late dates should have either started or finished during the update period but did not.
- e. Identify and discuss the schedule changes by activity ID and activity name, including what specifically was changed and why the change was needed. At a minimum, include new and deleted activities, logic changes, duration changes, calendar changes, lag changes, resource changes, and actual start and finish date changes.
- f. Identify and discuss out-of-sequence work.

3.5.3 Schedule Reports

Formatting, filtering, organizing, and sorting each schedule report shall be as directed by the Contracting Officer. Typically, reports shall contain Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float, Actual Start Date, Actual Finish Date, and Percent Complete. Provide the reports electronically in .pdf format. Provide _____ set(s) of hardcopy reports as requested by the Contracting Officer. Typical reports that will be requested include:

3.5.3.1 Activity Report

List of the activities sorted according to activity number.

3.5.3.2 Logic Report

List of detailed predecessor and successor activities for every activity in ascending order by activity number.

3.5.3.3 Total Float Report

A list of the incomplete activities sorted in ascending order of total float. List activities which have the same amount of total float in ascending order of Early Start Dates. Do not show completed activities on this report.

3.5.3.4 Earnings Report by CLIN

A compilation of the Total Earnings on the project from the NTP to the data date. This report shall reflect the earnings of activities based on the agreements made in the schedule update meeting. If a complete schedule update has been furnished, this report serves as the basis of determining progress payments. Group activities by CLIN number and sort by activity number. This report shall also provide a total CLIN percent earned value, CLIN percent complete, and project percent complete. The printed report shall contain the following for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Earnings to Date, Earnings this period, Total Quantity, Quantity to Date, and Percent Complete (based on cost).

3.5.3.5 Schedule Log

Provide a Scheduling/Leveling Report generated from the current project schedule being submitted.

3.5.4 Network Diagram

The Network Diagram is required for the Preliminary, Initial, and Periodic Updates. Depict and display the order and interdependence of activities and the sequence in which the work shall be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.4.1 Continuous Flow

Show a continuous flow from left to right with no arrows from right to left. Show the activity number, description, duration, and estimated earned value on the diagram.

3.5.4.2 Project Milestone Dates

Show dates on the diagram for start of project, Contract-required interim completion dates, and Contract completion dates.

3.5.4.3 Critical Path

Show all activities on the critical path. The critical path is defined as the longest path.

3.5.4.4 Banding

Organize activities using the WBS or as otherwise directed to assist in the understanding of the activity sequence. Typically, this flow will group activities by major elements of work, category of work, work area, and/or responsibility.

3.5.4.5 Cash Flow / Schedule Variance Control (SVC) Diagram

With each schedule submission, provide a SVC diagram showing:

- a. Cash Flow S-Curves indicating planned project cost based on projected early and late activity finish dates, and
- b. Earned Value to-date

3.6 PERIODIC SCHEDULE UPDATE

3.6.1 Periodic Schedule Update Meetings

Conduct periodic schedule update meetings, to review the proposed Periodic Schedule Update, Narrative Report, Schedule Reports, and progress payment. Conduct meetings at least monthly, within 5 days of the proposed schedule data date. Provide a computer with the scheduling software loaded and a projector which allows the meeting participants to view the proposed schedule during the meeting. The Contractor's authorized scheduler shall organize, group, sort, filter, perform schedule revisions as needed and review functions as requested by the Contractor and/or Government. The meeting is a working interactive exchange which allows the Government and Contractor the opportunity to review the updated schedule on a real-time and interactive basis. The meeting will last no longer than 8 hours. Provide a draft of the proposed narrative report and schedule data file to the Government at least 2 workdays in advance of the meeting. The Contractor's Project Manager and scheduler shall attend the meeting with the authorized representative of the Contracting Officer. Superintendents, foremen, and major subcontractors shall attend the meeting as required to discuss the project schedule and work. Following the periodic schedule update meeting, make corrections to the draft submission. Include only those changes approved by the Government in the submission and invoice for payment.

3.6.2 Update Submission Following Progress Meeting

Submit the complete Periodic Schedule Update, containing the approved progress, revisions, and adjustments, pursuant to Paragraph SUBMISSION REQUIREMENTS not later than 4 work days after the periodic schedule update meeting.

3.7 REQUESTS FOR TIME EXTENSIONS

Provide a justification of delay to the Contracting Officer, in accordance with the Contract provisions and clauses, for approval within 10 days of a delay occurring. Also prepare a time impact analysis for each Government request for proposal (RFP) to justify time extensions.

3.7.1 Justification of Delay

Provide a description of the event(s) that caused the delay and/or impact

to the work. As part of the description, identify the schedule activities impacted. Show that the event that caused the delay/impact was the responsibility of the Government. Provide a time impact analysis that demonstrates the effects of the delay or impact on the project completion date or interim completion dates. Multiple impacts shall be evaluated chronologically; each with its own justification of delay. With multiple impacts, consider concurrency of delay. A time extension and the schedule fragnet becomes part of the project schedule and future schedule updates upon approval by the Contracting Officer.

3.7.2 Time Impact Analysis (Prospective Analysis)

Prepare a time impact analysis for Government approval based on industry standard AACE 52R-06. Use a copy of the last approved schedule prior to the first day of the impact or delay for the time impact analysis. If the Government determines the time frame between the last approved schedule and the first day of impact is too great, prepare an interim updated schedule to perform the time impact analysis. Unless approved by the Contracting Officer, no other changes will be incorporated into the schedule being used to justify the time impact.

3.7.3 Forensic Schedule Analysis (Retrospective Analysis)

Prepare an analysis for Government approval based on industry standard AACE 29R-03.

3.7.4 Fragmentary Network (Fragnet)

Prepare a proposed fragnet for time impact analysis. The proposed fragnet shall sequence new activities into the project schedule to demonstrate the influence of the delay or impact to the project's contractual dates. Clearly show how the proposed fragnet shall be tied into the project schedule, including the predecessors and successors to the fragnet activities. Obtain Government approval of the proposed fragnet before incorporating it into the project schedule.

3.7.5 Time Extension

Time extensions will not be granted until after the Government has approved the Justification of Delay, including the time impact analysis. No time extension will be granted unless the delay consumes the available Project Float and extends the projected finish date ("End Project" milestone) beyond the Contract Completion Date. The time extension will be in calendar days.

Actual delays that the Government determines are caused by the Contractor's own actions and result in a calculated schedule delay will not be a cause for an extension to the performance period, completion date, or interim milestone date.

3.7.6 Impact to Early Completion Schedule

No extended overhead will be paid for delay prior to the original Contract Completion Date for an Early Completion IPS unless the Contractor actually performed work in accordance with that Early Completion Schedule. Show that an early completion was achievable had it not been for the impact.

3.8 FAILURE TO ACHIEVE PROGRESS

If the progress falls behind the approved project schedule for reasons other than those that are excusable within the terms of the Contract, the Contracting Officer may require submittal of a written recovery plan for approval. The plan shall detail how progress shall be recovered, including which activities will be accelerated by adding additional crews, longer work hours, extra work days, etc.

3.8.1 Artificially Improving Progress

Artificially improving progress by means such as, but not limited to, revising the schedule logic, modifying or adding constraints, shortening activity durations, or changing calendars in the project schedule is prohibited. Indicate assumptions made and the basis for logic, constraint, duration, and calendar changes used in the creation of the recovery plan. Additional resources, manpower, and daily and weekly work hour changes proposed shall be evident at the work site and documented in the daily report along with the Schedule Narrative Report.

3.8.2 Failure to Perform

Failure to perform work and maintain progress in accordance with the supplemental recovery plan may result in an interim and final unsatisfactory performance rating and/or may result in corrective action directed by the Contracting Officer pursuant to FAR 52.236-15 "Schedules for Construction Contracts", FAR 52.249-10 "Default (Fixed-Price Construction)", and other Contract provisions.

3.9 WEEKLY PROGRESS MEETINGS

Conduct a weekly meeting with the Government (or as otherwise mutually agreed to) between the meetings described in Paragraph PERIODIC SCHEDULE UPDATE MEETINGS, for the purpose of jointly reviewing the actual progress of the project as compared to the planned progress and to review planned activities for the upcoming 2 weeks. Use the current approved schedule update for the purposes of this meeting and for the production and review of reports. At the weekly progress meeting, address the status of RFIs, RFPs, and Submittals.

3.10 OWNERSHIP OF FLOAT

Except for the provisions in Paragraph IMPACT TO EARLY COMPLETION SCHEDULE, float available in the schedule shall not be considered for the exclusive use of either the Government or the Contractor, including activity and project float. Activity float is the number of work days that an activity can be delayed without causing a delay to the "End Project" finish milestone. Project float (if applicable) is the number of work days between the projected early finish and the Contract completion date milestone.

3.11 TRANSFER OF SCHEDULE DATA INTO RMS/QCS

Import the schedule data into the Quality Control System (QCS) and export the QCS data to the Government. This data is considered to be additional supporting data in a form and detail required by the Contracting Officer pursuant to FAR 52.232-5 "Payments under Fixed-Price Construction Contracts". The receipt of a proper payment request pursuant to FAR 52.232-27 "Prompt Payment for Construction Contracts" is contingent upon

the Government receiving both acceptable and approvable hard copies and matching electronic export from QCS of the application for progress payment.

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SUBMITTAL PROCEDURES

05/11

PART 1 GENERAL

1.1 SUMMARY

The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective Sections.

Units of weights and measures used on submittals shall be the same as those used in the Contract Drawings.

Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with Contract requirements.

Contractor's Quality Control (CQC) System Manager and the Designer of Record (DOR) shall check and approve items prior to submittal and stamp, sign, and date indicating action taken. Clearly identify proposed deviations from the Contract. Within the submittals, include items such as Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals.

Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Pick up and dispose of samples not incorporated into the work in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

1.2 DEFINITIONS

1.2.1 Submittal Descriptions (SD)

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

SD-01 Preconstruction Submittals

Submittals which are required prior to start of construction (work) or the start of the next major phase of the construction on a multi-phase contract, includes schedules, tabular list of data, or tabular list including location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

Certificates of insurance

Surety bonds

List of proposed subcontractors

List of proposed products

Construction progress schedule

Network Analysis Schedule (NAS)

Submittal register

Schedule of prices

Health and safety plan

Work plan

Quality Control(QC) plan

Construction Waste Management Plan

Indoor Air Quality Plan

Environmental protection plan

SD-02 Shop Drawings

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

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

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

SD-03 Product Data

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

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

SD-04 Samples

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

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

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

SD-05 Design Data

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

Design submittals, design substantiation submittals, and extensions of design submittals.

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 shall have been within 3 years of date of Contract award for the project.)

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

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

Investigation reports

Daily logs and checklists

Final acceptance test and operational test procedure

SD-07 Certificates

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

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

Confined space entry permits

Text of posted operating instructions

SD-08 Manufacturer's Instructions

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

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with

manufacturer's standards or instructions. The documentation shall be signed by an authorized official of a testing laboratory or agency and shall state the test results and indicate whether the material, product, or system has passed or failed the test.

Factory test reports

SD-10 Operation and Maintenance Data

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

This data shall be incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

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

Final submittals registered for Third Party Certification (TPC)

Special requirements necessary to properly close out a construction contract, such as as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

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

1.2.2 Approving Authority

Office or designated person authorized to approve submittal.

1.2.3 Work

As used in this section, on- and off-site construction required by Contract documents, including labor necessary to produce submittals, except those SD-01 Preconstruction Submittals noted above, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Submittal Register; G

1.4 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.4.1 Designer of Record Approved (DA)

DOR approval is required for extensions of design, critical materials, deviations from the solicitation, the accepted proposal, or the completed design, equipment whose compatibility with the entire system shall be checked, and other items as designated by the Contracting Officer. Within the terms of Contract Clause "Specifications and Drawings for Construction", they are considered to be "shop drawings". Provide the Government with the designated number of copies of DOR-approved submittals. The Government may review DOR-approved submittals for conformance to the Solicitation, Accepted Proposal, and the completed design. The Government will review submittals designated as deviating from the Solicitation or Accepted Proposal, as described below.

1.4.2 Government Approved

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

1.4.3 Designer of Record Approved/Government Conformance Review (DA/CR)

1.4.3.1 Deviations to the Accepted Design

DOR approval and the Government's concurrence are required for proposed deviations from the accepted design which still complies with the Contract before the Contractor is authorized to proceed with material acquisition or installation. Within the terms of Contract Clause "Specifications and Drawings for Construction", they are considered to be "shop drawings". If necessary to facilitate the project schedule, the Contractor and the DOR may discuss a submittal proposing a deviation with the Contracting Officer's Representative (COR) prior to officially submitting it to the Government. However, the Government reserves the right to review the submittal before providing an opinion. The Government will not formally agree to or provide a preliminary opinion on a deviation without the DOR's approval or recommended approval. The Government reserves the right to non-concur with deviations from the design, which may impact furniture, furnishings, equipment selections, or operations decisions that were made, based on the reviewed and concurred design.

1.4.3.2 Substitutions

Unless prohibited or provided for otherwise elsewhere in the Contract, where the accepted Contract proposal named products, systems, materials, or equipment by manufacturer, brand name, model number, or other specific identification, and the Contractor desires to substitute manufacturer or model after award, submit a requested substitution for Government concurrence. Include substantiation, identifying information, and the DOR's approval, as meeting the Contract requirements and that it is equal in function, performance, quality, and salient features to that in the

accepted Contract proposal. If the Contract otherwise prohibits substitutions of equal named products, systems, materials, or equipment by manufacturer, brand name, model number, or other specific identification, the request is considered a "variation" to the Contract. Variations are discussed below in Paragraphs "Designer of Record Approved/Government Approved" and "VARIATIONS".

1.4.4 Designer of Record Approved/Government Approved (DA/GA)

In addition to the above stated requirements for proposed deviations to the accepted design, both the DOR and Government Approval and, where applicable, a contract modification are required before the Contractor is authorized to proceed with material acquisition or installation of proposed variations to the Contract (the solicitation and the accepted proposal), which constitutes a change to the Contract terms. Within the terms of Contract Clause "Specifications and Drawings for Construction", they are considered to be "shop drawings". The Government reserves the right to accept or reject such proposed deviations at its discretion.

1.4.5 Information Only

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

1.4.6 Sustainability Submittals (S)

Submittals for Third Party Certification (TPC) are indicated with an "S" designation. These submittals for use as specified in Section 01 33 29 SUSTAINABILITY REPORTING. Schedule submittals for these items throughout the course of construction as provided. Do not wait until closeout.

1.5 TRANSMITTAL FORM

Use the transmittal form (ENG Form 4025) for submitting both Government approved and information only submittals in accordance with the instructions on the form. The form is included in the Quality Control System (QCS) software required by this Contract. Properly complete this form by filling out each heading blank spaces and identifying each item submitted. Ensure proper listing of the Specification Paragraph and sheet number of the Contract Drawings pertinent to the data submitted for each item.

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of Copies of SD-02 Shop Drawings

Submit copies of submittals of shop drawings requiring review and approval by either the QC organization or the Contracting Officer.

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

Submit in compliance with quantity requirements specified for shop drawings.

1.6.3 Number of Samples SD-04 Samples

- a. Submit 2 samples, or 2 sets of samples showing range of variation, of

each required item. One approved sample or set of samples will be retained by approving authority and one will be returned to Contractor.

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

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

Submit in compliance with quantity requirements specified for shop drawings.

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

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

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

Submit 3 copies of O&M Data to the Contracting Officer for review and approval.

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

Unless otherwise specified, submit 3 sets of administrative submittals.

1.7 INFORMATION ONLY SUBMITTALS

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

1.8 VARIATIONS

Variations from Contract requirements require both DOR and Government approval pursuant to Contract Clause FAR 52.236-21 and will be considered where advantageous to Government.

1.8.1 Considering Variations

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

of the variation as a Value Engineering Change Proposal (VECP).

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

1.8.2 Proposing Variations

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

Check the column "variation" of ENG Form 4025 for submittals which include proposed deviations requested by the Contractor. Set forth in writing the reasons for deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

1.8.3 Warranting That Variations Are Compatible

When delivering a variation for approval, the Contractor, including its DORs, warrants that this Contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.8.4 Review Schedule Is Modified

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

1.9 SUBMITTAL REGISTER

Prepare and maintain submittal register, as the work progresses. Do not change data which is output in columns (c), (d), (e), and (f) as delivered by Government; retain data which is output in columns (a), (g), (h), and (i) as approved. A submittal register showing items of equipment and materials for which submittals are required by the Specifications is attached. This list may not be all-inclusive and additional submittals may be required. Maintain a submittal register for the project in accordance with Section 01 45 00.00 10 QUALITY CONTROL. The Government will provide the initial submittal register in electronic format with the following fields completed, to the extent that will be required by the Government during subsequent usage.

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

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

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

Thereafter, track the submittals by maintaining a complete list, including completion of each data column and the dates on which submittals are received and returned by the Government.

The DOR shall develop a complete list of submittals during design and identify required submittals in the specifications, and use the list to prepare the Submittal Register. The list may not be all-inclusive and additional submittals may be required by other parts of the Contract. Complete the submittal register and submit it to the Contracting Officer for approval within 30 calendar days after Notice to Proceed. The approved submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the Contract period. Coordinate the submit dates and need dates with dates in the Contractor-prepared progress schedule. Submit monthly or until the submittals have been satisfactorily completed, updates to the submittal register showing the Contractor action codes and actual dates with Government action codes. Revise the submittal register when the progress schedule is revised and submit both for approval.

1.9.1 Use of Submittal Register

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

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

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

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

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

1.9.2 Contractor Use of Submittal Register

Update the following fields in the Government-furnished submittal register program or equivalent fields in program utilized by Contractor with each submittal throughout Contract.

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

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

Column (l) List date of submittal transmission.

Column (q) List date approval received.

1.9.3 Approving Authority Use of Submittal Register

Update the following fields in the Government-furnished submittal register program or equivalent fields in program utilized by Contractor.

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

Column (l) List date of submittal receipt.

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

Column (q) List date returned to Contractor.

1.9.4 Copies Delivered to the Government

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

1.10 SCHEDULING

Schedule and submit concurrently submittals covering component items forming a system or items that are interrelated. Include certifications to be submitted with the pertinent drawings at the same time. No delay damages or time extensions will be allowed for time lost in late submittals. An additional 10 calendar days will be allowed and shown on the register for review and approval of submittals for food service equipment and refrigeration and HVAC control systems.

- a. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work is not delayed by submittal processing. Allow for potential resubmittal of requirements.
- b. Submittals required by the Contract will be listed on the register. If a submittal is called for but does not pertain to the Contract work, include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the Contract documents but which have been omitted from the register or marked "N/A".
- c. Re-submit register and annotate monthly with actual submission and approval dates. When the items on the register have been fully approved, no further re-submittal is required.
- d. Carefully control procurement operations to ensure that each submittal is made on or before the submittal date shown on the approved Submittal Register.

1.11 GOVERNMENT APPROVING AUTHORITY

When approving authority is Contracting Officer, the Government will:

- a. Note date on which submittal was received.
- b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with Contract documents.
- c. Identify returned submittals with one of the actions defined in Paragraph "Review Notations" and with markings appropriate for action indicated.

Upon completion of review of submittals requiring Government approval, stamp and date approved submittals. An electronic copy of the approved submittal will be retained by the Contracting Officer and returned to the Contractor. If the Government performs a conformance review of other DOR-approved submittals, the submittals will be so identified and returned, as described above.

1.11.1 Review Notations

Contracting Officer review will be completed within 21 calendar days after date of submission. Submittals will be returned to the Contractor with the following notations:

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

1.12 DISAPPROVED OR REJECTED SUBMITTALS

Make the corrections required by the Contracting Officer. If the Contractor considers a correction or notation on the returned submittals to constitute a change to the Contract, notify the Contracting Officer as required under Contract Clause "Changes". Contractor is responsible for the dimensions, design of connection details, and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.

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

1.13 APPROVED/ACCEPTED SUBMITTALS

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

Approval or acceptance will not relieve the Contractor of the

responsibility for errors which may exist, as the Contractor is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of the work design, dimensions, design extensions, such as the design of adequate connections and details, etc., and the satisfactory construction of the work.

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

1.14 APPROVED SAMPLES

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

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

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

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

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

1.15 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained. No payment for materials incorporated in the work will be made if the required DOR and Government approvals have not been obtained. No payment will be made for materials incorporated into the work for conformance review submittals or information only submittals found to contain errors or deviations from the Solicitation or Accepted Proposal.

1.16 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets Contract requirements shall be similar to the following:

CONTRACTOR (Firm Name)
_____ Approved
_____ Approved with corrections as noted on submittal data and/or attached sheets(s)
SIGNATURE: _____
TITLE: _____
DATE: _____

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

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SECTION 01 33 29

SUSTAINABILITY REPORTING

02/17

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SECTION 01 33 29

SUSTAINABILITY REPORTING
02/17

PART 1 GENERAL

1.1 REFERENCES

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

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

ASHRAE 52.2 (2012; Errata 2013; INT 1 2014) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

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

ASTM INTERNATIONAL (ASTM)

ASTM D5149 (2002) Standard Test Method for Ozone in the Atmosphere: Continuous Measurement by Ethylene Chemiluminescence

ASTM D5197 (2016) Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology)

ASTM D6866 (2018) Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis

CALIFORNIA AIR RESOURCES BOARD (CARB)

(ATCM) Airborne Toxic Control Measure (ATCM) Reduce Formaldehyde Emissions from Composite Wood Products Regulation, Phase II, ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH/EHLB/Standard Standard Method (SM) for Testing and Evaluation from Indoor Sources Using Environmental Chambers V1.1-2010 and v1.2-2017, Section 8

FOREST STEWARDSHIP COUNCIL (FSC)

FSC STD 01 001 (2015) Principles and Criteria for Forest Stewardship

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 4224 Ambient Air-determination Of Carbon Monoxide-nondispersive Infrared Spectrometric Method

ISO 7708 Air quality -- Particle Size Fraction Definitions For Health-Related Sampling

ISO 13964 (1998) Air Quality - Determination Of Ozone In Ambient Air - Ultraviolet Photometric Method

ISO 14025 (2006) Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures

ISO 14040 (2006) Environmental Management, Lifecycle Assessment Principles and Framework

ISO 14044 (2006) Environmental Management Lifecycle Assessment Requirements and Guidelines

ISO 14071 (2006) Environmental Management Lifecycle Assessment Requirements and Guidelines

ISO 16000-3 (2011) Indoor air -- Part 3: Determination Of Formaldehyde And Other Carbonyl Compounds In Indoor Air And Test Chamber Air -- Active Sampling Method

ISO 16000-6 (2011) Indoor Air -- Part 6: Determination Of Volatile Organic Compounds In Indoor And Test Chamber Air By Active Sampling On Tenax TA Sorbent, Thermal Desorption And Gas Chromatography Using MS or MS-FID

ISO 21930 (2007) Sustainability in Building Construction - Environmental Declaration of Building Products

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

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

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1113 (2016) Architectural Coatings

UNITED NATIONS GLOBALLY HARMONIZED SYSTEM OF CLASSIFICATION AND
LABELLING OF CHEMICALS (GHS)

(GHS) (2015) Classification and Labeling
Chemicals revision 6

U.S. DEPARTMENT OF ENERGY (DOE)

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

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

IP-1 Analysis of Total Volatile Organic
Compounds

IP-3 Analysis of Carbon Monoxide

IP-10 Analysis of Particulates

TO-1 Compendium Method: Determination of
Volatile Organic Compounds

TO-11 Compendium of Methods for the
Determination of Toxic Organic Compounds
in Ambient Air: Determination of
Formaldehyde in Ambient Air

TO-17 Compendium Method: Determination of
Volatile Organic Compounds in Ambient Air

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED BDC Ref Guide (2013) USGBC LEED Reference Guide for
Building Design and Construction, v4
(2019) USGBC LEED Getting Started Guide,
V4.1 (BETA)

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

40 CFR 247 Comprehensive Procurement Guideline for
Products Containing Recovered Materials

1.2 SUMMARY

This specification includes general requirements and procedures for this project to be constructed and verified per the Third Party Certification (TPC) requirements, UFC 1-200-02 High Performance and Sustainable Building Requirements, and other requirements identified in this specification.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preliminary High Performance and Sustainable Building Checklist; G, S

Sustainability Action Plan; G, S

Preliminary Sustainability eNotebook; G, S

SD-11 Closeout Submittals

Final High Performance and Sustainable Building Checklist; G, S

Final Sustainability eNotebook; G, S

Amended Final Sustainability eNotebook; G, S

Amended Final High Performance and Sustainable Building Checklist; G, S

Third Party Certification Validation; G, S

1.4 GUIDING PRINCIPLES VALIDATION (GPV)

1.4.1 Sustainability Action Plan

Include the following information in the Sustainability Action Plan:

- a. Planned method to achieve each construction related GP requirement.
- b. Name and contact information for: Point of Contact (POC) responsible for ensuring sustainability goals are accomplished and documentation is assembled. For TPC that include on-site visit by third party representative, provide list of required attendees.
- c. Include the Indoor Air Quality plan with the Sustainability Action Plan.

1.4.2 Third Party Certification (TPC) Documentation

This project has been designed for, and must be constructed to be able to attain a sustainability rating of LEED BDC Ref Guide Certification. Project is not registered with the TPC Organization and will not seek certification. Provide construction related sustainability documentation, in the format required by the TPC Organization, to the Contracting Officer for approval, and for final approval by the USACE reviewers. Third Party Certification is met when Government receives USACE reviewer validation. Execute the following:

- a. Refer to TPC Checklist at the end of this specification section. (Multiple checklists indicate multiple buildings that require TPC.)
- b. Immediately bring to the attention of the Contracting Officer any project changes that impact meeting the approved TPC Requirements for this project.
- c. Complete all work required to incorporate the applicable TPC

Requirements.

- d. Maintain the construction related information, and provide replacement pages, in the Sustainability eNotebook pertaining to additions and changes to the approved sustainability requirements. Maintain the Sustainability eNotebook in electronic format. For more explanation, refer to paragraph SUSTAINABILITY eNOTEBOOK. Provide the following components in the Sustainability eNotebook, in addition to the GPV components above:
 - (1) TPC Checklist
 - (2) Completed TPC documentation for each identified requirement. Forward to the Contracting Officer for approval.
 - (3) Copy of all correspondence with the TPC organization.
- e. Provide the following information in the Sustainability Action Plan. Provide this TPC information in addition to the GPV Action Plan items above:
 - (1) Planned method to achieve each TPC requirement.
 - (2) For each TPC requirement that is attempted but not achieved, provide narrative explaining how mission or activity precludes achieving specific sustainability requirement or goal. Provide analysis of particular requirement and level to which project is able to comply.
 - (3) Provide name and contact information for: Sustainability Point of Contact (POC) and other names of sustainability professionals responsible for ensuring TPC sustainability goals are accomplished and documentation is assembled.
- f. Bear all costs associated with constructing, demonstrating, and documenting that project complies with approved TPC requirements, including but not limited to:
 - (1) TPC coordination with Government's AE and other consultants, and management for construction related documentation.
 - (2) Construction work required to incorporate TPC requirements.
 - (3) Submittals required to demonstrating compliance with Government approved TPC checklists.
 - (4) Documentation illustrating compliance with TPC requirements and additional documentation required by the TPC.
- g. Provide all calculations, product data, and certifications, assessments, or validations required in this contract to demonstrate compliance with the TPC Requirements of this section.
- h. Provide all offline TPC management and documentation.

1.5 SUSTAINABILITY SUBMITTALS

1.5.1 "S" Submittals for Sustainability Documentation

Submit the TPC sustainability documentation required in this specification as "S" submittals in all affected UFGS Sections.

- a. Highlight TPC compliance data in "S" submittal.
- b. Add "S" submittals to the Sustainability eNotebook only after submittal approval, and bookmark them as required in paragraph SUSTAINABILITY eNOTEBOOK below.
- c. Ensure all approved "S" submittals (the sustainability documentation requirements) are included in each Sustainability eNotebook submittal.

1.5.2 Sustainability eNotebook

The Sustainability eNotebook is an electronic organizational file that serves as a repository for all required sustainability submittals. To support documentation of compliance with an approved TPC checklist, provide and maintain a comprehensive and current Sustainability eNotebook. Sustainability eNotebook must contain all required data to support full compliance with the LEED BDC Ref Guide Requirements, including:

- a. TPC checklist
- b. Sustainable Action Plan
- c. Calculations
- d. Labels
- e. "S" submittals (sustainability documentation requirements)
- f. Certifications, assessments, or validations
- g. TPC documentation required in paragraph THIRD PARTY CERTIFICATION (TPC) above.

Provide sustainability eNotebook in the form of an Adobe PDF file; bookmark each TPC requirement, and sub-bookmark at each document. Match format to TPC numbering system indicated herein. Maintain up-to-date information, spreadsheets, templates, and other required documentation with each current submittal.

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

1.5.2.1 Sustainability eNotebook Submittal Schedule

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

- a. Preliminary Sustainability eNotebook

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

Sustainable Building Checklist and TPC checklist.

- b. Construction Progress Meetings. Provide up-to-date TPC documentation in the Sustainability eNotebook for each meeting.
- c. Final Sustainability eNotebook

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

- d. Amended Final Sustainability eNotebook

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

1.6 DOCUMENTATION REQUIREMENTS

- a. Incorporate each of the following LEED BDC Ref Guide Requirements into project construction; and provide documentation that proves compliance with each listed requirement. For life-cycle cost analysis requirements, one document with all analyses is acceptable, with Contracting Officer approval.
- b. For each of the following paragraphs that require the use of products listed on Government-required websites, provide documentation of the process used to select products, or process used to determine why listed products do not meet project performance requirements.

1.6.1 Commissioning

Submit approved Final Commissioning Report required by Section 01 91 00.00 37 COMMISSIONING as proof of this tracking requirement.

1.6.2 Exterior Lighting

Provide exterior lighting complying with Backlight, Uplight and Glare requirements within the LEED BDC Ref Guide.

1.6.3 Energy Efficient Products

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

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

1.6.4 Indoor Water Use

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

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

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

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

Provide certifications or labels that demonstrate compliance with cited requirements.

Provide paints, coatings, adhesives and sealants that do not contain methylene chloride and perchloroethylene.

1.6.6 Indoor Air Quality During Construction

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

For new construction and for renovation of unoccupied existing buildings, indoor air quality plan must meet the requirements of ASHRAE 189.1 Section 10.3.1.4. (Indoor Air Quality (IAQ) Construction Management), with maximum outdoor air consistent with achieving relative humidity no greater than 60 percent. In addition, comply with ANSI/SMACNA 008 IAQ Guidelines for Occupied Buildings Under Construction.

Provide temporary filtration media during construction rated for minimum efficiency reporting value (MERV) of 8 minimum, in accordance with ASHRAE 52.2.

Provide permanent filtration after construction is complete and prior to occupancy rated for a minimum efficiency reporting value (MERV) of 13 minimum, in accordance with ASHRAE 52.2.

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

Provide documentation showing that IAQ testing was completed in accordance with the cited standards.

1.6.7 Environmental Product Declarations

Provide documentation for at least 20 products from at least five different manufacturers which have product disclosures conforming to one of the following, and including declarations for at least cradle to gate scope:

- a. Product-specific declaration that is publicly available, critically reviewed, with life-cycle assessment conforming to ISO 14044 at a minimum: Contribute to LEED MR credit calculations as one whole product.
- b. Environmental Product Declaration: Conform to ISO 14025 ISO 14040 and ISO 14044 and Product Category Rules (PCR) standard EN 15804 or ISO 21930.
 - (1) Product-specific Type III EPD that is internally reviewed with LCA in accordance with ISO 14071: Contribute to LEED MR credit calculations as one whole product.
 - (2) Product-specific Type III EPD that is externally verified and reviewed: Contribute to LEED MR credit calculations as one and a half (1.5) products. For those that are externally reviewed only, contribution is one whole product.
 - (3) Industry-wide (generic) Type III EPD that is externally verified and which the manufacturer is recognized as participant by the program operator: Contribute to LEED MR credit calculations as one whole product.

Provide documentation showing that building flushout was performed and IAQ flushout was completed in accordance with the cited standards.

1.6.8 Sourcing of Raw Materials - General

Provide products with a total material cost value of at least 40% by cost, of the total value of permanently installed building products in the project.

Products complying with articles 1.6.9, 1.6.10, 1.6.11 1.6.12 and regionally extracted, manufactured and purchased may contribute at 200% of the material cost value. The regional location(s) must be within 100 miles of the project site.

1.6.9 Sourcing of Raw Materials - Recycled Content

Comply with 40 CFR 247. Refer to <https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program> for assistance identifying products cited in 40 CFR 247. Selected products must comply with non-proprietary requirements of the Federal Acquisition Regulation, and must meet performance requirements. Products are valued at 100% of material cost value. Provide the following documentation:

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

- c. In order to complete compliance with FAR 52.223-9 Estimate of Percentage of Recovered Material Content for EPA Designated Items, refer to submittal requirement for recycled/recovered material content in Section 01 78 00.00 37.

1.6.10 Sourcing of Raw Materials - Bio-Based Products

Provide products and material composed of the highest percentage of biobased materials (including rapidly renewable resources and certified sustainably harvested products), tested using ASTM D6866 Test Method, to the maximum extent possible without jeopardizing the intended end use or detracting from the overall quality delivered to the end user. Use only supplies and materials of a type and quality that conform to applicable specifications and standards. Products are valued at 100 percent of material if they meet sustainable Agriculture Network's Sustainable Agriculture Standard. Otherwise, products are valued at 50 percent of material cost value.

Selected products must comply with non-proprietary requirements of the Federal Acquisition Regulation, and must meet performance requirements. Provide the following documentation:

- a. Provide bio-based content and percentage as determined through ASTM Test Method D6866.

1.6.11 Sourcing of Raw Materials - Extended Producer Responsibility Program

Provide products from manufacturers who have measures to recover or recycle materials at the end of the useful life of the product for use in new products, to the maximum extent possible without jeopardizing the intended end use or detracting from the overall quality delivered to the end user. Such programs are also known as closed-loop programs or product take-back programs. Products are valued at 50 percent of material cost value. Provide the following documentation:

- a. Manufacturer-based programs: Brochure or letter from manufacturer describing the EPR program, contact information, proof that product is included in the program.
- b. Third-party program: Brochure describing recycling process and average rate of return for the material.

1.6.12 Sourcing of Raw Materials - Certified Wood

Provide wood products grown in sustainably managed forests certified by a Forest Stewardship Council FSC STD 01 001 accredited certification agency, to the maximum extent possible without jeopardizing the intended end use or detracting from the overall quality delivered to the end user. FSC-Certified wood products must have Chain-of-Custody (CoC) from forest to manufacturer. Products are valued at 100% material cost value. Provide the following documentation:

- a. Documentation indicating percentage new wood, percentage FSC and Chain-of-Custody (CoC) certificates for manufacturer and vendor indicating compliance with forest certification requirements. Include vendor invoice indicating FSC CoC number.

1.6.13 Health Product Declarations

Provide documentation for at least 20 products from at least five different manufacturers which demonstrate at least one of the following chemical inventory programs to at least one tenth percent (0.1%) or 1000 parts per million (ppm) of the end use product:

- a. Published Manufacturer Content Inventory demonstrating one of the following.
 - (1) Publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
 - (2) Materials defined as trade secret of intellectual property: Disclose role, amount and hazard screen using one of the following:
 - (a) GreenScreen benchmark as defined in GreenScreen version 1.2
 - (b) Global Harmonized System (GHS) of Classification and Labeling Chemicals revision 6 (2015)
- b. Health Product Declaration (HPD): Demonstrate full disclosure of known hazards in compliance with the HPD Open Standard and published in the HPD Public Repository.
- c. Cradle to Cradle version 3 Bronze level or higher
- d. Cradle to Cradle Material Health Certificate: Bronze level or higher, at least 90 percent of materials assessed by weight.
- e. Declare Product Label for one of the following:
 - (1) LBC Red List Free
 - (2) Declared
 - (3) LBC Compliant: Demonstrate compliance for content inventory to 1000 parts per million (0.1%).
- f. UL's Product Lens Certification
- g. ACT's Facts Certification (NSF /ANSI 336-2011): Demonstrate any certification level.

Material ingredient reports with third-party verification including verification of content inventory: Contribute to LEED MR credit calculations as one and a half (1.5) products.

1.6.14 Material Ingredient Optimization

Provide products from at least three different manufacturers that document their material ingredient optimization using the paths below. Choose either 10 compliant products, or select products that constitute at least 10%, by cost, of the total value of permanently installed products in the project.

- a. Material Ingredient Screening and Optimization Action Plan: The Manufacturer has screened the product to at least 1,000 ppm and has provided a publicly available inventory meeting the requirements of Option 1 and completed a detailed action plan to mitigate or reduce

known hazards using the principles of green chemistry. See LEED BDC Ref Guide for additional requirements. Value at fifty percent by cost or one-half (0.5) products.

- b. Advanced Inventory & Assessment: End use product meets requirements set forth in LEED BDC Ref Guide. Value at one hundred percent by cost or one (1) product.
- c. Material Ingredient Optimization: End use product has demonstrated a product inventory and assessment of ingredients using any of the programs listed in the LEED BDC Ref Guide. Value at one hundred-fifty percent by cost or one and one-half (1.5) products.

1.6.15 Light Pollution Reduction

Backlight, Uplight and Glare (OR Forward Light) Rating for Exterior Lighting: Maximum based on SSc6 Light Pollution Reduction Tables 1-4 in the LEED BDC Ref Guide.

1.6.16 Waste Material Management (Recycling - Construction)

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

1.6.17 Additional Sustainability Requirements

1.6.17.1 Validation and Certification Restrictions

Purchase of renewable energy certificates (RECs) specifically to meet project sustainability goals is prohibited.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 SUSTAINABILITY COORDINATION

3.1.1 Coordinating Sustainability Documentation Progress

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

- a. Pre-Construction Conference: Discuss the following: TPC Checklist, Sustainability Action Plan, Construction submittal requirements and schedule, individuals responsible for achieving each TPC prerequisite and credit.
- b. Construction Progress Meetings: Review TPC sustainability requirements with project team including contractor and sub-contractor representatives. Demonstrate TPC documentation is being collected and updated to the Sustainability eNotebook.

(1) For TPC that include on-site visit by third party representative,

execute, coordinate, and facilitate the visit.

(2) Facility Turnover Meetings: Review Sustainability eNotebook for completeness and identify any outstanding issues relating to final documentation requirements.

(3) Final Sustainability eNotebook Review

3.2 INDOOR AIR QUALITY (IAQ) ASSESSMENT

Perform building flushout and/ or IAQ testing as directed. Confirm the completion of the following prior to building flush-out or IAQ testing.

- a. Complete final cleaning the building including ductwork.
- b. Install all interior finishes and movable furnishing with all major punch list items completed.
- c. Install new air filtration media.
- d. Complete test, adjust and balance HVAC systems for proper operation.

3.2.1 Building Flush-Out

Provide building flush-out after construction ends, according to one of the following paths.

- a. Path 1: Before Occupancy: Supply total air volume of 14,000 cubic feet of outdoor air per square foot of floor area while maintaining an internal temperature between 60 degrees and 80 degrees Fahrenheit, and relative humidity no higher than 60 percent.
- b. Path 2: During Occupancy: Space may be occupied following delivery of a minimum of 3,500 cubic feet of outside air per square foot of gross floor area, provided the space is ventilated at minimum rate of 0.30 cubic feet per minute (cfm) of outside air or the design minimum outside air rate, whichever is greater, a minimum of three hours prior to the occupancy and during occupancy, until the total of 14,000 cubic feet per square foot of outside air has been delivered to the space.

- (1) Once the space is occupied, ventilate at a minimum rate of 0.30 cubic foot per minute (cfm) per square foot of outdoor air (1.5 liters per second per square meter of outside air) or the design minimum outdoor air rate determined in EQ Prerequisite 1 Minimum Indoor Air Quality Performance, whichever is greater.
- (2) During each day of the flush-out period, begin ventilation at least three hours before occupancy and continue during occupancy.
- (3) Maintain these conditions until a total of 14,000 cubic feet per square foot of outdoor air (4 270 liters of outdoor air per square meter) has been delivered to the space.

3.2.2 Baseline IAQ Testing

Conduct baseline IAQ testing, prior to occupancy, but during normal occupied hours, and with building ventilation system started at the normal start time and operated at the minimum outdoor airflow rate for the occupied mode throughout the testing.

- a. Use testing protocols consistent with LEED v4 Building Design and Construction EQ Credit: IAQ Assessment and all referenced standards.
- b. Determine sampling time based on testing method and maximum allowable concentration.
- c. Support the IAQ testing services firm by coordinating scheduling of required testing and providing services during IAQ remediation if necessary.
- d. Conduct IAQ testing after testing and balancing of the HVAC system has been completed.
- e. Test at least one location per ventilation system, minimum one test per floor. Testing locations must represent worst-case zones.
- f. Maximum testing area for offices, schools, retail, hospitality and multifamily residential buildings: 5000 square feet.
- g. Maximum testing area for warehouses or large open spaces such as ballrooms or gymnasiums: 50,000 square feet.
- h. Where spaces are identical in construction, finishes, configuration, square footage and HVAC system, test one of seven identical spaces. If sampled space fails, test all seven spaces.
- i. Collect air samples between 3 feet and 6 feet from the floor.

Demonstrate that the project does not exceed the following maximum contaminant concentration levels:

Chemical Contaminant	Maximum Concentration	ASTM and EPA Methods	ISO Method
Carbon Monoxide (CO)	9 parts per million and no greater than 2 ppm above outdoor levels	EPA Compendium Method IP-3	ISO 4224
Particulates (PM10)	50 micrograms per cubic meter	EPA Compendium Method IP-10	ISO 7708

Chemical Contaminant	Maximum Concentration	ASTM and EPA Methods	ISO Method
Particulates (PM 2.5) For Buildings in EPA nonattainment areas or local equivalent only	15 micrograms per cubic meter	EPA Compendium Method IP-10	ISO 7708
Ozone For Buildings in EPA nonattainment areas	0.075 parts per million	ASTM D5149-02	ISO 13964
Formaldehyde	27 parts per million	ASTM D5197; EPA TO-11	ISO 16000-3
Total Volatile Organic Compounds (TVOC)	500 micrograms per cubic meter	EPA TO-1, TO-17, IP-1	ISO 16000-6
Target chemicals listed in CDPH Standard Method v1.1	Table 4.1, except formaldehyde (Cal/ EPA OEHHA full CREL (June 2014	ASTM D5197; EPA TO-1, TO-17	ISO 16000-6

For each sampling point maximum concentration limits exceeded take corrective action and retest the specific parameter(s) that were exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. Take samples from the same locations as the first test when re-testing non-complying building areas.

Provide the services of a laboratory accredited under ISO/ IEC 17025 for the test methods used.

3.3 THIRD PARTY CERTIFICATION VALIDATION

Finalize the sustainability validation process and obtain the TPC validation, indicating completion of the projects sustainability goals.

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

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements				
Source: ASHRAE 189.1 section 8.4.2 (Materials)(Interior Applications Only) and LEED BDC Reference Guide for Beta v4.1				
MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	MATERIAL CATEGORY
Paints and Coatings	CDPH/EHLB/Standard method V1.1 or 2 (California Section 01350) (Use "classroom" space limits for all classrooms, use "private office" limits for all other applications)	or	Flat and nonflat topcoats, primers, undercoaters, and anti-corrosive coatings	Green Seal Standard GS-11 or California Air Resources Board (CARB) Suggested Control Measure (SCM) for Architectural Coatings or SCAQMD Rule 1113

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements

Source: ASHRAE 189.1 section 8.4.2 (Materials)(Interior Applications Only) and LEED BDC Reference Guide for Beta v4.1

MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	MATERIAL CATEGORY
Paints and Coatings	CDPH/EHLB/Standard method V1.1 or 2 (California Section 01350) (Use "classroom" space limits for classrooms, use "private office" limits for all applications)		Concrete/masonry sealers (waterproofing concrete/masonry sealers), concrete curing compounds, dry fog coatings, faux finishing coatings, fire resistive coatings, floor coatings, graphic arts (sign) coatings, industrial maintenance coatings, mastic texture coatings, metallic pigmented coatings, multicolor coatings, pretreatment wash primers, reactive penetrating sealers, recycled coatings, shellacs (clear and opaque), specialty primers, stains, wood coatings (clear wood finishes), wood preservatives, and zinc primers One hundred percent	California Air Resources Board (CARB) Suggested Control Measure for Architectural Coatings or SCAQMD Rule 1113

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements				
Source: ASHRAE 189.1 section 8.4.2 (Materials)(Interior Applications Only) and LEED BDC Reference Guide for Beta v4.1				
MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	MATERIAL CATEGORY
Paints and Coatings	CDPH/EHLB/Standard method V1.1 or V1.2 (California Section 01350) (Use "office" or "classroom" space limits for all applications) Seventy-five percent by volume or surface area		Basement specialty coatings, high-temperature coatings, low solids coatings, stone consolidants, swimming-pool coatings, tub- and tile-refining coatings, and waterproofing membranes One hundred percent	California Air Resources Board (CARB) Suggested Control Measure for Architectural Coatings SCAQMD Rule 1113
Flooring, wall base, underlayments	For flooring, all locations: CDPH/EHLB/Standard Method V1.1 or V1.2 (California Section 01350) (Use "classroom" space limits for classrooms, use "private office" limits for all applications) Ninety percent by cost of surface area		none	none

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements

Source: ASHRAE 189.1 section 8.4.2 (Materials)(Interior Applications Only) and LEED BDC Reference Guide for Beta v4.1

MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	MATERIAL CATEGORY
<p>Composite Wood, Wood Structural Panel, and Agrifiber Products particleboard medium density fiberboard (MDF) wheatboard strawboard panel substrates door cores no added urea-formaldehyde resins including laminating adhesives for composite wood and agrifiber assemblies</p>	<p>Third-party certification (approved by CARB) of California Air Resource Board's (CARB) regulation, Airborne Toxic Control Measure (ATCM), formaldehyde requirements for ultra-low-emitting (ULEF) resins or CARB ATCM formaldehyde requirements for no added formaldehyde resins (NAF) Seventy-five percent by cost or surface area</p>		<p>none</p>	<p>none</p>

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements				
Source: ASHRAE 189.1 section 8.4.2 (Materials)(Interior Applications Only) and LEED BDC Reference Guide for Beta v4.1				
MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	MATERIAL CATEGORY
All Stand-Alone Furniture and Seating installed prior to occupancy	ANSI/BIFMA M7.1-2011 (R2016) (95 percent of installed office furniture system workstations and seating units) and either Section 7.6.1 of ANSI/BIFMA e3 (half credit, by cost or Section 7.6.2 of ANSI/BIFMA e3 (full credit, by cost) Seventy-five percent by cost		none	none

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements				
Source: ASHRAE 189.1 section 8.4.2 (Materials)(Interior Applications Only) and LEED BDC Reference Guide for Beta v4.1				
MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	MATERIAL CATEGORY
Ceilings	CDPH/EHLB/Standard method V1.1 or V1.2 (California Section 01350) (Use "classroom" space limits for classrooms, use "private office" limits for all applications) Ninety percent by cost or surface area		none	none

-- End of Section --

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LEED v4.0 BD+C: New Construction

Project Scorecard

Project Information Form				
Y	?Y	?N	N	
Y				PIf1 Project Information
				1
Integrative Process				
Y	?Y	?N	N	
				IPc1 Integrative Process
				1
				1
Location and Transportation				
Y	?Y	?N	N	
				LTc1 LEED for Neighborhood Development Location
1				LTc2 Sensitive Land Protection
				LTc3 High Priority Site
2				LTc4 Surrounding Density and Diverse Uses
				LTc5 Access to Quality Transit
				LTc6 Bicycle Facilities
				LTc7 Reduced Parking Footprint
1				LTc8 Green Vehicles
				16
Sustainable Sites				
Y	?Y	?N	N	
Y				SSp1 Construction Activity Pollution Prevention
1				SSc1 Site Assessment
				SSc2 Site Development: Protect or Restore Habitat
				SSc3 Open Space
				SSc4 Rainwater Management
				SSc5 Heat Island Reduction
1				SSc6 Light Pollution Reduction
				10
Water Efficiency				
Y	?Y	?N	N	
Y				WEp1 Outdoor Water Use Reduction
Y				WEp2 Indoor Water Use Reduction
Y				WEp3 Building-Level Water Metering
2				WEc1 Outdoor Water Use Reduction
4				WEc2 Indoor Water Use Reduction
				WEc3 Cooling Tower Water Use
				WEc4 Water Metering
				11
Energy and Atmosphere				
Y	?Y	?N	N	
Y				EAp1 Fundamental Commissioning and Verification
Y				EAp2 Minimum Energy Performance
Y				EAp3 Building-Level Energy Metering
Y				EAp4 Fundamental Refrigerant Management
				33

U.S. Army SOF Human Platform Force Generation Facility

Clark Nexsen
7/21/2020



Energy & Atmosphere, cont.				
Y	?Y	?N	N	
5				EAc1 Enhanced Commissioning
6				EAc2 Optimize Energy Performance
1				EAc3 Advanced Energy Metering
				EAc4 Demand Response
				EAc5 Renewable Energy Production
1				EAc6 Enhanced Refrigerant Management
				EAc7 Green Power and Carbon Offsets
				2
Materials and Resources				
Y	?Y	?N	N	
5	4	1	3	MRp1 Storage & Collection of Recyclables
Y				MRp2 Construction and Demolition Waste Management Planning
				MRc1 Building Life-Cycle Impact Reduction
				MRc2 BPDO: Environmental Product Declarations
				MRc3 BPDO: Sourcing of Raw Materials
				MRc4 BPDO: Material Ingredients
2				MRc5 Construction and Demolition Waste Management
				13
Indoor Environmental Quality				
Y	?Y	?N	N	
Y				EQp1 Minimum IAQ Performance
Y				EQp2 Environmental Tobacco Smoke Control
				EQc1 Enhanced Indoor Air Quality Strategies
				EQc2 Low-Emitting Materials
				EQc3 Construction Indoor Air Quality Management Plan
				EQc4 Indoor Air Quality Assessment
				EQc5 Thermal Comfort
				EQc6 Interior Lighting
				EQc7 Daylight
				EQc8 Quality Views
				EQc9 Acoustic Performance
				16
Innovation				
Y	?Y	?N	N	
				INc1.1 Green Building Education
				INc1.2 Purchasing: Lamps
				INc1.3 Exemplary Performance: Low-Emitting Materials
				INc1.4 LEED O+M Starter Kit
				INc1.5 Pilot Credit - Bird Collision Deterrence
				INc2 LEED Accredited Professional
				6
				46
				8
				2
				54
				Total
				Possible Points 110

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110 points

[RP] - Regional Priority credit (adds 1 point)

Design Credits/Construction Credits

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

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GOVERNMENTAL SAFETY REQUIREMENTS

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PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B30.3	(2016) Tower Cranes
ASME B30.5	(2018) Mobile and Locomotive Cranes
ASME B30.7	(2011) Winches
ASME B30.8	(2015) Floating Cranes and Floating Derricks
ASME B30.9	(2018) Slings
ASME B30.20	(2018) Below-the-Hook Lifting Devices
ASME B30.22	(2016) Articulating Boom Cranes
ASME B30.23	(2011) Personnel Lifting Systems Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings
ASME B30.26	(2015; INT Jun 2010 - Jun 2014) Rigging Hardware

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.22	(2007; R 2017) Safety Requirements for Rope-Guided and Non-Guided Workers' Hoists
ASSP A10.34	(2001; R 2012) Protection of the Public on or Adjacent to Construction Sites
ASSP A10.44	(2014) Control of Energy Sources (Lockout/Tagout) for Construction and Demolition Operations
ASSP Z244.1	(2016) The Control of Hazardous Energy Lockout, Tagout and Alternative Methods
ASSP Z359.0	(2012) Definitions and Nomenclature Used for Fall Protection and Fall Arrest
ASSP Z359.1	(2016) The Fall Protection Code

ASSP Z359.2	(2017) Minimum Requirements for a Comprehensive Managed Fall Protection Program
ASSP Z359.3	(2017) Safety Requirements for Lanyards and Positioning Lanyards
ASSP Z359.4	(2013) Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components
ASSP Z359.6	(2016) Specifications and Design Requirements for Active Fall Protection Systems
ASSP Z359.7	(2011) Qualification and Verification Testing of Fall Protection Products
ASSP Z359.11	(2014) Safety Requirements for Full Body Harnesses
ASSP Z359.12	(2009) Connecting Components for Personal Fall Arrest Systems
ASSP Z359.13	(2013) Personal Energy Absorbers and Energy Absorbing Lanyards
ASSP Z359.14	(2014) Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems
ASSP Z359.15	(2014) Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems

ASTM INTERNATIONAL (ASTM)

ASTM F855	(2015) Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment
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INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(2018; TIA 18-1) Standard for Portable Fire Extinguishers
NFPA 51B	(2014) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2;

TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6;
TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10;
TIA 17-11; TIA 17-12; TIA 17-13; TIA
17-14; TIA 17-15; TIA 17-16; TIA 17-17)
National Electrical Code

NFPA 70E (2018; TIA 18-1; TIA 81-2) Standard for
Electrical Safety in the Workplace

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

NFPA 306 (2019) Standard for the Control of Gas
Hazards on Vessels

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-222 (2005G; Add 1 2007; Add 2 2009; Add 3
2014; Add 4 2014; R 2014; R 2016)
Structural Standards for Steel Antenna
Towers and Antenna Supporting Structures

TIA-1019 (2012; R 2016) Standard for Installation,
Alteration and Maintenance of Antenna
Supporting Structures and Antennas

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

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

10 CFR 20 Standards for Protection Against Radiation

29 CFR 1910 Occupational Safety and Health Standards

29 CFR 1910.146 Permit-required Confined Spaces

29 CFR 1910.147 The Control of Hazardous Energy (Lock
Out/Tag Out)

29 CFR 1910.333 Selection and Use of Work Practices

29 CFR 1915 Confined and Enclosed Spaces and Other
Dangerous Atmospheres in Shipyard
Employment

29 CFR 1915.89 Control of Hazardous Energy
(Lockout/Tags-Plus)

29 CFR 1926 Safety and Health Regulations for
Construction

29 CFR 1926.16 Rules of Construction

29 CFR 1926.500 Fall Protection

29 CFR 1926.552	Material Hoists, Personal Hoists, and Elevators
29 CFR 1926.553	Base-Mounted Drum Hoists
29 CFR 1926.1400	Cranes and Derricks in Construction
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
CPL 02-01-056	(2014) Inspection Procedures for Accessing Communication Towers by Hoist
CPL 2.100	(1995) Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146

1.2 DEFINITIONS

1.2.1 Competent Person (CP)

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

1.2.2 Competent Person, Confined Space

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

1.2.3 Competent Person, Cranes and Rigging

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

1.2.4 Competent Person, Excavation/Trenching

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

1.2.5 Competent Person, Fall Protection

The CP, Fall Protection, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and in accordance with ASSP Z359.0, who has been designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the fall protection program, who through training, knowledge and experience in fall protection and rescue systems and equipment, is capable of identifying, evaluating and addressing existing and potential fall hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

1.2.6 Competent Person, Scaffolding

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

1.2.7 Competent Person (CP) Trainer

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

1.2.8 High Risk Activities

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

1.2.9 High Visibility Accident

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

1.2.10 Load Handling Equipment (LHE)

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

horizontally move a load).

1.2.11 Medical Treatment

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

1.2.12 Near Miss

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

1.2.13 Operating Envelope

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

1.2.14 Qualified Person (QP)

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

1.2.15 Qualified Person, Fall Protection (QP for FP)

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

1.2.16 USACE Property and Equipment

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

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

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

load, or roll over). Document an LHE mishap using the Crane High Hazard working group mishap reporting form.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G

SD-06 Test Reports

Monthly Exposure Reports

Notifications and Reports

Accident Reports; G

LHE Inspection Reports

SD-07 Certificates

Standard Lift Plan; G

Critical Lift Plan ; G

Activity Hazard Analysis (AHA)

Confined Space Entry Permit

Hot Work Permit

Certificate of Compliance

License Certificates

Radiography Operation Planning Work Sheet; G

Portable Gauge Operations Planning Worksheet; G

1.4 MONTHLY EXPOSURE REPORTS

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

1.5 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, comply with the most recent edition of USACE EM 385-1-1,

and the applicable federal, state, and local laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern.

1.6 SITE QUALIFICATIONS, DUTIES, AND MEETINGS

1.6.1 Personnel Qualifications

1.6.1.1 Site Safety and Health Officer (SSHO)

Provide an SSHO that meets the requirements of EM 385-1-1 Section 1. The SSHO must ensure that the requirements of 29 CFR 1926.16 are met for the project. Provide a Safety oversight team that includes a minimum of one (1) person at each project site to function as the Site Safety and Health Officer (SSHO). The SSHO or an equally-qualified Alternate SSHO must be at the work site at all times to implement and administer the Contractor's safety program and government-accepted Accident Prevention Plan. The SSHO and Alternate SSHO must have the required training, experience, and qualifications in accordance with EM 385-1-1 Section 01.A.17, and all associated sub-paragraphs.

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

1.6.1.1.1 Additional Site Safety and Health Officer (SSHO) Requirements and Duties

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

1.6.1.2 Competent Person Qualifications

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

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

1.6.1.2.1 Competent Person for Confined Space Entry

Provide a Confined Space (CP) Competent Person who meets the requirements of EM 385-1-1, Appendix Q, and herein. The CP for Confined Space Entry

must supervise the entry into each confined space in accordance with EM 385-1-1, Section 34.

Since this work involves operations that handle combustible or hazardous materials, this person must have the ability to understand and follow through on the air sampling, Personal Protective Equipment (PPE), and instructions of a Marine Chemist, Coast Guard authorized persons, or Certified Industrial Hygienist. Confined space and enclosed space work must comply with NFPA 306, OSHA 29 CFR 1915, Subpart B, "Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment," or as applicable, 29 CFR 1910.147 for general industry.

1.6.1.2.2 Competent Person for Scaffolding

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

1.6.1.2.3 Competent Person for Fall Protection

Provide a Competent Person for Fall Protection who meets the requirements of EM 385-1-1, Section 21.C.04, 21.B.03, and herein.

1.6.1.3 Qualified Trainer Requirements

1.6.2 Personnel Duties

1.6.2.1 Duties of the Site Safety and Health Officer (SSHO)

The SSHO must:

- a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily production report.
- b. Conduct mishap investigations and complete required accident reports. Report mishaps and near misses.
- c. Use and maintain OSHA's Form 300 to log work-related injuries and illnesses occurring on the project site for Prime Contractors and subcontractors, and make available to the Contracting Officer upon request. Post and maintain the Form 300A on the site Safety Bulletin Board.
- d. Maintain applicable safety reference material on the job site.
- e. Attend the pre-construction conference, pre-work meetings including preparatory meetings, and periodic in-progress meetings.
- f. Review the APP and AHAs for compliance with EM 385-1-1, and approve, sign, implement and enforce them.
- g. Establish a Safety and Occupational Health (SOH) Deficiency Tracking System that lists and monitors outstanding deficiencies until resolution.
- h. Ensure subcontractor compliance with safety and health requirements.

- i. Maintain a list of hazardous chemicals on site and their material Safety Data Sheets (SDS).
- j. Maintain a weekly list of high hazard activities involving energy, equipment, excavation, entry into confined space, and elevation, and be prepared to discuss details during QC Meetings.
- k. Provide and keep a record of site safety orientation and indoctrination for Contractor employees, subcontractor employees, and site visitors.

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

1.6.3 Meetings

1.6.3.1 Preconstruction Conference

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

1.6.3.2 Safety Meetings

Conduct safety meetings to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation. Conduct meetings at least once a month for all supervisors on the project location. The SSHO, supervisors, foremen, or CDSOs must conduct meetings at least once a week for the trade workers. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting Officer on request. Notify the Contracting Officer of all scheduled meetings 7 calendar days in advance.

1.7 ACCIDENT PREVENTION PLAN (APP)

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

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

1.7.1 Names and Qualifications

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

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

personnel to be used. Specify the duties of each position.

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

1.7.2 Plans

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

1.7.2.1 Confined Space Entry Plan

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

1.7.2.2 Standard Lift Plan (SLP)

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

1.7.2.3 Critical Lift Plan - Crane or Load Handling Equipment

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

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

1.7.2.3.1 Critical Lift Plan Planning and Schedule

Critical lifts require detailed planning and additional or unusual safety precautions. Develop and submit a critical lift plan to the Contracting

Officer 30 calendar days prior to critical lift. Comply with load testing requirements in accordance with EM 385-1-1, Section 16.F.03.

1.7.2.3.2 Lifts of Personnel

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

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

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

1.7.2.5 Fall Protection and Prevention (FP&P) Plan

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

1.7.2.6 Rescue and Evacuation Plan

Provide a Rescue and Evacuation Plan in accordance with EM 385-1-1 Section 21.N and ASSP Z359.2, and include in the FP&P Plan and as part of the APP. Include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility.

1.7.2.7 Hazardous Energy Control Program (HECP)

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

1.7.2.8 Excavation Plan

Identify the safety and health aspects of excavation, and provide and prepare the plan in accordance with EM 385-1-1, Section 25.A and Section 31 00 00 EARTHWORK.

1.7.2.9 Occupant Protection Plan

Identify the safety and health aspects of lead-based paint removal, prepared in accordance with Section 02 83 00 LEAD REMEDIATION.

1.7.2.10 Asbestos Hazard Abatement Plan

Identify the safety and health aspects of asbestos work, and prepare in accordance with Section 02 82 00 ASBESTOS REMEDIATION.

1.7.2.11 Polychlorinated Biphenyls (PCB) Plan

Identify the safety and health aspects of Polychlorinated Biphenyls work, and prepare in accordance with Sections 02 84 16 HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBs AND MERCURY.

1.7.2.12 Site Demolition Plan

Identify the safety and health aspects, and prepare in accordance with Section 02 41 00 DEMOLITION and referenced sources.

1.8 ACTIVITY HAZARD ANALYSIS (AHA)

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

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

1.8.1 AHA Management

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

1.8.2 AHA Signature Log

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

1.9 DISPLAY OF SAFETY INFORMATION

1.9.1 Safety Bulletin Board

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

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

1.9.2 Safety and Occupational Health (SOH) Deficiency Tracking System

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

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

1.10 SITE SAFETY REFERENCE MATERIALS

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

1.11 EMERGENCY MEDICAL TREATMENT

Contractors must arrange for their own emergency medical treatment in accordance with EM 385-1-1. Government has no responsibility to provide emergency medical treatment.

1.12 NOTIFICATIONS and REPORTS

1.12.1 Mishap Notification

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

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

1.12.2 Accident Reports

- a. Conduct an accident investigation for recordable injuries and illnesses, property damage, and near misses as defined in EM 385-1-1, to establish the root cause(s) of the accident. Complete an investigation report within 30 days for those mishaps defined by EM 385-1-1 01.D.04. Mishaps defined by EM 385-1-1 01.D.04 and 01.D.05 must include a written report submitted as an attachment in ESAMS using the following outline: (1) Mishap summary description to include process, findings and outcomes; (2) Root Cause; (3) Direct Factors; (4) Indirect and Contributing Factors; (5) Corrective Actions; and (6) Recommendations. Complete the applicable USACE Accident Report Form 3394, and provide the report to the Contracting Officer within 5 calendar day(s) of the accident. The Contracting Officer will provide copies of any required or special forms.
- b. Near Misses: For Army projects, report all "Near Misses" to the GDA, using local mishap reporting procedures, within 24 hrs. The Contracting Officer will provide the Contractor the required forms. Near miss reports are considered positive and proactive Contractor safety management actions.
- c. Conduct an accident investigation for any load handling equipment accident (including rigging accidents) to establish the root cause(s) of the accident. Complete the LHE Accident Report (Crane and Rigging Accident Report) form and provide the report to the Contracting Officer within 30 calendar days of the accident. Do not proceed with crane operations until cause is determined and corrective actions have been implemented to the satisfaction of the Contracting Officer. The Contracting Officer will provide a blank copy of the accident report form.

1.12.3 LHE Inspection Reports

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

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

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

Develop a Standard Lift Plan (SLP) in accordance with EM 385-1-1, Section 16.H.03 using Form 16-2 Standard Pre-Lift Crane Plan/Checklist for each lift planned. Submit SLP to the Contracting Officer for approval within 15 calendar days in advance of planned lift.

1.13 HOT WORK

1.13.1 Permit and Personnel Requirements

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

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

1.13.2 Work Around Flammable Materials

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

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

1.14 RADIATION SAFETY REQUIREMENTS

Submit License Certificates, employee training records, and Leak Test Reports for radiation materials and equipment to the Contracting Officer

and Radiation Safety Office (RSO) for all specialized and licensed material and equipment proposed for use on the construction project (excludes portable machine sources of ionizing radiation including moisture density and X-Ray Fluorescence (XRF)). Maintain on-site records whenever licensed radiological materials or ionizing equipment are on government property.

Protect workers from radiation exposure in accordance with 10 CFR 20, ensuring any personnel exposures are maintained As Low As Reasonably Achievable.

1.14.1 Radiography Operation Planning Work Sheet

Submit a Gamma and X-Ray Radiography Operation Planning Work Sheet to Contracting Officer 14 days prior to commencement of operations involving radioactive materials or radiation generating devices. For portable machine sources of ionizing radiation, including moisture density and XRF, use and submit the Portable Gauge Operations Planning Worksheet instead. The Contracting Officer will review the submitted worksheet and provide questions and comments.

Contractors must use primary dosimeters process by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory.

1.14.2 Site Access and Security

Coordinate site access and security requirements with the Contracting Officer for all radiological materials and equipment containing ionizing radiation that are proposed for use on a government facility. For gamma radiography materials and equipment, a Government escort is required for any travels on the Installation. The Government authorized representative will meet the Contractor at a designated location outside the Installation, ensure safety of the materials being transported, and will escort the Contractor for gamma sources onto the Installation, to the job site, and off the Installation. For portable machine sources of ionizing radiation, including moisture density and XRF, the Government authorized representative will meet the Contractor at the job site.

Provide a copy of all calibration records, and utilization records for radiological operations performed on the site.

1.14.3 Loss or Release and Unplanned Personnel Exposure

Loss or release of radioactive materials, and unplanned personnel exposures must be reported immediately to the Contracting Officer, RSO, and Base Security Department Emergency Number.

1.14.4 Site Demarcation and Barricade

Properly demark and barricade an area surrounding radiological operations to preclude personnel entrance, in accordance with EM 385-1-1, Nuclear Regulatory Commission, and Applicable State regulations and license requirements, and in accordance with requirements established in the accepted Radiography Operation Planning Work Sheet.

Do not close or obstruct streets, walks, and other facilities occupied and used by the Government without written permission from the Contracting Officer.

1.14.5 Security of Material and Equipment

Properly secure the radiological material and ionizing radiation equipment at all times, including keeping the devices in a properly marked and locked container, and secondarily locking the container to a secure point in the Contractor's vehicle or other approved storage location during transportation and while not in use. While in use, maintain a continuous visual observation on the radiological material and ionizing radiation equipment. In instances where radiography is scheduled near or adjacent to buildings or areas having limited access or one-way doors, make no assumptions as to building occupancy. Where necessary, the Contracting Officer will direct the Contractor to conduct an actual building entry, search, and alert. Where removal of personnel from such a building cannot be accomplished and it is otherwise safe to proceed with the radiography, position a fully instructed employee inside the building or area to prevent exiting while external radiographic operations are in process.

1.14.6 Transportation of Material

Comply with 49 CFR 173 for Transportation of Regulated Amounts of Radioactive Material. Notify Local Fire authorities and the site Radiation Safety officer (RSO) of any Radioactive Material use.

1.14.7 Schedule for Exposure or Unshielding

Actual exposure of the radiographic film or unshielding the source must not be initiated until after 5 p.m. on weekdays.

1.14.8 Transmitter Requirements

Adhere to the base policy concerning the use of transmitters, such as radios and cell phones. Obey Emissions control (EMCON) restrictions.

1.15 CONFINED SPACE ENTRY REQUIREMENTS

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

1.15.1 Entry Procedures

Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. Comply with EM 385-1-1, Section 34 for entry procedures. Hazards pertaining to the space must be reviewed with each employee during review of the AHA.

1.15.2 Forced Air Ventilation

Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its action level.

1.15.3 Sewer Wet Wells

Sewer wet wells require continuous atmosphere monitoring with audible

alarm for toxic gas detection.

1.15.4 Rescue Procedures and Coordination with Local Emergency Responders

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

1.16 SEVERE STORM PLAN

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

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

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 CONSTRUCTION AND OTHER WORK

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

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

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

3.1.1 Worksite Communication

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

3.1.2 Hazardous Material Exclusions

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

3.1.3 Unforeseen Hazardous Material

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

3.2 UTILITY OUTAGE REQUIREMENTS

Apply for utility outages at least 14 days in advance. At a minimum, the written request must include the location of the outage, utilities being affected, duration of outage, any necessary sketches, and a description of the means to fulfill energy isolation requirements in accordance with EM 385-1-1, Section 11.A.02 (Isolation). Some examples of energy isolation devices and procedures are highlighted in EM 385-1-1, Section 12.D. In accordance with EM 385-1-1, Section 12.A.01, where outages involve Government or Utility personnel, coordinate with the Government on all activities involving the control of hazardous energy.

These activities include, but are not limited to, a review of HECF and HEC procedures, as well as applicable Activity Hazard Analyses (AHAs). In accordance with EM 385-1-1, Section 11.A.02 and NFPA 70E, work on energized electrical circuits must not be performed without prior government authorization. Government permission is considered through the permit process and submission of a detailed AHA. Energized work permits are considered only when de-energizing introduces additional or increased hazard or when de-energizing is infeasible.

3.3 OUTAGE COORDINATION MEETING

After the utility outage request is approved and prior to beginning work on the utility system requiring shut-down, conduct a pre-outage coordination meeting in accordance with EM 385-1-1, Section 12.A. This meeting must include the Prime Contractor, the Prime and subcontractors performing the work, the Contracting Officer, and the Installation

representative. All parties must fully coordinate HEC activities with one another. During the coordination meeting, all parties must discuss and coordinate on the scope of work, HEC procedures (specifically, the lock-out/tag-out procedures for worker and utility protection), the AHA, assurance of trade personnel qualifications, identification of competent persons, and compliance with HECP training in accordance with EM 385-1-1, Section 12.C. Clarify when personal protective equipment is required during switching operations, inspection, and verification.

3.4 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

Provide and operate a Hazardous Energy Control Program (HECP) in accordance with EM 385-1-1 Section 12, 29 CFR 1910.333, 29 CFR 1915.89, ASSP A10.44, NFPA 70E, and paragraph HAZARDOUS ENERGY CONTROL PROGRAM (HECP).

3.4.1 Safety Preparatory Inspection Coordination Meeting with the Government or Utility

For electrical distribution equipment that is to be operated by Government or Utility personnel, the Prime Contractor and the subcontractor performing the work must attend the safety preparatory inspection coordination meeting, which will also be attended by the Contracting Officer's Representative, and required by EM 385-1-1, Section 12.A.02. The meeting will occur immediately preceding the start of work and following the completion of the outage coordination meeting. Both the safety preparatory inspection coordination meeting and the outage coordination meeting must occur prior to conducting the outage and commencing with lockout/tagout procedures.

3.4.2 Lockout/Tagout Isolation

Where the Government or Utility performs equipment isolation and lockout/tagout, the Contractor must place their own locks and tags on each energy-isolating device and proceed in accordance with the HECP. Before any work begins, both the Contractor and the Government or Utility must perform energy isolation verification testing while wearing required PPE detailed in the Contractor's AHA and required by EM 385-1-1, Sections 05.I and 11.B. Install personal protective grounds, with tags, to eliminate the potential for induced voltage in accordance with EM 385-1-1, Section 12.E.06.

3.4.3 Lockout/Tagout Removal

Upon completion of work, conduct lockout/tagout removal procedure in accordance with the HECP. In accordance with EM 385-1-1, Section 12.E.08, each lock and tag must be removed from each energy isolating device by the authorized individual or systems operator who applied the device. Provide formal notification to the Government (by completing the Government form if provided by Contracting Officer's Representative), confirming that steps of de-energization and lockout/tagout removal procedure have been conducted and certified through inspection and verification. Government or Utility locks and tags used to support the Contractor's work will not be removed until the authorized Government employee receives the formal notification.

3.5 FALL PROTECTION PROGRAM

Establish a fall protection program, for the protection of all employees

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

3.5.1 Training

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

3.5.2 Fall Protection Equipment and Systems

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

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

3.5.2.1 Additional Personal Fall Protection

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

3.5.2.2 Personal Fall Protection Harnesses

Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. The use of body belts is not acceptable. Harnesses must have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Snap hooks and carabineers must be self-closing and self-locking, capable of being opened only by at least two consecutive deliberate actions and have a minimum gate strength of 3,600 lbs in all directions. Use webbing, straps, and ropes made of synthetic fiber. The maximum free fall distance when using fall arrest equipment must not exceed 6 feet, unless the proper energy absorbing lanyard is used. Always take into consideration the total fall distance and any swinging of the worker (pendulum-like motion), that can occur during a fall, when attaching a person to a fall arrest system. All full body harnesses must be equipped with Suspension Trauma

Preventers such as stirrups, relief steps, or similar in order to provide short-term relief from the effects of orthostatic intolerance in accordance with EM 385-1-1, Section 21.I.06.

3.5.3 Fall Protection for Roofing Work

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

a. Low Sloped Roofs:

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

(2) For work greater than 6 feet from an edge, erect and install warning lines in accordance with 29 CFR 1926.500 and EM 385-1-1, Section L.

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

3.5.4 Horizontal Lifelines (HLL)

Provide HLL in accordance with EM 385-1-1, Section 21.I.08.d.2. Commercially manufactured horizontal lifelines (HLL) must be designed, installed, certified and used, under the supervision of a qualified person, for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500). The competent person for fall protection may (if deemed appropriate by the qualified person) supervise the assembly, disassembly, use and inspection of the HLL system under the direction of the qualified person. Locally manufactured HLLs are not acceptable unless they are custom designed for limited or site specific applications by a Registered Professional Engineer who is qualified in designing HLL systems.

3.5.5 Guardrails and Safety Nets

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

3.5.6 Rescue and Evacuation Plan and Procedures

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

Prevention Plan (APP). The plan must comply with the requirements of EM 385-1-1, ASSP Z359.2, and ASSP Z359.4.

3.6 WORK PLATFORMS

3.6.1 Scaffolding

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

- a. Scaffold platforms greater than 20 feet in height must be accessed by use of a scaffold stair system.
- b. Ladders commonly provided by scaffold system manufacturers are prohibited for accessing scaffold platforms greater than 20 feet maximum in height.
- c. An adequate gate is required.
- d. Employees performing scaffold erection and dismantling must be qualified.
- e. Scaffold must be capable of supporting at least four times the maximum intended load, and provide appropriate fall protection as delineated in the accepted fall protection and prevention plan.
- f. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward.
- g. Special care must be given to ensure scaffold systems are not overloaded.
- h. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material are prohibited. The first tie-in must be at the height equal to 4 times the width of the smallest dimension of the scaffold base.
- i. Scaffolding other than suspended types must bear on base plates upon wood mudsills (2 in x 10 in x 8 in minimum) or other adequate firm foundation.
- j. Scaffold or work platform erectors must have fall protection during the erection and dismantling of scaffolding or work platforms that are more than 6 feet.
- k. Delineate fall protection requirements when working above 6 feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

3.6.2 Elevated Aerial Work Platforms (AWPs)

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

unless a safe device for 100 percent tie-off is used for the transfer.

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

3.7 EQUIPMENT

3.7.1 Material Handling Equipment (MHE)

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

3.7.2 Load Handling Equipment (LHE)

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

- a. Equip cranes and derricks as specified in EM 385-1-1, Section 16.
- b. Notify the Contracting Officer 15 working days in advance of any LHE entering the activity, in accordance with EM 385-1-1, Section 16.A.02, so that necessary quality assurance spot checks can be coordinated. Prior to cranes entering federal activities, a Crane Access Permit must be obtained from the Contracting Officer. A copy of the permitting process will be provided at the Preconstruction Conference. Contractor's operator must remain with the crane during the spot check. Rigging gear must comply with OSHA, ASME B30.9 Standards safety standards.
- c. Comply with the LHE manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person (as defined in ASME B30.5). Perform all testing in accordance with the manufacturer's recommended procedures.
- d. Comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22

for articulating boom cranes, ASME B30.3 for construction tower cranes, ASME B30.8 for floating cranes and floating derricks, ASME B30.9 for slings, ASME B30.20 for below the hook lifting devices and ASME B30.26 for rigging hardware.

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

for review.

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

3.7.4 Base Mounted Drum Hoists

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

3.7.5 Use of Explosives

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

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

3.8 EXCAVATIONS

Soil classification must be performed by a competent person in accordance with 29 CFR 1926 and EM 385-1-1.

3.8.1 Utility Locations

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

3.8.2 Utility Location Verification

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

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

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

3.9 ELECTRICAL

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

3.9.1 Conduct of Electrical Work

As delineated in EM 385-1-1, electrical work is to be conducted in a de-energized state unless there is no alternative method for accomplishing the work. In those cases obtain an energized work permit from the Contracting Officer. The energized work permit application must be accompanied by the AHA and a summary of why the equipment/circuit needs to be worked energized. Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Attach temporary grounds in accordance with ASTM F855 and IEEE 1048. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator is allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method.

When working in energized substations, only qualified electrical workers are permitted to enter. When work requires work near energized circuits as defined by NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves and electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA. Ensure that each employee is familiar with and complies with these procedures and 29 CFR 1910.147.

3.9.2 Qualifications

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

3.9.3 Arc Flash

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

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

3.9.4 Grounding

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

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

3.9.5 Testing

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

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SOURCES FOR REFERENCE PUBLICATIONS

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PART 1 GENERAL

1.1 REFERENCES

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

1.2 ORDERING INFORMATION

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

AACE INTERNATIONAL (AACE)
1265 Suncrest Towne Centre Drive
Morgantown, WV 26505-1876 USA
Ph: 304-296-8444
Fax: 304-291-5728
E-mail: info@aacei.org
Internet: <http://www.aacei.org>

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

AIR BARRIER ASSOCIATION OF AMERICA (ABAA)
1600 Boston-Providence Hwy
Walpole, MA 02081
Ph: 866-956-5888
Fax: 866-956-5819
E-mail: abaa@airbarrier.org
Internet:

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

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC. (AMCA)
Arlington Heights, IL 60004

Ph: 847-394-0150
Fax: 847-253-0088
Internet:

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

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

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

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

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

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

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)
1330 Kemper Meadow Drive
Cincinnati, OH 45240

Ph: 513-742-2020 or 513-742-6163
Fax: 513-742-3355
E-mail: mail@acgih.org
Internet: <http://www.acgih.org>

AMERICAN GAS ASSOCIATION (AGA)
400 North Capitol Street N.W.
Suite 450
Washington, D.C. 20001
Ph: 202-824-7000
Internet: <http://www.aga.org>

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

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
One East Wacker Drive, Suite 700
Chicago, IL 60601-1802
Ph: 312-670-2400
Fax: 312-670-5403
Bookstore: 800-644-2400
E-mail: aisc@ware-pak.com
Internet: <http://www.aisc.org>

AMERICAN IRON AND STEEL INSTITUTE (AISI)
25 Massachusetts Avenue, NW Suite 800
Washington, DC 20001
Ph: 202-452-7100
Internet: <http://www.steel.org>

AMERICAN LADDER INSTITUTE (ALI)
2025 M St. NW
Washington, DC 20036
Ph: 202-367-1217
Fax: 202-973-8712
E-mail: info@americanladderinstitute.org
Internet: <http://www.americanladderinstitute.org>

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)
P.O. Box 210
Germantown, MD 20875-0210
Ph: 301-972-1700
Fax: 301-540-8004
E-mail: alsc@alsc.org
Internet: <http://www.alsc.org>

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
1899 L Street, NW, 11th Floor
Washington, DC 20036
Ph: 202-293-8020
Fax: 202-293-9287
E-mail: storemanager@ansi.org
Internet: <http://www.ansi.org/>

AMERICAN PETROLEUM INSTITUTE (API)
Internet: <http://www.api.org>

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)
P.O. Box 28518
1711 Arlingate Lane
Columbus, OH 43228-0518
Ph: 800-222-2768; 614-274-6003
Fax: 614-274-6899
E-mail: tjones@asnt.org
Internet: <http://www.asnt.org>

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
1801 Alexander Bell Drive
Reston, VA 20191
Ph: 703-295-6300; 800-548-2723
E-mail: member@asce.org
Internet: <http://www.asce.org>

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
ASME
Two Park Avenue
New York, NY 10016-5990
Ph U.S/Canada: (800) 843-2763
E-mail: CustomerCare@asme.org
Internet:

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)
1791 Tullie Circle, NE
Atlanta, GA 30329
Ph: 800-527-4723 or 404-636-8400
Fax: 404-321-5478
E-mail: ashrae@ashrae.org
Internet: <http://www.ashrae.org>

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)
18927 Hickory Creek Drive, Suite 220
Mokena, IL 60448
Ph: 708-995-3019
Fax: 708-479-6139
E-mail: staffengineer@asse-plumbing.org
Internet: <http://www.asse-plumbing.org>

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)
520 N. Northwest Highway
Park Ridge, IL 60068
Ph: 847-699-2929
E-mail: customerservice@assp.org
Internet:

AMERICAN WATER WORKS ASSOCIATION (AWWA)
6666 West Quincy Avenue
Denver, CO 80235-3098
Ph: 303-794-7711
E-mail: distribution@awwa.org
Internet: <http://www.awwa.org>

AMERICAN WELDING SOCIETY (AWS)
13301 NW 47 Ave
Miami, FL 33054

Ph: 888-WELDING, 305-824-1177, 305-826-6192
Fax: 305-826-6195
E-mail: customer.service@awspubs.com
Internet: <http://www.aws.org>

AMERICAN WOOD COUNCIL (AWC)
222 Catocin Circle SE, Suite 201
Leesburg, VA 20175
Ph: 800-890-7732
Fax: 412-741-0609
E-mail: publications@awc.org
Internet: <http://www.awc.org>

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)
P.O. Box 361784
Birmingham, AL 35236-1784
Ph: 205-733-4077
Fax: 205-733-4075
Internet: <http://www.awpa.com>

AmericanHort (AH)
2130 Stella Court
Columbus, OH 43215 USA
Ph: 614-487-1117
Fax: 614-487-1216
E-mail: hello@AmericanHort.org
Internet: <http://americanhort.org/AmericanHort/AmericanHort>

APA - THE ENGINEERED WOOD ASSOCIATION (APA)
7011 South 19th St.
Tacoma, WA 98466-5333
Ph: 253-565-6600
Fax: 253-565-7265
Internet: <http://www.apawood.org>

ARCHITECTURAL WOODWORK INSTITUTE (AWI)
46179 Westlake Drive, Suite 120
Potomac Falls, VA 20165
Ph: 571-323-3636
Fax: 571-323-3630
E-mail: info@awinet.org
Internet: <http://www.awinet.org>

ASME INTERNATIONAL (ASME)
Two Park Avenue, M/S 10E
New York, NY 10016-5990
Ph: 800-843-2763
Fax: 973-882-1717
E-mail: customercare@asme.org
Internet: <http://www.asme.org>

ASPHALT INSTITUTE (AI)
2696 Research Park Drive
Lexington, KY 40511-8480
Ph: 859-288-4960

Fax: 859-288-4999
E-mail: info@asphaltinstitute.org
Internet: <http://www.asphaltinstitute.org>

ASSOCIATED AIR BALANCE COUNCIL (AABC)
1518 K Street, NW
Washington, DC 20005
Ph: 202-737-0202
Fax: 202-638-4833
E-mail: info@aabc.com
Internet: <http://www.aabc.com/>

ASTM INTERNATIONAL (ASTM)
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959
Ph: 877-909-2786
Internet: <http://www.astm.org>

BRITISH STANDARDS INSTITUTE (BSI)
Ph: +44 845-086-9001
E-mail: cservices@bsigroup.com
Internet: <http://www.bsigroup.com>

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)
355 Lexington Avenue, 15th Floor
New York, NY 10017
Ph: 212-297-2122
Fax: 212-370-9047
Internet: <http://www.buildershardware.com>

CALIFORNIA AIR RESOURCES BOARD (CARB)
1001 I Street
Sacramento, CA 95814
Ph: 800-242-4450
E-mail: helpline@arb.ca.gov
Internet:

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)
P.O. Box 997377
MS 0500
Sacramento, CA 95899-7377
Ph: 916-558-1784
Internet:

CALIFORNIA ENERGY COMMISSION (CEC)
Media and Public Communications Office
1516 Ninth Street, MS-29
Sacramento, CA 95814-5512
Ph: 916-654-5106
E-mail: appliances@energy.ca.gov
Internet: <http://www.energy.ca.gov/>

CARPET AND RUG INSTITUTE (CRI)
P.O. Box 2048
Dalton, GA 30722-2048
Ph: 706-278-3176
Fax: 706-278-8835
Internet: <http://www.carpet-rug.com>

CAST IRON SOIL PIPE INSTITUTE (CISPI)
3008 Preston Station Drive
Hixson, TN 37343
Ph: 423-842-2122
Internet: <http://www.cispi.org>

COMPRESSED GAS ASSOCIATION (CGA)
14501 George Carter Way, Suite 103
Chantilly, VA 20151-1788
Ph: 703-788-2700
Fax: 703-961-1831
E-mail: cga@cganet.com
Internet: <http://www.cganet.com>

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)
933 North Plum Grove Road
Schaumburg, IL 60173-4758
Ph: 847-517-1200
Fax: 847-517-1206
Internet: <http://www.crsi.org/>

CONSUMER ELECTRONICS ASSOCIATION (CEA)
1919 South Eads St.
Arlington, VA 22202
Ph: 866-858-1555 or 703-907-7634
Fax: 866-858-2555 or 703-907-7693
E-mail: standards@CE.org
Internet: <http://www.CE.org>

CONSUMER PRODUCT SAFETY COMMISSION (CPSC)
4330 East-West Highway
Bethesda, MD 20814
Ph: 301-504-7923
Fax: 301-504-0124 or 301-504-0025
Internet: <http://www.cpsc.gov>

CONSUMER TECHNOLOGY ASSOCIATION (CTA)
1919 S. Eads Street
Arlington, VA 22202
Ph: 703-907-7600
E-mail: CTA@CTA.tech
Internet:

COPPER DEVELOPMENT ASSOCIATION (CDA)
Internet: <http://www.copper.org>

CSA GROUP (CSA)
178 Rexdale Blvd.
Toronto, ON, Canada M9W 1R3
Ph: 416-747-4044
Fax: 416-747-2510
E-mail: sales@csagroup.org
Internet: <http://www.csagroup.org/us/en/home>

ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION (ECIA)
2214 Rock Hill Rd., Suite 170
Herndon, VA 20170
Ph: 571-323-0294
Fax: 571-323-0245

E-mail: emikoski@ecaus.org
Internet: <http://www.ecianow.org/>

ELECTRONIC INDUSTRIES ALLIANCE (EIA)
EIA has become part of the ELECTRONIC COMPONENTS INDUSTRY
ASSOCIATION (ECIA)

FLUID CONTROLS INSTITUTE (FCI)
1300 Sumner Avenue
Cleveland, OH 44115
Ph: 216-241-7333
Fax: 216-241-0105
E-mail: fcifluidcontrolsinstitute.org
Internet: www.fluidcontrolsinstitute.org

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E-mail: environment@ul.com
Internet: <http://www.ul.com/environment>

UNDERWRITERS LABORATORIES (UL)
2600 N.W. Lake Road
Camas, WA 98607-8542
Ph: 877-854-3577
E-mail: CEC.us@us.ul.com
Internet: <http://www.ul.com/>
UL Directories available through IHS at <http://www.ihs.com>

VIBRATION ISOLATION AND SEISMIC CONTROL MANUFACTURERS ASSOCIATION
(VISCMA)
994 Old Eagle School Road
Suite 109
Wayne, PA 19087-1866
Ph: 610-971-4850
Internet:

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)
P.O. Box 23145
Portland, OR 97281
Ph: 503-639-0651
Fax: 503-684-8928
E-mail: info@wclib.org
Internet: <http://www.wclib.org>

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)
1500 SW First Ave., Suite 870
Portland, OR 97201
Ph: 503-224-3930
Fax: 503-224-3934
E-mail: info@wwpa.org
Internet: <http://www.wwpa.org>

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)
330 N Wabash Avenue, Suite 2000

Chicago, IL 60611
Ph: 312-321-6802
E-mail: wdma@wdma.com
Internet: <http://www.wdma.com>

WOODWORK INSTITUTE (WI)
Internet:

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

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QUALITY CONTROL
11/16

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM D3740	(2012a) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E329	(2018) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

1.2 PAYMENT

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

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Contractor Quality Control (CQC) Plan; G

SD-06 Test Reports

Verification Statement

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Establish and maintain an effective quality control (QC) system that complies with FAR 52.246-12 Inspection of Construction. QC consist of plans, procedures, and organization necessary to produce an end product which complies with the Contract requirements. The QC system covers all design and construction operations, both onsite and offsite, and be keyed to the proposed design and construction sequence. The project superintendent will be held responsible for the quality of work and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the Contract. In this context the highest level manager responsible for the overall construction activities at the site, including quality and production is the project superintendent. The project superintendent maintains a physical presence at the site at all times and is responsible for all construction and related activities at the site, except as otherwise acceptable to the Contracting Officer.

3.2 CONTRACTOR QUALITY CONTROL (CQC) PLAN

Submit no later than 30 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements FAR 52.246-12 Inspection of Construction. The Government will consider an interim plan for the first 60 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional work.

3.2.1 Content of the CQC Plan

Include, as a minimum, the following to cover all construction-operations, both onsite and offsite, including work by subcontractors consultants, architect/engineers (AE), fabricators, suppliers and purchasing agents:

- a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff will implement the three phase control system for all aspects of the work specified. Include a CQC System Manager that reports to the project superintendent.
- b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
- c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the Contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will be issued by the CQC System Manager. Furnish copies of these letters to the Contracting Officer.
- d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, consultants, architect engineers (AE), offsite fabricators, suppliers, and purchasing

agents. These procedures must be in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES.

- e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer are required to be used.)
- f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.
- g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.
- h. Reporting procedures, including proposed reporting formats.
- i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and is identified by different trades or disciplines, or it is work by the same trade in a different environment. Although each section of the specifications can generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.
- j. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections. Where the applicable Code issue by the International Code Council (ICC) calls for inspections by the Building Official, the Contractor must include the inspections in the Quality Control Plan and must perform the inspections required by the applicable ICC. The Contractor must perform these inspections using independent qualified inspectors. Include the Special Inspection Plan requirements in the QC Plan.

3.2.2 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in the Contractor Quality Control(CQC) Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.3 Notification of Changes

After acceptance of the CQC Plan, notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer and discuss the Contractor's quality control system.

During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the Government, signed by both the Contractor and the Contracting Officer and will become a part of the contract file. There can be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings or address deficiencies in the CQC system or procedures which can require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 Personnel Requirements

The requirements for the CQC organization are a Safety and Health Manager, CQC System Manager, and sufficient number of additional qualified personnel to ensure safety and Contract compliance. The Safety and Health Manager reports directly to a senior project (or corporate) official independent from the CQC System Manager. The Safety and Health Manager will also serve as a member of the CQC Staff Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff maintains a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure Contract compliance. The CQC staff will be subject to acceptance by the Contracting Officer. Provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawing submittals, schedules and all other project documentation to the CQC organization. The CQC organization is responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

3.4.2 CQC System Manager

Identify as CQC System Manager an individual within the onsite work organization that is responsible for overall management of CQC and has the authority to act in all CQC matters for the Contractor. The CQC System Manager is required to be a graduate engineer, graduate architect, or a graduate of construction management, with a minimum of 5 years construction experience on construction similar to this Contract. This CQC System Manager is on the site at all times during construction and is employed by the prime Contractor. The CQC System Manager is assigned no other duties. Identify in the plan an alternate to serve in the event of the CQC System Manager's absence. The requirements for the alternate are the same as the CQC System Manager.

3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas: electrical, mechanical, submittals clerk, Cx Agent. These individuals or specialized technical companies are directly employed by the prime Contractor and can not be employed by a supplier or subcontractor on this project; be responsible to the CQC System Manager; be physically present at the construction site

during work on the specialized peronnel's areas of responsibility; have the necessary education or experience in accordance with the experience matrix listed herein. These individuals can perform other duties but need to be allowed sufficient time to perform the specialized personnel's assigned quality control duties as described in the Quality Control Plan. A single person can cover more than one area provided that the single person is qualified to perform quality control activities in each designated and that workload allows.

Experience Matrix	
Area	Qualifications
Mechanical	Graduate Mechanical Engineer with 2 yrs experience or person with 5 years of experience supervising mechanical features of work in the field with a construction company
Civil/Structural	Graduate Civil/Structural Engineer with 2 years related experience or person with 5 years of experience supervising Civil/Structural features of work in the field with a construction company.
Electrical	Graduate Electrical Engineer with 2 years related experience or person 5 years of experience supervising electrical features of work in the field with a construction company
Materials Technician	Specialist with 5 years of related experience supervising materials features of work in the field with a construction company.
Submittals	Submittal Clerk with 1 year experience
Testing, Adjusting and Balancing (TAB) Personnel	Specialist must be a member of AABC or an experienced technician of the firm certified by the NEBB

3.4.4 Additional Requirement

In addition to the above experience and education requirements, the Contractor Quality Control(CQC) System Manager and Alternate CQC System Manager are required to have completed the Construction Quality Management (CQM) for Contractors course. If the CQC System Manager does not have a current certification, obtain the CQM for Contractors course certification within 90 days of award. This course is periodically offered by the Army Corps of Engineers. Contact the Contracting Officer for information on the next scheduled class.

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

3.4.5 Organizational Changes

Maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS AND DELIVERABLES

Submittals, if needed, have to comply with the requirements in Section 01 33 00.00 37 SUBMITTAL PROCEDURES. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. When Section 01 91 00.00 37 COMMISSIONING are included in the contract, the submittals required by those sections have to be coordinated with Section 01 33 00.00 37 SUBMITTAL PROCEDURES to ensure adequate time is allowed for each type of submittal required.

3.6 CONTROL

CQC is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control are required to be conducted by the CQC System Manager for each definable feature of the construction work as follows:

3.6.1 Preparatory Phase

This phase is performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:

- a. A review of each paragraph of applicable specifications, reference codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.
- b. Review of the Contract drawings.
- c. Check to assure that all materials and equipment have been tested, submitted, and approved.
- d. Review of provisions that have been made to provide required control inspection and testing.
- e. Review Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.
- f. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the Contract.
- g. Examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- h. Review of the appropriate activity hazard analysis to assure safety requirements are met.

- i. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- j. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- k. Discussion of the initial control phase.
- l. The Government needs to be notified at least 48 hours in advance of beginning the preparatory control phase. Include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the preparatory phase actions by separate minutes prepared by the CQC System Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:

- a. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing are in compliance with the contract.
- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- d. Resolve all differences.
- e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
- f. The Government needs to be notified at least 48 hours in advance of beginning the initial phase for definable feature of work. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with follow-up phases.
- g. The initial phase for each definable feature of work is repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.
- h. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.

3.6.3 Follow-up Phase

Perform daily checks to assure control activities, including control

testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. Record the checks in the CQC documentation. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.

3.6.4 Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

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

- a. Verify that testing procedures comply with contract requirements.
- b. Verify that facilities and testing equipment are available and comply with testing standards.
- c. Check test instrument calibration data against certified standards.
- d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
- e. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Contracting Officer, actual test reports are submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.

3.7.2 Testing Laboratories

All testing laboratories must be validated by the USACE Material Testing Center (MTC) for the tests to be performed. Information on the USACE MTC with web-links to both a list of validated testing laboratories and for the laboratory inspection request for can be found at:

3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel is required to meet criteria detailed in ASTM D3740 and ASTM E329.

3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the Contract amount due the Contractor.

3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.8 COMPLETION INSPECTION

3.8.1 Punch-Out Inspection

Conduct an inspection of the work by the CQC System Manager near the end of the work, or any increment of the work established by a time stated in FAR 52.211-10 Commencement, Prosecution, and Completion of Work, or by the specifications. Prepare and include in the CQC documentation a punch list of items which do not conform to the approved drawings and specifications, as required by paragraph DOCUMENTATION. Include within the list of deficiencies the estimated date by which the deficiencies will be corrected. Make a second inspection the CQC System Manager or staff to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. Ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Correct any items noted on the Pre-Final inspection in a timely manner. These inspections and any deficiency corrections required by this paragraph need to be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative is required to be in attendance at the final acceptance inspection. Additional Government personnel including, but not

limited to, those from Base/Post Civil Facility Engineer user groups, and major commands can also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notify the Contracting Officer at least 14 days prior to the final acceptance inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the Contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance FAR 52.246-12 Inspection of Construction.

3.9 DOCUMENTATION

3.9.1 Quality Control Activities

Maintain current records providing factual evidence that required quality control activities and tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:

- a. The name and area of responsibility of the Contractor/Subcontractor.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
- d. Test and control activities performed with results and references to specifications/drawings requirements. Identify the control phase (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.
- e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- f. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.
- g. Offsite surveillance activities, including actions taken.
- h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- i. Instructions given/received and conflicts in plans and specifications.

3.9.2 Verification Statement

Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract. Furnish the original and one copy of these records in report form to the Government daily within 24 hours after the date covered by the report, except that reports need not be

submitted for days on which no work is performed. As a minimum, prepare and submit one report for every 7 days of no work and on the last day of a no work period. All calendar days need to be accounted for throughout the life of the contract. The first report following a day of no work will be for that day only. Reports need to be signed and dated by the Contractor Quality Control(CQC) System Manager. Include copies of test reports and copies of reports prepared by all subordinate quality control personnel within the CQC System Manager Report.

3.10 NOTIFICATION OF NONCOMPLIANCE

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

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RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM)

11/16

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 - 1.2.2 Other Factors
- 1.3 RMS SOFTWARE
 - 1.3.1 RMS CONTRACTOR'S MODE (CM)
- 1.4 SYSTEM REQUIREMENTS
- 1.5 RELATED INFORMATION
 - 1.5.1 RMS User Guide
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RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM)
11/16

PART 1 GENERAL

1.1 REFERENCES

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

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

1.2 CONTRACT ADMINISTRATION

The Government will use the Resident Management System (RMS) to assist in its monitoring and administration of this contract. The Contractor uses the Government-furnished Construction Contractor Mode of RMS, referred to as RMS CS, to record, maintain, and submit various information throughout the contract period. The Contractor mode user manuals, updates, and training information can be downloaded from the RMS web site (<http://rms.usace.army.mil>). The joint Government-Contractor use of RMS facilitates electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

- Administration
- Finances
- Quality Control
- Submittal Monitoring
- Scheduling
- Import/Export of Data

1.2.1 Correspondence and Electronic Communications

For ease and speed of communications, exchange correspondence and other documents in electronic format to the maximum extent feasible between the Government and Contractor. Correspondence, pay requests and other documents comprising the official contract record are also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

1.2.2 Other Factors

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Section 01 33 00.00 37 SUBMITTAL PROCEDURES, and Section 01 45 00.00 10 QUALITY CONTROL, which have a direct relationship to the reporting to be accomplished through RMS. Also, there is no separate payment for establishing and maintaining the RMS database; costs associated will be included in the contract pricing for the work.

1.3 RMS SOFTWARE

RMS is a Windows-based program that can be run on a Windows based PC meeting the requirements as specified in Section 1.3. The Government will make available the RMS software to the Contractor after award of the construction contract. Prior to the Pre-Construction Conference, the Contractor will be responsible to download, install and use the latest version of the RMS software from the Government's RMS Internet Website. Any program updates of RMS will be made available to the Contractor via the Government RMS Website as the updates become available.

1.3.1 RMS CONTRACTOR'S MODE (CM)

RMS Contractor's Mode or RMS CM is the replacement for Quality Control System or QCS. The database remains the same. References to RMS in this specification includes RMS CM.

1.4 SYSTEM REQUIREMENTS

The following is the minimum system configuration required to run RMS and Contractor Mode:

Minimum RMS System Requirements	
Hardware	
Windows-based PC	1.5 GHz 2 core or higher processor
RAM	8 GB
Hard drive disk	200 GB space for sole use by the QCS system
Monitor	Screen resolution 1366 x 768
Mouse or other pointing device	
Windows compatible printer	Laser printer must have 4 MB+ of RAM
Connection to the Internet	minimum 4 Mbs per user
Software	
MS Windows	Windows 7 x 64 bit (RMS requires 64 bit O/S) or newer
Word Processing software	Viewer for MS Word 2013, MS Excel 2013, or newer
Microsoft.NET Framework	Coordinate with Government QA Representative for free version required
Email	MAPI compatible
Virus protection software	Regularly upgraded with all issued manufacturer's updates and is able to detect most zero day viruses.

1.5 RELATED INFORMATION

1.5.1 RMS User Guide

After contract award, download instructions for the installation and use of RMS from the Government RMS Internet Website.

1.6 CONTRACT DATABASE

Prior to the pre-construction conference, the Government will provide the Contractor with basic contract award data to use for RMS. The Government will provide data updates to the Contractor as needed. These updates will generally consist of submittal reviews, correspondence status, Quality Assurance(QA) comments, and other administrative and QA data.

1.7 DATABASE MAINTENANCE

Establish, maintain, and update data in the RMS database throughout the duration of the contract at the Contractor's site office. Submit data updates to the Government (e.g., daily reports, submittals, RFI's, schedule updates, payment requests) using RMS. The RMS database typically includes current data on the following items:

1.7.1 Administration

1.7.1.1 Contractor Information

Contain within the database the Contractor's name, address, telephone numbers, management staff, and other required items. Within 7 calendar days of receipt of RMS software from the Government, deliver Contractor administrative data in electronic format in RMS.

1.7.1.2 Subcontractor Information

Contain within the database the name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor is listed separately for each trade to be performed. Assign each subcontractor/trade a unique Responsibility Code, provided in RMS. Within 7 calendar days of receipt of RMS software from the Government, deliver subcontractor administrative data in electronic format.

1.7.1.3 Correspondence

Identify all Contractor correspondence to the Government with a serial number. Prefix correspondence initiated by the Contractor's site office with "S". Prefix letters initiated by the Contractor's home (main) office with "H". Letters are numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C".

1.7.1.4 Equipment

Contain within the Contractor's RMS database a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

1.7.1.5 Management Reporting

RMS includes a number of reports that Contractor management can use to

track the status of the project. The value of these reports is reflective of the quality of the data input, and is maintained in the various sections of RMS. Among these reports are: Progress Payment Request worksheet, Quality Assurance/Quality Control (QA/QC) comments, Submittal Register Status, Three-Phase Control checklists.

1.7.1.6 Request For Information (RFI)

Exchange all Requests For Information (RFI) using the Built-in RFI generator and tracker in RMS.

1.7.2 Finances

1.7.2.1 Pay Activity Data

Include within the RMS database a list of pay activities that the Contractor develops in conjunction with the construction schedule. The sum of pay activities equals the total contract amount, including modifications. Each pay activity must be assigned to a Contract Line Item Number (CLIN). The sum of the activities equals the amount of each CLIN. The sum of all CLINs equals the contract amount.

1.7.2.2 Payment Requests

Prepare all progress payment requests using RMS. Complete the payment request worksheet, prompt payment certification, and payment invoice in RMS. Update the work completed under the contract, measured as percent or as specific quantities, at least monthly. After the update, generate a payment request report using RMS. Submit the payment request, prompt payment certification, and payment invoice with supporting data using RMS CM. If permitted by the Contracting Officer, email or a optical disc may be used. A signed paper copy of the approved payment request is also required and will govern in the event of discrepancy with the electronic version.

1.7.3 Quality Control (QC)

RMS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other Contractor QC requirements. Maintain this data on a daily basis. Entered data will automatically output to the RMS generated daily report. Provide the Government a Contractor Quality Control (CQC) Plan within the time required in Section 01 45 00.00 10 QUALITY CONTROL. Within seven calendar days of Government acceptance, submit a RMS update reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

1.7.3.1 Daily Contractor Quality Control (CQC) Reports

RMS includes the means to produce the Daily CQC Report. The Contractor can use other formats to record basic Quality Control(QC) data. However, the Daily CQC Report generated by RMS must be the Contractor's official report. Summarize data from any supplemental reports by the Contractor and consolidate onto the RMS-generated Daily CQC Report. Submit daily CQC Reports by 10:00 am of the following workday. Electronically submit reports to the Government by 12:00 pm the day after the date covered by the report. Also provide the Government a signed, printed copy of the daily CQC report.

1.7.3.2 Deficiency Tracking

Use RMS to track deficiencies. Deficiencies identified by the Contractor will be numerically tracked using its Quality Control (QC) punch list items. Maintain a current log of its QC punch list items in the RMS database. The Government will log the deficiencies it has identified using its Quality Assurance (QA) punch list items. The Government's QA punch list items will be included in its export file to the Contractor. Regularly update the correction status of both QC and QA punch list items.

1.7.3.3 QC Requirements

Develop and maintain a complete list of QC testing and required structural and life safety special inspections required by the International Code Council (ICC), transferred and installed property, and user training requirements in RMS. Update data on these QC requirements as work progresses, and promptly provide the information to the Government via RMS.

1.7.3.4 Three-Phase Control Meetings

Maintain scheduled and actual dates and times of preparatory and initial control meetings in RMS.

1.7.3.5 Labor and Equipment Hours

Log labor and equipment exposure hours on a daily basis. The labor and equipment exposure data will be rolled up into a monthly exposure report.

1.7.3.6 Accident/Safety Reporting

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be provided via RMS CM. Regularly update the correction status of the safety comments. In addition, utilize RMS to advise the Government of any accidents occurring on the jobsite. A brief supplemental entry of an accident is not to be considered as a substitute for completion of mandatory reports, e.g., ENG Form 3394 and OSHA Form 300.

1.7.3.7 Features of Work

Include a complete list of the features of work in the RMS database. A feature of work is associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

1.7.3.8 Hazard Analysis

Use RMS CM to develop a hazard analysis for each feature of work included in the CQC Plan. The Activity Hazard Analysis will include information required by EM 385-1-1, paragraph 01.A.13.

1.7.4 Submittal Management

The Government will provide the initial submittal register in electronic format. Thereafter, maintain a complete list of submittals, including completion of data columns. Dates when submittals are received and returned by the Government will be included. Use RMS CM to track and transmit submittals. ENG Form 4025, submittal transmittal form, and the

submittal register update is produced using RMS. RMS will be used to update, store and exchange submittal registers and transmittals. In addition to requirements stated in specification 01 33 00, actual submittals are to be stored in RMS CM, with hard copies also provided. Exception will be where the Contracting Officer specifies only hard copies required, where size of document cannot be saved in RMS CM, and where samples, spare parts, color boards, and full size drawings are to be provided.

1.7.5 Schedule

Input and maintain in the RMS database the schedule manually). Include with each pay request the updated schedule. Provide electronic copies of transmittals.

1.7.6 Import/Export of Data

RMS includes the ability to import schedule data using SDEF.

1.8 IMPLEMENTATION

Use of RMS CM as described in the preceding paragraphs is mandatory. Ensure that sufficient resources are available to maintain contract data within the RMS CM system. RMS CM is an integral part of the Contractor's management of quality control.

1.9 MONTHLY COORDINATION MEETING

Update the RMS CM database each workday. At least monthly, generate and submit a schedule update. At least one week prior to submittal, meet with the Government representative to review the planned progress payment data submission for errors and omissions.

Make required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will not be accepted. The Government will not process progress payments until all required corrections are processed.

1.10 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. Take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, will be deemed sufficient for the purpose of notification.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

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SECTION 01 45 35

SPECIAL INSPECTIONS
02/15

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2010) Minimum Design Loads for Buildings
and Other Structures

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2015) International Building Code

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-310-04 (2013; with Change 1, 2016) Seismic Design
of Buildings

1.2 GENERAL REQUIREMENTS

Perform Special Inspections in accordance with the Statement of Special Inspections, Schedule of Special Inspections and Chapter 17 of ICC IBC. The Statement of Special Inspections and Schedule of Special Inspections are included as an attachment to this specification. Special Inspections are to be performed by an independent third party and are intended to ensure that the work of the prime contractor is in accordance with the Contract Documents and applicable building codes. Special inspections do not take the place of the three phases of control inspections performed by the Contractor's QC Manager or any testing and inspections required by other sections of the specifications.

1.3 DEFINITIONS

1.3.1 Continuous Special Inspections

Continuous Special Inspections is the constant monitoring of specific tasks by a special inspector. These inspections must be carried out continuously over the duration of the particular tasks.

1.3.2 Periodic Special Inspections

Periodic Special Inspections is Special Inspections by the special inspector who is intermittently present where the work to be inspected has been or is being performed.

1.3.3 Perform

Perform these Special Inspections tasks for each welded joint or member.

1.3.4 Observe

Observe these Special Inspections items on a random daily basis. Operations need not be delayed pending these inspections.

1.3.5 Special Inspector (SI)

A qualified person retained by the contractor and approved by the Contracting Officer as having the competence necessary to inspect a particular type of construction requiring Special Inspections. The SI must be an independent third party hired directly by the Prime Contractor.

1.3.6 Associate Special Inspector (ASI)

A qualified person who assists the SI in performing Special Inspections but must perform inspection under the direct supervision of the SI and cannot perform inspections without the SI on site.

1.3.7 Third Party

A third party inspector must not be company employee of the Contractor or any Sub-Contractor performing the work to be inspected.

1.3.8 Contracting Officer

The Government official having overall authority for administrative contracting actions. Certain contracting actions may be delegated to the Contracting Officer's Representative (COR).

1.3.9 Contractor's Quality Control (QC) Manager

An individual retained by the prime contractor having the overall responsibility for the contractor's QC organization.

1.3.10 Designer of Record (DOR)

A registered design professional contracted by the Government as an A/E responsible for the overall design and review of submittal documents prepared by others. The DOR is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws in state in which the design professional works. The DOR is also referred to as the Engineer of Record (EOR) in design code documents.

1.3.11 Statement of Special Inspections (SSI)

A document developed by the DOR identifying the material, systems, components and work required to have Special Inspections.

1.3.12 Schedule of Special Inspections

A schedule which lists each of the required Special Inspections, the extent to which each Special Inspections is to be performed, and the required frequency for each in accordance with ICC IBC Chapter 17.

1.3.13 Designated Seismic System

Those nonstructural components that require design in accordance with ASCE 7 Chapter 13 and for which the component importance factor, I_p , is greater than 1.0. This designation applies to systems that are required to be operational following the Design Earthquake for RC I - IV structures and following the MCER for RC V structures. All systems in RC V facilities designated as MC-1 in accordance with UFC 3-310-04 are considered part of the Designated Seismic Systems. Designated Seismic Systems will be identified by Owner and will have an Importance Factor $I_p = 1.5$.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Special Inspections Agency's Written Practices
NDT Procedures and Equipment Calibration Records

SD-06 Test Reports

Special Inspections Daily Reports
Special Inspections Biweekly Reports

SD-07 Certificates

Fabrication Plant
Steel Truss Plant
AC472 Accreditation
Steel Joist Institute Membership
Certificate of Compliance
Special Inspector Qualifications; G
Qualification Records for NDT technicians

SD-11 Closeout Submittals

Comprehensive Final Report of Special Inspections; G

1.5 SPECIAL INSPECTOR QUALIFICATIONS

Submit qualifications for each special inspector and the special inspector of record.

Certifying Associations	
AABC	Associated Air Balance Council

Certifying Associations	
ACI	American Concrete Institute
AWCI	Association of the Wall and Ceiling Industry
AWS	American Welding Society
FM	Factory Mutual
ICC	International Code Council
NDT	Nondestructive Testing
NICET	National Institute for Certification in Engineering Technologies
PCI	Precast/Prestressed Concrete Institute
PTI	Post-Tensioning Institute
UL	Underwriters Laboratories

1.5.1 Steel Construction and High Strength Bolting

1.5.1.1 Special Inspector

- a. ICC Structural Steel and Bolting Special Inspector certificate with one year of related experience, or
- b. Registered Professional Engineer with related experience

1.5.1.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

1.5.2 Welding Structural Steel

1.5.2.1 Special Inspector

- a. ICC Structural Welding Special Inspector certificate with one year of related experience, or
- b. AWS Certified Welding Inspector

1.5.2.2 Associate Special Inspector

AWS Certified Associate Welding Inspector

1.5.3 Nondestructive Testing of Welds

1.5.3.1 Special Inspector

NDT Level III Certificate

1.5.3.2 Associate Special Inspector

NDT Level II Certificate plus one year of related experience

1.5.4 Cold Formed Steel Framing

1.5.4.1 Special Inspector

- a. ICC Structural Steel and Bolting Special Inspector certificate with one year of related experience, or
- b. ICC Commercial Building Inspector with one year of experience, or
- c. ICC Residential Building Inspector with one year of experience, or
- d. Registered Professional Engineer with related experience

1.5.4.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

1.5.5 Concrete Construction

1.5.5.1 Special Inspector

- a. ICC Reinforced Concrete Special Inspector Certificate with one year of related experience, or
- b. ACI Concrete Construction Special Inspector, or
- c. NICET Concrete Technician Level III Certificate in Construction Materials Testing, or
- d. Registered Professional Engineer with related experience

1.5.5.2 Associate Special Inspector

- a. ACI Concrete Construction Special Inspector in Training, or
- b. Engineer-In-Training with one year of related experience

1.5.6 Masonry Construction

1.5.6.1 Special Inspector

- a. ICC Structural Masonry Special Inspector Certificate with one year of related experience, or
- b. Registered Professional Engineer with related experience

1.5.6.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

1.5.7 Verification of Site Soil Condition, Fill Placement and Load-Bearing Requirements

1.5.7.1 Special Inspector

- a. ICC Soils Special Inspector Certificate with one year of related experience, or
- b. NICET Soils Technician Level II Certificate in Construction Material Testing, or
- c. NICET Geotechnical Engineering Technician Level II Construction or Generalist Certificate, or
- d. Geologist-In-Training with one year of related experience, or
- e. Registered Professional Engineer with related experience

1.5.7.2 Associate Special Inspector

- a. NICET Soils Technician Level I Certificate in Construction Material Testing with one year of related experience, or
- b. NICET Geotechnical Engineering Technician Level I Construction or Generalist Certificate with one year of related experience, or
- c. Engineer-In-Training with one year of related experience

1.5.8 Sprayed Fire Resistant Material

1.5.8.1 Special Inspector

- a. ICC Spray-applied Fireproofing Special Inspector Certificate, or
- b. ICC Fire Inspector I Certificate with one year of related experience, or
- c. Registered Professional Engineer with related experience

1.5.8.2 Associate Special Inspector

Engineer-In-Training with one year of related experience

1.5.9 Mastic and Intumescent Fire Resistant Coatings

1.5.9.1 Special Inspector

- a. ICC Spray-applied Fireproofing Special Inspector Certificate, or
- b. ICC Fire Inspector I Certificate with one year of related experience, or
- c. Registered Professional Engineer with related experience

1.5.9.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

1.5.10 Exterior Insulation and Finish System (EIFS)

1.5.10.1 Special Inspector

- a. AWCI EIFS Inspector Certificate, or
- b. Exterior Design Institute Certificate, or
- c. Registered Professional Engineer with related experience

1.5.10.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

1.5.11 Fire-Resistant Penetrations and Joints

1.5.11.1 Special Inspector

- a. Passed the UL Firestop Exam with one year of related experience, or
- b. Passed the FM Firestop Exam with one year of related experience, or
- c. Registered Professional Engineer with related experience

1.5.11.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

1.5.12 Smoke Control

1.5.12.1 Special Inspector

- a. AABC Technician Certification with one year of related experience, or
- b. Registered Professional Engineer with related experience

1.5.12.2 Associate Special Inspector

Engineer-In-Training with one year of related experience.

PART 2 PRODUCTS

2.1 FABRICATOR SPECIAL INSPECTIONS

Special Inspections of fabricator's work performed in the fabricator's shop is required to be inspected in accordance with the Statement of Special Inspections and the Schedule of Special Inspections unless the fabricator is certified by the approved agency to perform such work without Special Inspections. Submit the following certifications to the Contracting Officer for information to allow work performed in the fabricator's shop to not be subjected to Special Inspections.

American Institute of Steel Construction (AISC) Certified Fabrication Plant, Category STD.
Truss Plate Institute (TPI) steel truss plant quality assurance program certification.
International Accreditation Service, AC472 Accreditation
Steel Joist Institute Membership

At the completion of fabrication, submit a certificate of compliance, to be included with the comprehensive final report of Special Inspections, stating that the materials supplied and work performed by the fabricator are in accordance the construction documents.

PART 3 EXECUTION

3.1 RESPONSIBILITIES

3.1.1 Quality Control Manager

- a. Supervise all Special Inspectors required by the contract documents and the IBC.
- b. Verify the qualifications of all of the Special Inspectors.
- c. Verify the qualifications of fabricators.
- d. Maintain a 3- ring binder for the Special Inspector's daily and biweekly reports. This file must be located in a conspicuous place in the project trailer/office to allow review by the Contracting Officer and the DOR.
- e. Maintain a rework items list that includes discrepancies noted on the Special Inspectors daily report.

3.1.2 Special Inspectors

- a. Inspect all elements of the project for which the special inspector is qualified to inspect and are identified in the Schedule of Special Inspections.
- b. Attend preparatory phase meetings related to the Definable Feature of Work (DFOW) for which the special inspector is qualified to inspect.
- c. Submit Special Inspections agency's written practices for the monitoring and control of the agency's operations to include the following:
 - (1) The agency's procedures for the selection and administration of inspection personnel, describing the training, experience and examination requirements for qualifications and certification of inspection personnel.
 - (2) The agency's inspection procedures, including general inspection, material controls, and visual welding inspection.
- d. Submit qualification records for nondestructive testing (NDT) technicians designated for the project.
- e. Submit NDT procedures and equipment calibration records for NDT to be performed and equipment to be used for the project.
- f. Submit a copy of the daily reports to the QC Manager.
- g. Discrepancies that are observed during Special Inspections must be reported to the QC Manager for correction. If discrepancies are not corrected before the special inspector leaves the site the observed discrepancies must be documented in the daily report.

- h. Submit a biweekly Special Inspection Report until all inspections are complete. A report is required for each biweekly period in which Special Inspections activity occurs, and must include the following:
 - (1) A brief summary of the work performed during the reporting time frame.
 - (2) Changes and/or discrepancies with the drawings, specifications and mechanical or electrical component certification, that were observed during the reporting period.
 - (3) Discrepancies which were resolved or corrected.
 - (4) A list of nonconforming items requiring resolution.
 - (5) All applicable test result including nondestructive testing reports.
- i. At the completion of the project submit a comprehensive final report of Special Inspections that documents the Special Inspections completed for the project and corrections of all discrepancies noted in the daily reports. The comprehensive final report of Special Inspections must be signed, dated and indicate the certification of the special inspector qualifying them to conduct the inspection.

3.2 DEFECTIVE WORK

Check work as it progresses, but failure to detect any defective work or materials must in no way prevent later rejection if defective work or materials are discovered, nor obligate the Contracting Officer to accept such work.

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Project: SOF Human Platform - Force Generation Facility
 Location: Ft. Bragg, NC
 Project #: 81165
 Date: 7/23/2020



STATEMENT OF SPECIAL INSPECTIONS

Project Seismic Design Category: C
 Project Risk Category: III
 Project Design Wind Speed (mph): 92
 Number of Stories: 2
 Structure Height Above Grade (ft): 51
 Hazardous Occupancy or attached to such? No Group H Occupancies (2015 IBC, Section 415)

Special Inspector of Record (SIOR)

A Special Inspector of Record (SIOR) IS NOT required (per UFGS 01 45 35, Section 1.3.8)

Lateral Force Resisting System (LFRS)

2015 IBC 1704.3.2 and 1704.3.3

Following is a listing of critical main wind/seismic force resisting systems for this structure. Carefully inspect these elements as part of the roles and responsibilities of the Special Inspector (reference the Schedule of Special Inspections for inspection checklists).

Vertical LFRS Elements	Notes
Intermediate Reinforced Masonry Shear Walls	North - South and East - West Direction, See Plan
PEMB Rigid Moment Frames	North - South Direction, See Plan
PEMB X-Bracing	East - West Direction, See Plan
Horizontal LFRS Elements	Notes
Concrete over Steel Deck	See Second Floor Plan
Steel Roof Deck & Related Fastening System	See Roof Plan

Project: SOF Human Platform - Force Generation Facility
 Location: Ft. Bragg, NC
 Project #: 81165
 Date: 7/23/2020

Designated Seismic Systems (DSS)

(2015 IBC 1705.13.3.4) (ASCE 7-10, 13.2.2, C13.2.2) (UFC 3-310-04, 2-11.2 & 2-13.2.2)

Non-structural 'Designated Seismic Systems' (DSS) must remain operable and contain hazardous substances following a design earthquake. Accordingly, all Designated Seismic Systems must be listed below and must be certified by the manufacturer to remain both operable and/or to contain hazardous substances after a design earthquake per UFC 3-301-01, Section 2-13.2.2. Submit said Certificates of Compliance to the Contracting Officer for each DSS after they have been reviewed and accepted by the EOR/DOR.

Additionally, the below listed Designated Seismic Systems must be carefully inspected by the Special Inspector according to the requirements noted in the Schedule of Special Inspections, Section AA.

ELECTRICAL Designated Seismic Systems (DSS) Requiring a Certificate of Compliance	
1.	Anchorage of electrical equipment used for emergency or standby power systems
2.	
3.	
4.	
5.	

If additional space is required, append an additional sheet listing the remaining DSS

MECHANICAL/PLUMBING Designated Seismic Systems (DSS) Requiring a Certificate of Compliance	
1.	Heating, ventilation, and air-conditioning (HVAC) ductwork containing hazardous materials and anchorage of such ductwork
2.	Piping systems and mechanical units containing flammable, combustible, or highly toxic materials
3.	
4.	
5.	
6.	

If additional space is required, append an additional sheet listing the remaining DSS

OTHER Designated Seismic Systems (DSS) Requiring a Certificate of Compliance	
1.	DSS Building Egress Stair Systems
2.	DSS Building Fire Sprinkler Systems
3.	
4.	
5.	
6.	

Final Walk Down Inspection and Report

(UFC 3 301 01 SECTION 2-2.4.3)

Designated Seismic Systems shall receive a final walk-down inspection by the Registered Design Professional in Responsible Charge

Final Walk Down Report, Prepared by the Registered Design Professional in Responsible Charge, Must Include:

1. Record observations of Final Walk Down Inspection
2. Document that Inspections were performed in accordance with the Schedule of Special Inspections
3. Document that all Designated Seismic Systems are installed according to construction/manufacture document requirements, and that Compliance Certificates have been collected (UFC 03 301 01, 2-13.2.2.1).

SCHEDULE OF SPECIAL INSPECTIONS

Reference UFGS 01 45 35 for all requirements not noted as part of this schedule.

INSPECTION DEFINITIONS:

- PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and noted verification.
- OBSERVE:** Observe these items randomly during the course of each work day to insure that applicable requirements are being met. Operations need not be delayed pending these inspections at contractor's risk.
- DOCUMENT:** Document, with a report, that the work has been performed in accordance with the contract documents. This is in addition to any other reports required in the Special Inspections guide specification.
- CONTINUOUS:** Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

A. STRUCTURAL - STEEL – WELDING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

STEEL INSPECTION PRIOR TO WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.4-1		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Verify that the welding procedures specification (WPS) is available	PERFORM	
2. Verify manufacturer certifications for welding consumables are available	PERFORM	
3. Verify material identification	PERFORM	Type and grade.
4. Welder Identification System	PERFORM	The fabricator or erector, as applicable, shall maintain a system by which a welder who has welded a joint or member can be identified. Stamps, if used, shall be the low-stress type.
5. Fit-up of groove welds (including joint geometry)	OBSERVE	<ul style="list-style-type: none"> ✓ Joint preparation ✓ Dimensions (alignment, root opening, root face, bevel) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location) ✓ Backing type and fit (if applicable)
6. Configuration and finish of access holes	OBSERVE	

¹ **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.

OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

7. Fit-up of fillet welds	OBSERVE	<ul style="list-style-type: none"> ✓ Dimensions (alignment, gaps at root) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location)
STEEL INSPECTION DURING WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.4-2		
TASK	INSPECTION TYPE	DESCRIPTION
8. Use of qualified welders	PERFORM	Welding by welders, welding operators, and tack welders who are qualified in conformance with requirements.
9. Control and handling of welding consumables	OBSERVE	<ul style="list-style-type: none"> ✓ Packaging ✓ Electrode atmospheric exposure control
10. No welding over cracked tack welds	OBSERVE	
11. Environmental conditions	OBSERVE	<ul style="list-style-type: none"> ✓ Wind speed within limits ✓ Precipitation and temperature
12. Welding Procedures Specification followed	OBSERVE	<ul style="list-style-type: none"> ✓ Settings on welding equipment ✓ Travel speed ✓ Selected welding materials ✓ Shielding gas type/flow rate ✓ Preheat applied ✓ Interpass temperature maintained (min./max.) ✓ Proper position (F, V, H, OH) ✓ Intermix of filler metals avoided
13. Welding techniques	OBSERVE	<ul style="list-style-type: none"> ✓ Interpass and final cleaning ✓ Each pass within profile limitations ✓ Each pass meets quality requirements

A. STRUCTURAL - STEEL – WELDING SECTION (CONTINUED)

STEEL INSPECTION AFTER WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 2015 1705.2.1, AISC 360-10: Table C-N5.4-3		
TASK	INSPECTION TYPE ¹	DESCRIPTION
14. Welds cleaned	OBSERVE	
15. Size, length, and location of all welds	PERFORM	Size, length, and location of all welds conform to the requirements of the detail drawings.
16. Welds meet visual acceptance criteria	PERFORM AND DOCUMENT	<ul style="list-style-type: none"> ✓ Crack prohibition ✓ Weld/base-metal fusion ✓ Crater cross section ✓ Weld profiles ✓ Weld size ✓ Undercut ✓ Porosity
17. Arc strikes	PERFORM	
18. k-area	PERFORM	When welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, visually inspect the web k-area for cracks.
19. Backing removed, weld tabs removed and finished, and fillet welds added where required	PERFORM	
20. Repair activities	PERFORM AND DOCUMENT	
21. Document acceptance or rejection of welded joint or member	PERFORM	

END SECTION

¹ **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.

DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

B. STRUCTURAL - STEEL – BOLTING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

STEEL INSPECTION TASKS PRIOR TO BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.6-1		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Manufacture’s certifications available for fastener materials	PERFORM	
2. Fasteners marked in accordance with ASTM requirements	OBSERVE	
3. Proper fasteners selected for joint detail (grade, type, bolt length if threads are to be excluded from shear plane)	OBSERVE	
4. Proper bolting procedure selected for joint detail	OBSERVE	
5. Connecting elements, including appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	OBSERVE	
6. Proper storage provided for bolts, nuts, washers, and other fastener components	OBSERVE	
STEEL INSPECTION TASKS DURING BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.6-2		
TASK	INSPECTION TYPE ¹	DESCRIPTION
7. Fastener assemblies of suitable condition, placed in all holes and washers (if required) are positioned as required	OBSERVE	
8. Joint brought to the snug-tight condition prior to pretensioning operation	OBSERVE	
9. Fastener component not turned by the wrench prevented from rotating	OBSERVE	
10. Bolts are pretensioned in accordance with RCSC Specification, progressing systematically from the most rigid point toward the free edges	OBSERVE	
STEEL INSPECTION TASKS AFTER BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.6-3		
TASK	INSPECTION TYPE ¹	DESCRIPTION
11. Document acceptance or rejection of all bolted connections	DOCUMENT	

END SECTION

¹ **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor’s risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

C. STRUCTURAL - STEEL - NON DESTRUCTIVE TESTING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Section N5.5		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Use of qualified nondestructive testing personnel	PERFORM	Visual weld inspection and nondestructive testing (NDT) shall be conducted by personnel qualified in accordance with AWS D1.8 clause 7.2
2. Welded joints subject to fatigue	OBSERVE	Dye penetrant testing (DT) and Ultrasonic testing (UT) shall be performed on 100% of welded joints identified on contract drawings as being subject to fatigue.
3. Weld tab removal sites	OBSERVE	At the end of welds where weld tabs have been removed, magnetic particle testing shall be performed on the same beam-to-column joints receiving UT

END SECTION

¹ **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor’s risk.

D. STRUCTURAL - STEEL – AISC 341 REQUIREMENTS (SEISMIC PROVISIONS) SECTION**THIS SECTION APPLICABLE IF BOX IS CHECKED:**

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 341-10: Section J6.2		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. CJP groove welds	OBSERVE	Dye penetrant testing (DT) and ultrasonic testing (UT) shall be performed on 100% of CJP groove welds for materials greater than 5/16" thick (8mm).
2. Beam cope and access hole.	OBSERVE	At welded splices and connections, thermally cut surfaces of beam copes and access holes shall be tested using magnetic particle testing (MT) or dye penetrant testing (DT), when the flange thickness exceeds 1 1/2 in. for rolled shapes, or when the web thickness exceeds 1 1/2 in. for built-up shapes.
3. K-area NDT (AISC 341)	PERFORM	Where welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, the web shall be tested for cracks using magnetic particle testing (MT). The MT inspection area shall include the k-area base metal within 3-inches of the weld. The MT shall be performed no sooner than 48 hours following completion of the welding.
4. Placement of reinforcing or contouring fillet welds	DOCUMENT	

END SECTION

¹ **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

E. STRUCTURAL - STEEL - COMPOSITE CONSTRUCTION ¹

THIS SECTION APPLICABLE IF BOX IS CHECKED:

COMPOSITE CONSTRUCTION PRIOR TO PLACING CONCRETE – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table N6.1, AISC 341-10: Table J9-1		
TASK	INSPECTION TYPE ²	DESCRIPTION
1. Placement and installation of steel headed stud anchors	PERFORM	
2. Material identification of reinforcing steel (Type/Grade)	OBSERVE	
3. Determination of carbon equivalent for reinforcing steel other than ASTM A706	OBSERVE	
4. Proper reinforcing steel size, spacing, clearances, support, and orientation	OBSERVE	
5. Reinforcing steel has been tied and supported as required	OBSERVE	

END SECTION

F. STRUCTURAL - STEEL - OTHER INSPECTIONS

THIS SECTION APPLICABLE IF BOX IS CHECKED:

OTHER STEEL INSPECTIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 341-10: Tables J8-1 & J10-1		
TASK	INSPECTION TYPE ²	DESCRIPTION
1. Anchor rods and other embedments supporting structural steel	PERFORM	Verify the diameter, grade, type, and length of the anchor rod or embedded item, and the extent or depth of embedment prior to placement of concrete.
2. Fabricated steel or erected steel frame	OBSERVE	Verify compliance with the details shown on the construction documents, such as braces, stiffeners, member locations and proper application of joint details at each connection.
3. Reduced beam sections (RBS) where/if occurs	DOCUMENT	✓ Contour and finish ✓ Dimensional tolerances
4. Protected zones	DOCUMENT	No holes or unapproved attachments made by fabricator or erector
5. H-piles where/if occurs	DOCUMENT	No holes or unapproved attachments made by the responsible contractor

END SECTION

¹ See Concrete Construction Section for all concrete related inspection of composite steel construction.

² **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor’s risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

G. STRUCTURAL - COLD-FORMED METAL DECK - PLACEMENT SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

METAL DECK INSPECTION <u>PRIOR TO</u> DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.1		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Verify compliance of materials (deck and all deck accessories) with construction documents, including profiles, material properties, and base metal thickness	PERFORM	
2. Document acceptance or rejection of deck and deck accessories	DOCUMENT	
METAL DECK INSPECTION <u>DURING</u> DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.2		
TASK	INSPECTION TYPE ¹	DESCRIPTION
3. Verify compliance of deck and all deck accessories installation with construction documents	PERFORM	
4. Verify deck materials are represented by the mill certifications that comply with the construction documents	PERFORM	
5. Document acceptance or rejection of installation of deck and deck accessories	DOCUMENT	
METAL DECK INSPECTION <u>AFTER</u> DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.3		
TASK	INSPECTION TYPE ¹	DESCRIPTION
6. Welding procedure specification (WPS) available	PERFORM	
7. Manufacturers certifications for welding consumables available	OBSERVE	
8. Material identification (type/grade)	OBSERVE	
9. Check welding equipment	OBSERVE	

END SECTION

¹ **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor’s risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

H. STRUCTURAL - COLD-FORMED METAL DECK – WELDING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

METAL DECK INSPECTION DURING WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.4		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Use of qualified welders	OBSERVE	
2. Control and handling of welding consumables	OBSERVE	
3. Environmental conditions (wind speed, moisture, temperature)	OBSERVE	
4. WPS followed	OBSERVE	
METAL DECK INSPECTION AFTER WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.5		
TASK	INSPECTION TYPE ¹	DESCRIPTION
5. Verify size and location of welds, including support, sidelap, and perimeter welds.	PERFORM	
6. Welds meet visual acceptance criteria	PERFORM	
7. Verify repair activities	PERFORM	
8. Document acceptance or rejection of welds	DOCUMENT	

END SECTION

¹ **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor’s risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

I. STRUCTURAL - COLD-FORMED METAL DECK – FASTENING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

METAL DECK INSPECTION BEFORE MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.6		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Manufacturer installation instructions available for mechanical fasteners	OBSERVE	
2. Proper tools available for fastener installation	OBSERVE	
METAL DECK INSPECTION <u>DURING</u> MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.7		
TASK	INSPECTION TYPE ¹	DESCRIPTION
3. Fasteners are positioned as required	OBSERVE	
4. Fasteners are installed in accordance with manufacturer's instructions	OBSERVE	
METAL DECK INSPECTION <u>AFTER</u> MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.8		
TASK	INSPECTION TYPE ¹	DESCRIPTION
5. Check spacing, type, and installation of support fasteners	PERFORM	
6. Check spacing, type, and installation of sidelap fasteners	PERFORM	
7. Check spacing, type, and installation of perimeter fasteners	PERFORM	
8. Verify repair activities	PERFORM	
9. Document acceptance or rejection of mechanical fasteners	DOCUMENT	

END SECTION

¹ **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor’s risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

J. STRUCTURAL - LIGHT GAUGE STEEL FRAMING AND/OR LIGHT GAUGE TRUSSES SECTION**THIS SECTION APPLICABLE IF BOX IS CHECKED:**

LIGHT GAUGE STEEL CONSTRUCTION AND CONNECTIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.2, 1705.11.2, 1705.11.3, UFC 4 023 03		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Trusses spanning 60-feet or greater where/if applies	PERFORM	Verify that temporary and permanent truss restraint/bracing is installed in accordance with approved truss submittal package.
2. Welded connections (seismic and/or wind resisting system)	OBSERVE	Visually inspect all welds composing part of the main wind or seismic force resisting system, including shearwalls, braces, collectors (drag struts), and hold-downs.
3. Connections (seismic and/or wind resisting system)	OBSERVE	Visually inspect all screw attachment, bolting, anchoring and other fastening of components within the main wind or seismic force resisting system, including roof deck, roof framing, exterior wall covering, wall to roof/floor connections, braces, collectors (drag struts) and hold-downs.
4. Cold-formed steel (progressive collapse resisting system where/if applies)	OBSERVE	Verify proper welding operations, screw attachment, bolting, anchoring and other fastening of components within the progressive collapse resisting system, including horizontal tie force elements, vertical tie force elements and bridging elements (UFC 4 023 03).

END SECTION**K. STRUCTURAL - OPEN-WEB STEEL JOISTS SECTION****THIS SECTION APPLICABLE IF BOX IS CHECKED:**

OPEN-WEB STEEL JOISTS AND JOIST GIRDERS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.2.3		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Installation of open-web steel joists and joist girders	OBSERVE	<ul style="list-style-type: none"> ✓ End connections – welded or bolted ✓ Bridging – horizontal and diagonal

END SECTION

¹ **PERFORM:** Perform these tasks for each weld, fastener or bolted connection, and required verification.

OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

L. STRUCTURAL - CONCRETE CONSTRUCTION SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.3 (ACI 318 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Inspect reinforcement, including prestressing tendons, and verify placement.	OBSERVE	Verify prior to placing concrete that reinforcing is of specified type, grade and size; that it is free of oil, dirt and unacceptable rust; that it is located and spaced properly; that hooks, bends, ties, stirrups and supplemental reinforcement are placed correctly; that lap lengths, stagger and offsets are provided; and that all mechanical connections are installed per the manufacturer’s instructions and/or evaluation report.
2. Reinforcing bar welding	OBSERVE	<ul style="list-style-type: none"> ✓ Verify weldability of reinforcing bars other than ASTM A 706 ✓ Inspect single-pass fillet welds, maximum 5/16” in accordance with AWS D1.4
3. All other welding	CONTINUOUS	Visually inspect all welds in accordance with AWS D1.4
4. Cast in place anchors and post installed drilled anchors (downward inclined)	OBSERVE	Verify prior to placing concrete that cast in place anchors and post installed drilled anchors have proper embedment, spacing and edge distance.
5. Post-installed adhesive anchors in horizontal or upward inclined orientations	CONTINUOUS AND DOCUMENT	<ul style="list-style-type: none"> ✓ Inspect as required per approved ICC-ES report ✓ Verify that installer is certified for installation of horizontal and overhead installation applications ✓ Inspect proof loading as required by the contract documents
6. Verify use of required mix design	OBSERVE	Verify that all mixes used comply with the approved construction documents
7. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete	CONTINUOUS	At the time fresh concrete is sampled to fabricate specimens for strength test verify these tests are performed by qualified technicians.
8. Inspect concrete and/or shotcrete placement for proper application techniques	CONTINUOUS	Verify proper application techniques are used during concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated.
9. Verify maintenance of specified curing temperature and technique	OBSERVE	Inspect curing, cold weather protection, and hot weather protection procedures.
10. Pre-stressed concrete	CONTINUOUS	Verify application of prestressing forces and grouting of bonded prestressing tendons.

CONTINUED ON FOLLOWING PAGE

¹ **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor’s risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

K. STRUCTURAL - CONCRETE CONSTRUCTION (CONTINUED)

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.3 (ACI 318 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE ¹	DESCRIPTION
11. Inspect erection of precast concrete members	OBSERVE	
12. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	OBSERVE	
13. Inspect formwork for shape, location and dimensions of the concrete member being formed.	OBSERVE	

END SECTION

¹ **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

M. STRUCTURAL - MASONRY CONSTRUCTION SECTION (ALL RISK CATEGORIES)

THIS SECTION APPLICABLE IF BOX IS CHECKED:

MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE <u>AT START</u> OF CONSTRUCTION IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Compliance with approved submittals prior to start	OBSERVE	
2. Proportions of site-mixed mortar.	OBSERVE	
3. Grade and type of reinforcement, anchor bolts, and prestressing tendons and anchorages	OBSERVE	
4. Prestressing technique	OBSERVE	
5. Properties of thin bed mortar for AAC masonry	OBSERVE	
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE <u>PRIOR TO</u> GROUTING IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE ¹	DESCRIPTION
6. Grout space	OBSERVE	
7. Proportions of site-prepared grout and prestressing grout for bonded tendons	OBSERVE	
8. Proportions of site-mixed grout and prestressing grout for bonded tendons	OBSERVE	
9. Placement of masonry units and mortar joints	OBSERVE	
10. Welding of reinforcement	CONTINUOUS	
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE <u>DURING</u> CONSTRUCTION IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE ¹	DESCRIPTION
11. Size and location of structural elements is in compliance	OBSERVE	
12. Preparation, construction, and protection of masonry during cold weather (temperature below 40°F (4.4°C) or hot weather (temp above 90°F (32.2°C))	OBSERVE	
13. Application and measurement of prestressing force	CONTINUOUS	
14. Placement of grout and prestressing grout for bonded tendons	CONTINUOUS	
15. Placement of AAC masonry units and construction of thin bed mortar joints	CONTINUOUS	Continuous for first 5000 square feet only (465 square meters).
16. Observe preparation of grout specimens, mortar specimens, and/or prisms	OBSERVE	
17. Type, size and placement of reinforcement, connectors, anchor bolts and prestressing tendons and anchorages, including details of anchorage of masonry to structural members, frames, or other construction	OBSERVE	

END SECTION

¹ **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor’s risk.

CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

N. STRUCTURAL - WOOD CONSTRUCTION – SPECIALTY ITEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

WOOD CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.5		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. High-load diaphragms where applicable	OBSERVE	Verify thickness and grade of sheathing, size of framing members at panel edges, nail diameters and length, and the number of fastener lines and that fastener spacing is per approved contract documents.
2. Metal-plate connected wood trusses spanning 60 feet or greater	OBSERVE	Verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package

END SECTION

O. STRUCTURAL - WOOD CONSTRUCTION - SEISMIC & WIND SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

WOOD CONSTRUCTION SEISMIC AND WIND – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.5		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Nailing, bolting, anchoring and other fastening of elements of the main wind/seismic force-resisting system	OBSERVE	Includes connectors for: shearwall sheathing, roof/floor sheathing, drag struts/collectors, braces, hold downs, roof and floor framing connections to exterior walls.

END SECTION

P. STRUCTURAL – ISOLATION AND ENERGY DISSIPATION SYSTEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

ISOLATION AND ENERGY DISSIPATION SYSTEMS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.2.3		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Fabrication and installation	OBSERVE	Verify that fabrication and installation of isolator units and energy dissipation devices conform to manufacturer’s recommendations and approved construction documents

END SECTION

¹ **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor’s risk.

Q. GEOTECHNICAL - SOILS INSPECTION SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

SOILS INSPECTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.6		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Materials below shallow foundations are adequate to achieve the design bearing capacity.	OBSERVE	
2. Excavations are extended to proper depth and have reached proper material	OBSERVE	
3. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill	CONTINUOUS	
4. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.	OBSERVE	During fill placement, the special inspector shall verify that proper materials and procedures are used in accordance with the provisions of the approved geotechnical report

END SECTION

R. GEOTECHNICAL - DRIVEN DEEP FOUNDATION ELEMENTS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

DEEP DRIVEN FOUNDATION CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.5		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Verify element materials, sizes and lengths comply with requirements	CONTINUOUS	
2. Inspect driving operations and maintain complete and accurate records for each element	CONTINUOUS	
3. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	CONTINUOUS	

END SECTION

¹ **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor’s risk.

CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

S. GEOTECHNICAL - HELICAL PILE FOUNDATIONS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

HELICAL PILE FOUNDATIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.9		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Record installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data. The approved geotechnical report and the contract documents shall be used to determine compliance	CONTINUOUS	

END SECTION

T. GEOTECHNICAL - CAST IN PLACE DEEP FOUNDATION ELEMENTS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

CAST IN PLACE DEEP FOUNDATION ELEMENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.8		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Inspect drilling operations and maintain complete and accurate records for each element.	CONTINUOUS	
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable and adequate end-bearing strata capacity. Record concrete or grout volumes	CONTINUOUS	

END SECTION

¹ **CONTINUOUS:** Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

U. FIRE PROTECTION - SPRAYED FIRE-RESISTANT MATERIALS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

SPRAYED FIRE RESISTANT MATERIALS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.14		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Surface condition	OBSERVE	Prior to application confirm that surface has been prepared per the approved fire-resistance design and manufacturer’s instructions.
2. Application	OBSERVE	Prior to application confirm that the substrate meets the minimum ambient temperature per the approved fire-resistance design and manufacturer’s instructions.
3. Material thickness	OBSERVE	Verify that the thickness of the SFRM to structural elements is not less than the thickness require by the fire-resistant design in more that 10 percent of the measurement, but in no case less than minimum allowable thickness required by 1705.14.
4. Material density	OBSERVE	Verify that the thickness of the SFRM to structural elements is not less than the thickness require by the fire-resistant design in more than 10 percent of the measurement, but in no case less than minimum allowable thickness required by IBC 1705.14.5
5. Bond strength	OBSERVE	Verify cohesive/adhesive bond strength of the cured SFRM applied to the structural element is not less than 150psf and according to IBC 1705.14.6

END SECTION

V. FIRE PROTECTION - MASTIC AND INTUMESCENT COATINGS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

MASTIC AND INTUMESCENT FIRE-RESISTANT COATINGS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.15		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Surface preparation	OBSERVE	Inspections shall be performed in accordance with AWCI 12-B and the contract documents

END SECTION

W. FIRE PROTECTION – FIRE RESISTANT PENETRATIONS AND JOINTS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

FIRE RESISTANT PENETRATIONS AND JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.17		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Inspections of penetration firestop systems conducted in accordance with ASTM E 2174.	OBSERVE	
2. Inspections of fire-resistant joint systems conducted in accordance with ASTM E 2393	OBSERVE	

END SECTION

¹ **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor’s risk.

X. FIRE PROTECTION – SMOKE CONTROL SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

SMOKE CONTROL – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.17		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Verify device locations and perform leakage testing	OBSERVE	Perform during erection of ductwork and prior to concealment
2. Pressure difference testing, flow measurements and detection and control verification	OBSERVE	Perform prior to occupancy and after sufficient completion

END SECTION

¹ **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor’s risk.

Y. ARCHITECTURAL - EXTERIOR INSULATION AND FINISH SYSTEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.16		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Water resistive barrier coating applied over a sheathing substrate.	OBSERVE	Verify that water resistive barrier coating complies with ASTM E 2570.

END SECTION

Z. ARCHITECTURAL – ARCHITECTURAL COMPONENTS

THIS SECTION APPLICABLE IF BOX IS CHECKED:

ARCHITECTURAL COMPONENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.12.5, 1705.12.7		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Erection and fastening of exterior cladding and interior and exterior veneer.	OBSERVE	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. Inspector Note: Inspection not required if height is less than 30 feet or weight is less than 5psf
2. Interior and exterior non-load bearing walls	OBSERVE	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. Inspector Note: Inspection not required if height is less than 30 feet. Also, Interior non-load bearing walls need not be inspected if weighing less than 15psf
3. Access floors	OBSERVE	Verify that anchorage complies with approved construction documents. Inspection of post-installed anchors shall comply with approved ICC-ES report
4. Storage racks	OBSERVE	Verify that anchorage complies with approved construction documents. Inspection of post-installed anchors shall comply with approved ICC-ES report. Inspector Note: Not required for racks less than 8 feet in height

END SECTION

¹ **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor’s risk.

AA. PLUMBING/MECHANICAL/ELECTRICAL DESIGNATED SEISMIC SYSTEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED:

PLUMBING, MECHANICAL AND ELECTRICAL - DESIGNATED SEISMIC SYSTEMS IBC 1705.12.4		
TASK	INSPECTION TYPE ¹	DESCRIPTION
1. Designated Seismic Systems equipment verification	OBSERVE	<ul style="list-style-type: none"> ✓ Verify model number and serial number are in conformance with project specific seismic qualification (PSSQ) ✓ Verify Tag ID is correct and installed per specifications
2. Designated Seismic Systems equipment Mounting	OBSERVE	<ul style="list-style-type: none"> ✓ Verify that Anchor Base Bolting is installed per PSSQ ✓ Verify that Equipment Bracing is Installed per PSSQ ✓ Verify that Bracing Attachments are installed per PSSQ
3. Designated Seismic Systems utility Conduit/Piping	OBSERVE	<ul style="list-style-type: none"> ✓ Verify that Conduit/Piping is connected to the equipment per PSSQ (flex or rigid) ✓ Verify that Conduit/Piping is seismically supported independently of equipment and in accordance with PSSQ support requirements
4. Designated Seismic Systems clearance	OBSERVE	<ul style="list-style-type: none"> ✓ Adjacent Equipment – Verify that there is adequate gap to eliminate possibility of pounding ✓ Conduit/Piping - Verify that there is adequate gap to eliminate possibility of pounding

END SECTION

¹ **OBSERVE:** Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor’s risk.

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SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
05/18

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511 (2017) Reduced-Pressure Principle Backflow
Prevention Assembly

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

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

FCCCHR Manual (10th Edition) Manual of Cross-Connection
Control

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2017; Errata 1-2 2017; INT 1 2017)
National Electrical Safety Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2;
TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6;
TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10;
TIA 17-11; TIA 17-12; TIA 17-13; TIA
17-14; TIA 17-15; TIA 17-16; TIA 17-17)
National Electrical Code

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

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD (2015) Manual on Uniform Traffic Control
Devices

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Site Plan; G

Traffic Control Plan; G

SD-03 Product Data

Backflow Preventers; G

SD-06 Test Reports

Backflow Preventer Tests

SD-07 Certificates

Backflow Tester Certification

Backflow Preventers Certificate of Full Approval

1.3 CONSTRUCTION SITE PLAN

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

1.4 BACKFLOW PREVENTERS CERTIFICATE

Certificate of Full Approval from FCCCHR List, University of Southern California, attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval will not be acceptable.

1.4.1 Backflow Tester Certificate

Prior to testing, submit to the Contracting Officer certification issued by the State or local regulatory agency attesting that the backflow tester has successfully completed a certification course sponsored by the regulatory agency. Tester must not be affiliated with any company participating in any other phase of this Contract.

1.4.2 Backflow Prevention Training Certificate

Submit a certificate recognized by the State or local authority that states the Contractor has completed at least 10 hours of training in backflow preventer installations. The certificate must be current.

1.5 DOD CONDITION OF READINESS (COR)

DOD will set the Condition of Readiness (COR) based on the weather forecast for sustained winds 50 knots (60mph or 95 km/hr) or greater. Contact the Contracting Officer for the current COR setting.

Monitor weather conditions a minimum of twice a day and take appropriate actions according to the approved Emergency Plan in the accepted Accident Prevention Plan, EM 385-1-1 Section 01 Emergency Planning and the instructions below.

Unless otherwise directed by the Contracting Officer, comply with:

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

PART 2 PRODUCTS

2.1 TEMPORARY SIGNAGE

2.1.1 Bulletin Board

Within 7 calendar days of mobilization on site and prior to the commencement of work activities, provide a clear weatherproof covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, Safety and Health Information as required by EM 385-1-1 Section 01 and other information

approved by the Contracting Officer. Coordinate requirements herein with 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

2.1.2 Warning Signs

Post temporary signs, tags, and labels to give workers and the public adequate warning and caution of construction hazards according to the EM 385-1-1 Section 04. Attach signs to the perimeter fencing every 150 feet warning the public of the presence of construction hazards. Signs must require unauthorized persons to keep out of the construction site. Correct the data required by safety signs daily.

2.2 TEMPORARY TRAFFIC CONTROL

2.2.1 Barricades

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

2.3 FENCING

Provide fencing along the construction site and at all open excavations and tunnels to control access by unauthorized personnel. Safety fencing must be highly visible to be seen by pedestrians and vehicular traffic. Specific fencing requirements are as described herein. All fencing will meet the requirements of EM 385-1-1.

2.3.1 Polyethylene Mesh Safety Fencing

Temporary safety fencing must be a high visibility orange colored, high density polyethylene grid, a minimum of 48 inches high and maximum mesh size of 2 inches. Fencing must extend from the grade to a minimum of 48 inches above the grade and be tightly secured to T-posts spaced as necessary to maintain a rigid and taut fence. Fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection.

2.3.2 Chain Link Panel Fencing

Temporary panel fencing must be galvanized steel chain link panels 6 feet high. Multiple fencing panels may be linked together at the bases to form long spans as needed. Each panel base must be weighted down using sand bags or other suitable materials in order for the fencing to withstand anticipated winds while remaining upright. Fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection.

2.3.3 Post-Driven Chain Link Fencing

Temporary post-driven fencing must be galvanized chain link fencing 6 feet high supported by an tightly secured to galvanized steel posts driven below grade. Fence posts must be located on minimum 10 foot centers. Posts may be set in various surfaces such as sand, soil, asphalt or concrete as necessary. Chain link fencing must remain rigid and taut with

a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection. Fencing and posts must be completely removed at the completion of construction and any surfaces disturbed or damaged must be restored to its original condition. Underground utilities must be located and identified prior to setting fence posts. Fence must be equipped with a lockable gate. Gate must remain locked when construction personnel are not present.

2.4 TEMPORARY WIRING

Provide temporary wiring in accordance with EM 385-1-1 Section 11, NFPA 241 and NFPA 70. Include monthly inspection and testing of all equipment and apparatus.

2.5 BACKFLOW PREVENTERS

Reduced pressure principle type conforming to the applicable requirements AWWA C511. Provide backflow preventers complete with 150 pound brass mounted gate valve and strainer, 304 stainless steel or bronze, internal parts. The particular make, model/design, and size of backflow preventers to be installed must be included in the latest edition of the List of Approved Backflow Prevention Assemblies issued by the FCCCHR List and be accompanied by a Certificate of Full Approval from FCCCHR List. After installation conduct Backflow Preventer Tests and provide test reports verifying that the installation meets the FCCCHR Manual Standards.

PART 3 EXECUTION

3.1 EMPLOYEE PARKING

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

3.2 TEMPORARY BULLETIN BOARD

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

3.3 AVAILABILITY AND USE OF UTILITY SERVICES

3.3.1 Temporary Utilities

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

3.3.2 Payment for Utility Services

- a. The Government will make all reasonably required utilities available from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed will be charged to or paid at prevailing rates charged to the Government. Carefully conserve any utilities furnished without charge.

- c. Coordinate with installation's private utility companies for utility connections, available capacities, responsibility of providing materials and performing connections. Pay all costs incurred in connecting, converting, and transferring the utilities to the work.

3.3.3 Meters and Temporary Connections

Provide and maintain necessary temporary connections, distribution lines, and meter bases required to measure the amount of each utility used for the purpose of determining charges. Meters furnished by installation private utility companies. Notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired so that a utilities contract can be established. The respective private utility company will provide a meter and make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. Do not make the final electrical connection.

3.3.4 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of \$50.00 will be required. The last monthly bills for the fiscal year will normally be offset by the deposit and adjustments will be billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning 1 October, will require a new deposit. Notification of the due date for this deposit will be mailed prior to the end of the current fiscal year.

3.3.5 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, notify the Contracting Officer, in writing, 5 working days before termination is desired. The private utility companies operating and maintaining Fort Bragg utilities will take a final meter reading, disconnect service, and remove the meters. Then remove all the temporary distribution lines, meter bases, and associated paraphernalia. Pay all outstanding utility bills before final acceptance of the work by the Government.

3.3.6 Water

Contractor shall coordinate all temporary and permanent potable water piping and appurtenance installation and connections with Old North Utility Services, Inc. (ONUS), the private utility company providing exterior water distribution utility service for Fort Bragg. No connection to the water distribution system will be made without a permit from ONUS. All exterior water distribution system components and appurtenances shall be installed in accordance with the manufacturer's instructions, AWWA, North Carolina standards, and ONUS's standards and specifications. Contact ONUS at (910) 495-1311 for a copy of the latest approved installation standards.

3.3.7 Sanitation

- a. Provide toilet/sanitation and temporary sewer facilities in accordance with EM 385-1-1 Section 02. Ventilate the units to control odors and fumes and empty and clean them at least once a week or more often if required by the Contracting Officer. Provide self-closing doors. The exterior of the unit shall match the base standard color. Locate the facility behind the construction fence or out of the public view.

- b. Contractor shall coordinate all temporary and permanent sanitary sewer piping an appurtenance installation and connections with Old North Utility Services, Inc. (ONUS), the private utility company providing exterior sanitary sewer utility service for Fort Bragg. No connection to the sanitary sewer system will be made without a permit from ONUS. All exterior sanitary sewer system components and appurtenances shall be installed in accordance with the manufacturer's instructions, North Carolina standards, and ONUS's standards and specifications. Contact ONUS at (910) 495-1311 for a copy of the latest approved installation standards.

3.3.8 Telephone

Make arrangements and pay all costs for telephone facilities desired.

3.3.9 Obstruction Lighting of Cranes

Contractor shall coordinate all temporary and permanent exterior electrical utility service, lighting and associated appurtenance installation and connections with Sandhills Utility Services, LLC (SUS), the private utility company providing exterior utility service and lighting for Fort Bragg. SUS shall install all exterior electric system components and appurtenances in accordance with the manufacturer's instructions, IEEE C2, and the SUS's installation standards. All necessary transformers, switchgear, poles, hardware, cables, conductors, connectors, and other equipment required for a complete and operable system shall be provided by SUS.

3.3.10 Fire Protection

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

3.4 TRAFFIC PROVISIONS

3.4.1 Maintenance of Traffic

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

3.4.2 Protection of Traffic

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

3.4.3 Rush Hour Restrictions

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

3.4.4 Dust Control

Dust control methods and procedures must be approved by the Contracting Officer. Coordinate dust control methods with 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

3.5 CONTRACTOR'S TEMPORARY FACILITIES

Temporary facilities will meet requirements as identified in EM 385-1-1 Section 04.

3.5.1 Safety Systems

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

3.5.2 Administrative Field Offices

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

3.5.3 Storage Area

Construct a temporary 6 foot high chain link fence around trailers and materials. Include plastic strip inserts, colored brown that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Do not place or store trailers, materials, or equipment outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the installation boundaries. Trailers, equipment, or materials must not be open to public view with the exception

of those items which are in support of ongoing work on any given day. Do not stockpile materials outside the fence in preparation for the next day's work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day.

3.5.4 Supplemental Storage Area

Upon request, and pending availability, the Contracting Officer will designate another or supplemental area for the use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but will be within the installation boundaries. The area will be maintained in an clean and orderly fashion and secured if needed to protect supplies and equipment. Utilities will not be provided to this area by the Government.

3.5.5 Appearance of Trailers

- a. Trailers which are rusted, have peeling paint or are otherwise in need of repair will not be allowed on Installation property. Trailers must present a clean and neat exterior appearance and be in a state of good repair.
- b. Maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal.

3.5.6 Maintenance of Storage Area

- a. Keep fencing in a state of good repair and proper alignment. Grassed or unpaved areas, which are not established roadways, and will be traversed with construction equipment or other vehicles, will be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways, should the Contractor elect to traverse them with construction equipment or other vehicles. Mow and maintain grass located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers will be edged or trimmed neatly.
- b. Cut grass (or annual weeds) within the construction and storage sites to a maximum 4 inch height at least once a week during the growing season, whether or not area is visible to the public to assist in rodent control. Trim the grass around fences at time of grass cutting. Maintain grass or weeds on stockpiled earth as described above.

3.5.7 New Building

In the event a new building is constructed for the temporary project field office, it will be a minimum 12 feet in width, 16 feet in length and have a minimum of 7 feet headroom. Equip the building with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. Provide a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building must be waterproof, supplied with a heater, have a minimum of two doors, electric lights, a telephone, a battery operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Approved sanitary facilities must be furnished. Screen

the windows and doors and provide the doors with dead bolt type locking devices or a padlock and heavy duty hasp bolted to the door. Door hinge pins will be non-removable. Arrange the windows to open and to be securely fastened from the inside. Protect glass panels in windows by bars or heavy mesh screens to prevent easy access. In warm weather, furnish air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 20 degrees F below the outside temperature when the outside temperature is 95 degrees F. Any new building erected for a temporary field office must be maintained during the life of the contract. Unless otherwise directed by the Contracting Officer, remove the building from the site upon completion and acceptance of the work.

3.5.8 Security Provisions

Provide adequate outside security lighting at the temporary facilities. The Contractor will be responsible for the security of its own equipment.

3.5.9 Storage Size and Location

The open site available for storage must be confined to the indicated project limits.

3.5.10 Storage in Existing Buildings

The Contractor will be working around existing buildings; the storage of material will not be allowed in the buildings.

3.5.11 Weather Protection of Temporary Facilities and Stored Materials

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

3.5.11.1 Building and Site Storm Protection

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

3.6 PLANT COMMUNICATIONS

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

3.7 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, furnish and erect temporary project safety fencing at the work site. Maintain the safety fencing during the

life of the contract and, upon completion and acceptance of the work, remove from the work site.

3.8 CLEANUP

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

3.9 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and any other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence. Restore areas used during the performance of the contract to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary.

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TEMPORARY ENVIRONMENTAL CONTROLS
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PART 1 GENERAL

1.1 REFERENCES

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

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

29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
29 CFR 1910.1053	Respirable Crystalline Silica
29 CFR 1926.1153	Respirable Crystalline Silica
40 CFR 50	National Primary and Secondary Ambient Air Quality Standards
40 CFR 60	Standards of Performance for New Stationary Sources
40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 63	National Emission Standards for Hazardous Air Pollutants for Source Categories
40 CFR 64	Compliance Assurance Monitoring
40 CFR 112	Oil Pollution Prevention
40 CFR 122.26	Storm Water Discharges (Applicable to State NPDES Programs, see section 123.25)
40 CFR 152	Pesticide Registration and Classification Procedures
40 CFR 152 - 186	Pesticide Programs
40 CFR 241	Guidelines for Disposal of Solid Waste
40 CFR 243	Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste
40 CFR 258	Subtitle D Landfill Requirements
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous

Waste

40 CFR 261.7	Residues of Hazardous Waste in Empty Containers
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 262.31	Standards Applicable to Generators of Hazardous Waste-Labeling
40 CFR 262.34	Standards Applicable to Generators of Hazardous Waste-Accumulation Time
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 273	Standards for Universal Waste Management
40 CFR 273.2	Standards for Universal Waste Management - Batteries
40 CFR 273.3	Standards for Universal Waste Management - Pesticides
40 CFR 273.4	Standards for Universal Waste Management - Mercury Containing Equipment
40 CFR 273.5	Standards for Universal Waste Management - Lamps
40 CFR 279	Standards for the Management of Used Oil
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 300.125	National Oil and Hazardous Substances Pollution Contingency Plan - Notification and Communications
40 CFR 355	Emergency Planning and Notification
40 CFR 403	General Pretreatment Regulations for Existing and New Sources of Pollution

40 CFR 745	Lead-Based Paint Poisoning Prevention in Certain Residential Structures
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Class I and II Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act. A list of Class I ODS can be found on the EPA website at the following weblink.
<https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances>.

Class II ODS is defined in Section 602(s) of The Clean Air Act. A list of Class II ODS can be found on the EPA website at the following weblink.
<https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances>.

1.2.2 Contractor Generated Hazardous Waste

Contractor generated hazardous waste is materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene), waste thinners, excess paints, excess solvents, waste solvents, excess pesticides, and contaminated pesticide equipment rinse water.

1.2.3 Electronics Waste

Electronics waste is discarded electronic devices intended for salvage, recycling, or disposal.

1.2.4 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally or historically.

1.2.5 Environmental Protection

Environmental protection is the prevention/control of pollution and

habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2.6 Hazardous Debris

As defined in paragraph SOLID WASTE, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore structure) in accordance with 40 CFR 261. Hazardous debris also includes debris that exhibits a characteristic of hazardous waste in accordance with 40 CFR 261.

1.2.7 Hazardous Materials

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

Hazardous material is any material that: Is regulated as a hazardous material in accordance with 49 CFR 173; or requires a Safety Data Sheet (SDS) in accordance with 29 CFR 1910.120; or during end use, treatment, handling, packaging, storage, transportation, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by 40 CFR 261 Subparts A, B, C, or D. Designation of a material by this definition, when separately regulated or controlled by other sections or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this section for "control" purposes. Such material includes ammunition, weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, medical waste and infectious materials, bulk fuels, radioactive materials, and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs).

1.2.8 Hazardous Waste

Hazardous Waste is any material that meets the definition of a solid waste and exhibit a hazardous characteristic (ignitability, corrosivity, reactivity, or toxicity) as specified in 40 CFR 261, Subpart C, or contains a listed hazardous waste as identified in 40 CFR 261, Subpart D.

1.2.9 Installation Pest Management Coordinator

Installation Pest Management Coordinator (IPMC) is the individual officially designated by the Installation Commander to oversee the Installation Pest Management Program and the Installation Pest Management Plan.

1.2.10 Land Application

Land Application means spreading or spraying discharge water at a rate that allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" must occur. Comply with federal, state, and local laws and regulations.

1.2.11 Municipal Separate Storm Sewer System (MS4) Permit

MS4 permits are those held by installations to obtain NPDES permit coverage for their stormwater discharges.

1.2.12 National Pollutant Discharge Elimination System (NPDES)

The NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

1.2.13 Oily Waste

Oily waste are those materials that are, or were, mixed with Petroleum, Oils, and Lubricants (POLs) and have become separated from that POLs. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, POLs and may be appropriately tested and discarded in a manner which is in compliance with other state and local requirements.

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land filled provided that: It is not prohibited in other state regulations or local ordinances; the amount generated is "de minimus" (a small amount); it is the result of minor leaks or spills resulting from normal process operations; and free-flowing oil has been removed to the practicable extent possible. Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, perform a hazardous waste determination prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

1.2.14 Pesticide

Pesticide is any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, or intended for use as a plant regulator, defoliant or desiccant.

1.2.15 Pesticide Treatment Plan

A plan for the prevention, monitoring, and control to eliminate pest infestation.

1.2.16 Pests

Pests are arthropods, birds, rodents, nematodes, fungi, bacteria, viruses, algae, snails, marine borers, snakes, weeds and other organisms (except for human or animal disease-causing organisms) that adversely affect readiness, military operations, or the well-being of personnel and animals; attack or damage real property, supplies, equipment, or vegetation; or are otherwise undesirable.

1.2.17 Project Pesticide Coordinator

The Project Pesticide Coordinator (PPC) is an individual who resides at a Civil Works Project office and who is responsible overseeing of pesticide application on project grounds.

1.2.18 Regulated Waste

Regulated waste are solid wastes that have specific additional federal, state, or local controls for handling, storage, or disposal.

1.2.19 Sediment

Sediment is soil and other debris that have eroded and have been transported by runoff water or wind.

1.2.20 Solid Waste

Solid waste is a solid, liquid, semi-solid or contained gaseous waste. A solid waste can be a hazardous waste, non-hazardous waste, or non-Resource Conservation and Recovery Act (RCRA) regulated waste. Types of solid waste typically generated at construction sites may include:

1.2.20.1 Debris

Debris is non-hazardous solid material generated during the construction, demolition, or renovation of a structure that exceeds 2.5-inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (for example, cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may not be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.

1.2.20.2 Green Waste

Green waste is the vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.

1.2.20.3 Material not regulated as solid waste

Material not regulated as solid waste is nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

1.2.20.4 Non-Hazardous Waste

Non-hazardous waste is waste that is excluded from, or does not meet, hazardous waste criteria in accordance with 40 CFR 263.

1.2.20.5 Recyclables

Recyclables are materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable, wiring, insulated/non-insulated copper wire cable, wire rope, and structural components. It also includes commercial-grade refrigeration equipment with Freon removed, household

appliances where the basic material content is metal, clean polyethylene terephthalate bottles, cooking oil, used fuel oil, textiles, high-grade paper products and corrugated cardboard, stackable pallets in good condition, clean crating material, and clean rubber/vehicle tires. Metal meeting the definition of lead contaminated or lead based paint contaminated may not be included as recyclable if sold to a scrap metal company. Paint cans that meet the definition of empty containers in accordance with 40 CFR 261.7 may be included as recyclable if sold to a scrap metal company.

1.2.20.6 Surplus Soil

Surplus soil is existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars, and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included and must be managed in accordance with paragraph HAZARDOUS MATERIAL MANAGEMENT.

1.2.20.7 Scrap Metal

This includes scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe, and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

1.2.20.8 Wood

Wood is dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included. Treated wood includes, but is not limited to, lumber, utility poles, crossties, and other wood products with chemical treatment.

1.2.21 Surface Discharge

Surface discharge means discharge of water into drainage ditches, storm sewers, creeks or "waters of the United States". Surface discharges are discrete, identifiable sources and require a permit from the governing agency. Comply with federal, state, and local laws and regulations.

1.2.22 Wastewater

Wastewater is the used water and solids from a community that flow to a treatment plant.

1.2.22.1 Stormwater

Stormwater is any precipitation in an urban or suburban area that does not evaporate or soak into the ground, but instead collects and flows into storm drains, rivers, and streams.

1.2.23 Waters of the United States

Waters of the United States means Federally jurisdictional waters, including wetlands, that are subject to regulation under Section 404 of the Clean Water Act or navigable waters, as defined under the Rivers and Harbors Act.

1.2.24 Wetlands

Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

1.2.25 Universal Waste

The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (for example, thermostats), and lamps (for example, fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal. These regulations can be found at 40 CFR 273.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preconstruction Survey

Solid Waste Management Permit; G

Regulatory Notifications; G

Environmental Protection Plan; G

Stormwater Pollution Prevention Plan (SWPPP); G

Stormwater Notice of Intent (for NPDES coverage under the general permit for construction activities); G

Dirt and Dust Control Plan; G

Employee Training Records; G

Environmental Manager Qualifications; G

SD-06 Test Reports

Inspection Reports

Monthly Solid Waste Disposal Report; G, S

SD-07 Certificates

Employee Training Records; G

Certificate of Competency

Erosion and Sediment Control Inspector Qualifications

SD-11 Closeout Submittals

Stormwater Pollution Prevention Plan Compliance Notebook; G

Stormwater Notice of Termination (for NPDES coverage under the
general permit for construction activities); G
Waste Determination Documentation; G

Disposal Documentation for Hazardous and Regulated Waste; G

Assembled Employee Training Records; G

Solid Waste Management Permit; G

Project Solid Waste Disposal Documentation Report; G, S

Contractor Hazardous Material Inventory Log; G

Hazardous Waste/Debris Management; G

Regulatory Notifications; G
Sales Documentation; G

Contractor Certification

As-Built Topographic Survey

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Protect the environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire duration of this Contract. Comply with federal, state, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

Tests and procedures assessing whether construction operations comply with Applicable Environmental Laws may be required. Analytical work must be performed by qualified laboratories; and where required by law, the laboratories must be certified.

1.4.1 Conformance with the Environmental Management System

Perform work under this contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). Perform work in a manner that conforms to objectives and targets of the environmental programs and operational controls identified by the EMS. Support Government personnel when environmental compliance and EMS audits are conducted by escorting auditors at the Project site, answering

questions, and providing proof of records being maintained. Provide monitoring and measurement information as necessary to address environmental performance relative to environmental, energy, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, take corrective and preventative actions. In addition, employees must be aware of their roles and responsibilities under the installation EMS and of how these EMS roles and responsibilities affect work performed under the contract.

Coordinate with the installation's EMS coordinator to identify training needs associated with environmental aspects and the EMS, and arrange training or take other action to meet these needs. Provide training documentation to the Contracting Officer. The Installation Environmental Office will retain associated environmental compliance records. Make EMS Awareness training completion certificates available to Government auditors during EMS audits and include the certificates in the Employee Training Records. See paragraph EMPLOYEE TRAINING RECORDS.

1.5 QUALITY ASSURANCE

1.5.1 Preconstruction Survey and Protection of Features

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, perform a Preconstruction Survey of the project site with the Contracting Officer, and take photographs showing existing environmental conditions in and adjacent to the site. Submit a report for the record. Include in the report a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. The Contractor and the Contracting Officer will sign this survey report upon mutual agreement regarding its accuracy and completeness. Protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference that their preservation may cause to the work under the Contract.

1.5.2 Regulatory Notifications

Provide regulatory notification requirements in accordance with federal, state and local regulations. In cases where the Government will also provide public notification (such as stormwater permitting), coordinate with the Contracting Officer. Submit copies of regulatory notifications to the Contracting Officer at least 30 days prior to commencement of work activities. Typically, regulatory notifications must be provided for the following (this listing is not all-inclusive): demolition, renovation, NPDES defined site work, construction, removal or use of a permitted air emissions source, and remediation of controlled substances (asbestos, hazardous waste, lead paint).

1.5.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting. Provide the following information: types, quantities, and use of hazardous materials that will be brought onto the installation; and types and quantities of wastes/wastewater that may be generated during the

Contract. Discuss the results of the Preconstruction Survey at this time.

Prior to initiating any work on site, meet with the Contracting Officer and installation Environmental Office to discuss the proposed Environmental Protection Plan (EPP). Develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural and cultural resources, required reports, required permits, permit requirements (such as mitigation measures), and other measures to be taken.

1.5.4 Environmental Manager

Appoint in writing an Environmental Manager for the project site. The Environmental Manager is directly responsible for coordinating contractor compliance with federal, state, local, and installation requirements. The Environmental Manager must ensure compliance with Hazardous Waste Program requirements (including hazardous waste handling, storage, manifesting, and disposal); implement the EPP; ensure environmental permits are obtained, maintained, and closed out; ensure compliance with Stormwater Program requirements; ensure compliance with Hazardous Materials (storage, handling, and reporting) requirements; and coordinate any remediation of regulated substances (lead, asbestos, PCB transformers). This can be a collateral position; however, the person in this position must be trained to adequately accomplish the following duties: ensure waste segregation and storage compatibility requirements are met; inspect and manage Satellite Accumulation areas; ensure only authorized personnel add wastes to containers; ensure Contractor personnel are trained in 40 CFR requirements in accordance with their position requirements; coordinate removal of waste containers; and maintain the Environmental Records binder and required documentation, including environmental permits compliance and close-out. Submit Environmental Manager Qualifications to the Contracting Officer.

1.5.5 Employee Training Records

Prepare and maintain Employee Training Records throughout the term of the contract meeting applicable 40 CFR requirements. Provide Employee Training Records in the Environmental Records Binder. Submit these Assembled Employee Training Records to the Contracting Officer at the conclusion of the project, unless otherwise directed.

Train personnel to meet state requirements. Conduct environmental protection/pollution control meetings for personnel prior to commencing construction activities. Contact additional meetings for new personnel and when site conditions change. Include in the training and meeting agenda: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, waters of the United States, and endangered species and their habitat that are known to be in the area. Provide copy of the Erosion and Sediment Control Inspector Certification as required by state.

1.5.5.1 Pest Control Training

Trained personnel in pest control. Conduct a pest control meeting for

personnel prior to commencing construction activities. Conduct additional meetings for new personnel and when site conditions change. Include in the training and meeting agenda: methods of detecting and pest infestation; familiarization with statutory and contractual pest control standards; installation and care of devices, and instruments, if required, for monitoring purposes to ensure adequate and continuous pest control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of waters of the United States, and endangered species and their habitat that are known to be in the area. Provide a Certificate of Competency for the personnel who will be conducting the pesticide application and management of pest control.

1.5.6 Non-Compliance Notifications

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with federal, state or local environmental laws or regulations, permits, and other elements of the Contractor's EPP. After receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. FAR 52.242-14 Suspension of Work provides that a suspension, delay, or interruption of work due to the fault or negligence of the Contractor allows for no adjustments to the contract for time extensions or equitable adjustments. In addition to a suspension of work, the Contracting Officer may use additional authorities under the contract or law..

1.6 ENVIRONMENTAL PROTECTION PLAN

The purpose of the EPP is to present an overview of known or potential environmental issues that must be considered and addressed during construction. Incorporate construction related objectives and targets from the installation's EMS into the EPP. Include in the EPP measures for protecting natural and cultural resources, required reports, and other measures to be taken. Meet with the Contracting Officer or Contracting Officer Representative to discuss the EPP and develop a mutual understanding relative to the details for environmental protection including measures for protecting natural resources, required reports, and other measures to be taken. Submit the EPP within 30 days after notice to proceed and not less than 21 days before the preconstruction meeting. Revise the EPP throughout the project to include any reporting requirements, changes in site conditions, or contract modifications that change the project scope of work in a way that could have an environmental impact. No requirement in this section will relieve the Contractor of any applicable federal, state, and local environmental protection laws and regulations. During Construction, identify, implement, and submit for approval any additional requirements to be included in the EPP. Maintain the current version onsite.

The EPP includes, but is not limited to, the following elements:

1.6.1 General Overview and Purpose

1.6.1.1 Descriptions

A brief description of each specific plan required by environmental permit or elsewhere in this Contract such as stormwater pollution prevention plan, spill control plan, solid waste management plan, air pollution control plan, pesticide treatment plan, traffic control plan.

1.6.1.2 Duties

The duties and level of authority assigned to the person(s) on the job site who oversee environmental compliance, such as who is responsible for adherence to the EPP, who is responsible for spill cleanup and training personnel on spill response procedures, who is responsible for manifesting hazardous waste to be removed from the site (if applicable), and who is responsible for training the Contractor's environmental protection personnel.

1.6.1.3 Procedures

A copy of any standard or project-specific operating procedures that will be used to effectively manage and protect the environment on the project site.

1.6.1.4 Communications

Communication and training procedures that will be used to convey environmental management requirements to Contractor employees and subcontractors.

1.6.1.5 Contact Information

Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

1.6.2 General Site Information

1.6.2.1 Drawings

Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, jurisdictional wetlands, material storage areas, structures, sanitary facilities, storm drains and conveyances, and stockpiles of excess soil.

1.6.2.2 Work Area

Work area plan showing the proposed activity in each portion of the area and identify the areas of limited use or nonuse. Include measures for marking the limits of use areas, including methods for protection of features to be preserved within authorized work areas and methods to control runoff and to contain materials on site, and a traffic control plan.

1.6.2.3 Documentation

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

1.6.3 Management of Natural Resources

- a. Land resources
- b. Tree protection

- c. Replacement of damaged landscape features
- d. Temporary construction

1.6.4 Protection of Historical and Archaeological Resources

- a. Objectives
- b. Methods

1.6.5 Stormwater Management and Control

- a. Ground cover
- b. Erodible soils
- c. Temporary measures
 - (1) Structural Practices
 - (2) Temporary and permanent stabilization
- d. Effective selection, implementation and maintenance of Best Management Practices (BMPs).

1.6.6 Protection of the Environment from Waste Derived from Contractor Operations

Control and disposal of solid and sanitary waste. Control and disposal of hazardous waste.

This item consist of the management procedures for hazardous waste to be generated. The elements of those procedures will coincide with the Installation Hazardous Waste Management Plan. The Contracting Officer will provide a copy of the Installation Hazardous Waste Management Plan. As a minimum, include the following:

- a. List of the types of hazardous wastes expected to be generated
- b. Procedures to ensure a written waste determination is made for appropriate wastes that are to be generated
- c. Sampling/analysis plan, including laboratory method(s) that will be used for waste determinations and copies of relevant laboratory certifications
- d. Methods and proposed locations for hazardous waste accumulation/storage (that is, in tanks or containers)
- e. Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted)
- f. Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268)
- g. Management procedures for recyclable hazardous materials such as

lead-acid batteries, used oil, and similar

- h. Used oil management procedures in accordance with 40 CFR 279; Hazardous waste minimization procedures
- i. Plans for the disposal of hazardous waste by permitted facilities; and Procedures to be employed to ensure required employee training records are maintained.

1.6.7 Prevention of Releases to the Environment

Procedures to prevent releases to the environment

Notifications in the event of a release to the environment

1.6.8 Regulatory Notification and Permits

List what notifications and permit applications must be made. Some permits require up to 180 days to obtain. Demonstrate that those permits have been obtained or applied for by including copies of applicable environmental permits. The EPP will not be approved until the permits have been obtained.

1.6.9 Clean Air Act Compliance

1.6.9.1 Haul Route

Submit truck and material haul routes along with a Dirt and Dust Control Plan for controlling dirt, debris, and dust on Installation roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

1.6.9.2 Pollution Generating Equipment

Identify air pollution generating equipment or processes that may require federal, state, or local permits under the Clean Air Act. Determine requirements based on any current installation permits and the impacts of the project. Provide a list of all fixed or mobile equipment, machinery or operations that could generate air emissions during the project to the Installation Environmental Office (Air Program Manager).

1.6.9.3 Stationary Internal Combustion Engines

Identify portable and stationary internal combustion engines that will be supplied, used or serviced. Comply with 40 CFR 60 Subpart IIII, 40 CFR 60 Subpart JJJJ, 40 CFR 63 Subpart ZZZZ, and local regulations as applicable. At minimum, include the make, model, serial number, manufacture date, size (engine brake horsepower), and EPA emission certification status of each engine. Maintain applicable records and log hours of operation and fuel use. Logs must include reasons for operation and delineate between emergency and non-emergency operation.

1.6.9.4 Refrigerants

Identify management practices to ensure that heating, ventilation, and air conditioning (HVAC) work involving refrigerants complies with 40 CFR 82 requirements. Technicians must be certified, maintain copies of certification on site, use certified equipment and log work that requires

the addition or removal of refrigerant. Any refrigerant reclaimed is the property of the Government, coordinate with the Installation Environmental Office to determine the appropriate turn in location.

1.6.9.5 Air Pollution-engineering Processes

Identify planned air pollution-generating processes and management control measures (including, but not limited to, spray painting, abrasive blasting, demolition, material handling, fugitive dust, and fugitive emissions). Log hours of operations and track quantities of materials used.

1.6.9.6 Compliant Materials

Provide the Government a list of and SDSs for all hazardous materials proposed for use on site. Materials must be compliant with all Clean Air Act regulations for emissions including solvent and volatile organic compound contents, and applicable National Emission Standards for Hazardous Air Pollutants requirements. The Government may alter or limit use of specific materials as needed to meet installation permit requirements for emissions.

1.7 LICENSES AND PERMITS

Obtain licenses and permits required for the construction of the project and in accordance with FAR 52.236-7 Permits and Responsibilities. Notify the Government of all general use permitted equipment the Contractor plans to use on site. This paragraph supplements the Contractor's responsibility under FAR 52.236-7 Permits and Responsibilities.

a. The following permits have been obtained by the Government:

- (1) NCDEQ Stormwater Management Plan approval.
- (2) Erosion and Sediment Control Plan approval.
- (3) NEPA Approval.

1.8 ENVIRONMENTAL RECORDS BINDER

Maintain on-site a separate three-ring Environmental Records Binder and submit at the completion of the project. Make separate parts within the binder that correspond to each submittal listed under paragraph CLOSEOUT SUBMITTALS in this section.

1.9 PESTICIDE DELIVERY, STORAGE, AND HANDLING

1.9.1 Delivery and Storage

Deliver pesticides to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses. Store pesticides according to manufacturer's instructions and under lock and key when unattended.

1.9.2 Handling Requirements

Formulate, treat with, and dispose of pesticides and associated containers in accordance with label directions and use the clothing and personal

protective equipment specified on the labeling for use during each phases of the application. Furnish SDSs for pesticide products.

1.10 SOLID WASTE MANAGEMENT PERMIT

Provide the Contracting Officer with written notification of the quantity of anticipated solid waste or debris that is anticipated or estimated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance from the receiving location or as applicable; submit one copy of the receiving location state and local Solid Waste Management Permit or license showing such agency's approval of the disposal plan before transporting wastes off Government property.

1.10.1 Monthly Solid Waste Disposal Report

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the definitions provided in this section), amount, location, and name of the business receiving the solid waste.

1.11 FACILITY HAZARDOUS WASTE GENERATOR STATUS

Fort Bragg is designated as a Large Quantity Generator. Meet the regulatory requirements of this generator designation for any work conducted within the boundaries of this Installation. Comply with provisions of federal, state, and local regulatory requirements applicable to this generator status regarding training and storage, handling, and disposal of construction derived wastes.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants, including their habitats. Prior to the commencement of activities, consult with the Installation Environmental Office, regarding rare species or sensitive habitats that need to be protected. The protection of rare, threatened, and endangered animal and plant species identified, including their habitats, is the Contractor's responsibility.

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work that is consistent with the requirements of the Installation Environmental Office or as otherwise specified. Confine construction activities to within the limits of the work indicated or specified.

3.1.1 Flow Ways

Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as specified and permitted.

3.1.2 Vegetation

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

Protect existing trees that are to remain to ensure they are not injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. Coordinate with the Contracting Officer and Installation Environmental Office to determine appropriate action for trees and other landscape features scarred or damaged by equipment operations.

3.2 STORMWATER

Do not discharge stormwater from construction sites to the sanitary sewer. If the water is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization in advance from the Installation Environmental Office for any release of contaminated water.

3.2.1 Construction General Permit

Provide a Construction General Permit as required by 40 CFR 122.26 or the State of North Carolina General Permit. Under the terms and conditions of the permit, install, inspect, maintain BMPs, prepare stormwater erosion and sediment control inspection reports, and submit SWPPP inspection reports. Maintain construction operations and management in compliance with the terms and conditions of the general permit for stormwater discharges from construction activities.

3.2.1.1 Stormwater Pollution Prevention Plan

Submit a project-specific Stormwater Pollution Prevention Plan (SWPPP) to the Contracting Officer for approval, prior to the commencement of work. The SWPPP must meet the requirements of 40 CFR 122.26 and the North Carolina State General Permit for stormwater discharges from construction sites.

Include the following:

- a. Comply with terms of the state general permit for stormwater discharges from construction activities. Prepare SWPPP in accordance with state requirements. Use EPA guide Developing your Stormwater Pollution Prevention Plan located at <https://www.epa.gov/npdes/developing-stormwater-pollution-prevention-plan-swppp> to prepare the SWPPP.
- b. Select applicable BMPs from EPA Fact Sheets located at <https://www.epa.gov/npdes/national-menu-best-management-practices-bmps-stormwater#> or in accordance with applicable state or local requirements.
- c. Include a completed copy of the Notice of Intent, BMP Inspection Report Template, and Stormwater Notice of Termination, except for the effective date.

3.2.1.2 Stormwater Notice of Intent for Construction Activities

Submit the construction NOI and appropriate permit fees to the appropriate federal or state agency for approval. No land disturbing activities may commence without permit coverage. Maintain an approved copy of the SWPPP at the onsite construction office, and continually update as regulations require, reflecting current site conditions.

3.2.1.3 Inspection Reports

Submit "Inspection Reports" to the Contracting Officer in accordance with the State of North Carolina Construction General Permit.

3.2.1.4 Stormwater Pollution Prevention Plan Compliance Notebook

Create and maintain a three ring binder of documents that demonstrate compliance with the Construction General Permit. Include a copy of the permit Notice of Intent, proof of permit fee payment, SWPPP and SWPPP update amendments, inspection reports and related corrective action records, copies of correspondence with the the North Carolina Department of Environmental Quality, and a copy of the permit Notice of Termination in the binder. At project completion, the notebook becomes property of the Government. Provide the compliance notebook to the Contracting Officer.

3.2.1.5 Stormwater Notice of Termination for Construction Activities

Submit a Notice of Termination to the Contracting Officer for approval once construction is complete and final stabilization has been achieved on all portions of the site for which the permittee is responsible. Once approved, submit the Notice of Termination to the appropriate state or federal agency. Prepare as-built topographic survey information required by the permitting agency for certification of the stormwater management system, and provide to the Contracting Officer.

3.2.2 Erosion and Sediment Control Measures

Provide erosion and sediment control measures in accordance with state and local laws and regulations. Preserve vegetation to the maximum extent practicable.

Erosion control inspection reports may be compiled as part of a stormwater pollution prevention plan inspection reports.

3.2.3 Work Area Limits

Mark the areas that need not be disturbed under this Contract prior to commencing construction activities. Mark or fence isolated areas within the general work area that are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, any markers must be visible in the dark. Personnel must be knowledgeable of the purpose for marking and protecting particular objects.

3.2.4 Contractor Facilities and Work Areas

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the

Contracting Officer. Move or relocate the Contractor facilities only when approved by the Government. Provide erosion and sediment controls for onsite borrow and spoil areas to prevent sediment from entering nearby waters. Control temporary excavation and embankments for plant or work areas to protect adjacent areas.

3.2.5 Municipal Separate Storm Sewer System (MS4) Management

Comply with the Installation's MS4 permit requirements.

3.3 SURFACE AND GROUNDWATER

3.3.1 Cofferdams, Diversions, and Dewatering

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure must be constantly controlled to maintain compliance with existing state water quality standards and designated uses of the surface water body. Comply with the State of North Carolina water quality standards and anti-degradation provisions. Do not discharge excavation ground water to the sanitary sewer, storm drains, or to surface waters without prior specific authorization in writing from the Installation Environmental Office. Discharge of hazardous substances will not be permitted under any circumstances. Use sediment control BMPs to prevent construction site runoff from directly entering any storm drain or surface waters.

If the construction dewatering is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization for any contaminated groundwater release in advance from the Installation Environmental Officer and the federal or state authority, as applicable. Discharge of hazardous substances will not be permitted under any circumstances.

3.3.2 Waters of the United States

Do not enter, disturb, destroy, or allow discharge of contaminants into waters of the United States.

3.4 PROTECTION OF CULTURAL RESOURCES

3.4.1 Archaeological Resources

If, during excavation or other construction activities, any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, activities that may damage or alter such resources will be suspended. Resources covered by this paragraph include, but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. Cease all activities that may result in impact to or the destruction of these resources. Secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources. The Government retains ownership and control over archaeological resources.

3.5 AIR RESOURCES

Equipment operation, activities, or processes will be in accordance with 40 CFR 64 and state air emission and performance laws and standards.

3.5.1 Preconstruction Air Permits

Notify the Air Program Manager, through the Contracting Officer, at least 6 months prior to bringing equipment, assembled or unassembled, onto the Installation, so that air permits can be secured. Necessary permitting time must be considered in regard to construction activities. Clean Air Act (CAA) permits must be obtained prior to bringing equipment, assembled or unassembled, onto the Installation.

Confirm that these permits have been obtained.

3.5.2 Oil or Dual-fuel Boilers and Furnaces

Provide product data and details for new, replacement, or relocated fuel fired boilers, heaters, or furnaces to the Installation Environmental Office (Air Program Manager) through the Contracting Officer. Data to be reported include: equipment purpose (water heater, building heat, process), manufacturer, model number, serial number, fuel type (oil type, gas type) size (MMBTU heat input). Provide in accordance with paragraph PRECONSTRUCTION AIR PERMITS.

3.5.3 Burning

Burning is prohibited on the Government premises.

3.5.4 Class I and II ODS Prohibition

Class I and II ODS are Government property and must be returned to the Government for appropriate management. Coordinate with the Installation Environmental Office to determine the appropriate location for turn in of all reclaimed refrigerant.

3.5.5 Accidental Venting of Refrigerant

Accidental venting of a refrigerant is a release and must be reported immediately to the Contracting Officer.

3.5.6 EPA Certification Requirements

Heating and air conditioning technicians must be certified through an EPA-approved program. Maintain copies of certifications at the employees' places of business; technicians must carry certification wallet cards, as provided by environmental law.

3.5.7 Dust Control

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

concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster. Since these products contain Crystalline Silica, comply with the applicable OSHA standard, 29 CFR 1910.1053 or 29 CFR 1926.1153 for controlling exposure to Crystalline Silica Dust.

3.5.7.1 Particulates

Dust particles, aerosols and gaseous by-products from construction activities, and processing and preparation of materials (such as from asphaltic batch plants) must be controlled at all times, including weekends, holidays, and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates that would exceed 40 CFR 50, state, and local air pollution standards or that would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators, or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp. Provide sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a particulate nuisance or hazard occurs. Comply with state and local visibility regulations.

3.5.7.2 Abrasive Blasting

Blasting operations cannot be performed without prior approval of the Installation Air Program Manager. The use of silica sand is prohibited in sandblasting.

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

3.5.8 Odors

Control odors from construction activities. The odors must be in compliance with state regulations and local ordinances and may not constitute a health hazard.

3.6 WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of waste. Include procedures for pollution prevention/ hazardous waste minimization in the Hazardous Waste Management Section of the EPP. Obtain a copy of the installation's Pollution Prevention/Hazardous Waste Minimization Plan for reference material when preparing this part of the EPP. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the anticipated types of the hazardous materials to be used in the construction when requesting information.

3.6.1 Salvage, Reuse and Recycle

Identify anticipated materials and waste for salvage, reuse, and recycling. Describe actions to promote material reuse, resale or recycling. To the extent practicable, all scrap metal must be sent for reuse or recycling and will not be disposed of in a landfill.

Include the name, physical address, and telephone number of the hauler, if transported by a franchised solid waste hauler. Include the destination and, unless exempted, provide a copy of the state or local permit (cover) or license for recycling.

3.6.2 Nonhazardous Solid Waste Diversion Report

Maintain an inventory of nonhazardous solid waste diversion and disposal of construction and demolition debris. Submit a report to the Contracting Officer on the first working day after each fiscal year quarter, starting the first quarter that nonhazardous solid waste has been generated. Include the following in the report:

Construction and Demolition (C&D) Debris Disposed	tons, as appropriate
C&D Debris Recycled	tons, as appropriate
C&D Debris Composted	cubic yards, as appropriate
Total C&D Debris Generated	cubic yards or tons, as appropriate
Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount)	cubic yards or tons, as appropriate

3.7 WASTE MANAGEMENT AND DISPOSAL

3.7.1 Waste Determination Documentation

Complete a Waste Determination form (provided at the pre-construction conference) for Contractor-derived wastes to be generated. All potentially hazardous solid waste streams that are not subject to a specific exclusion or exemption from the hazardous waste regulations (e.g. scrap metal, domestic sewage) or subject to special rules, (lead-acid batteries and precious metals) must be characterized in accordance with the requirements of 40 CFR 261 or corresponding applicable state or local regulations. Base waste determination on user knowledge of the processes and materials used, and analytical data when necessary. Consult with the Installation environmental staff for guidance on specific requirements. Attach support documentation to the Waste Determination form. As a minimum, provide a Waste Determination form for the following waste (this listing is not inclusive): oil- and latex -based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and containers of the original materials.

3.7.2 Solid Waste Management

3.7.2.1 Project Solid Waste Disposal Documentation Report

Provide copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, a statement indicating the disposal location for the solid waste that is signed by an employee authorized to legally obligate or bind the firm may be submitted. The sales documentation Contractor certification must include the receiver's tax identification number and business, EPA or state registration number, along with the receiver's delivery and business addresses and telephone numbers. For each solid waste retained for the Contractor's own use, submit the information previously described in this paragraph on the solid waste disposal report. Prices paid or received do not have to be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

3.7.2.2 Control and Management of Solid Wastes

Pick up solid wastes, and place in covered containers that are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Employ segregation measures so that no hazardous or toxic waste will become co-mingled with non-hazardous solid waste. Transport solid waste off Government property and dispose of it in compliance with 40 CFR 260, state, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill is the minimum acceptable offsite solid waste disposal option. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. Segregate and separate treated wood components disposed at a lined landfill approved to accept this waste in accordance with local and state regulations. Solid waste disposal offsite must comply with most stringent local, state, and federal requirements, including 40 CFR 241, 40 CFR 243, and 40 CFR 258.

Manage hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, in accordance with 49 CFR 173.

3.7.3 Control and Management of Hazardous Waste

Do not dispose of hazardous waste on Government property. Do not discharge any waste to a sanitary sewer, storm drain, or to surface waters or conduct waste treatment or disposal on Government property without written approval of the Contracting Officer.

3.7.3.1 Hazardous Waste/Debris Management

Identify construction activities that will generate hazardous waste or debris. Provide a documented waste determination for resultant waste streams. Identify, label, handle, store, and dispose of hazardous waste or debris in accordance with federal, state, and local regulations, including 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, and 40 CFR 268.

Manage hazardous waste in accordance with the approved Hazardous Waste Management Section of the EPP. Store hazardous wastes in approved containers in accordance with 49 CFR 173 and 49 CFR 178. Hazardous waste generated within the confines of Government facilities is identified as being generated by the Government. Prior to removal of any hazardous waste from Government property, hazardous waste manifests must be signed by personnel from the Installation Environmental Office. Do not bring hazardous waste onto Government property. Provide the Contracting Officer with a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in 40 CFR 372-SUBPART D.

3.7.3.2 Waste Storage/Satellite Accumulation/90 Day Storage Areas

Accumulate hazardous waste at satellite accumulation points and in compliance with 40 CFR 262.34 and applicable state or local regulations. Individual waste streams will be limited to 55 gallons of accumulation (or 1 quart for acutely hazardous wastes). If the Contractor expects to generate hazardous waste at a rate and quantity that makes satellite accumulation impractical, the Contractor may request a temporary 90 day accumulation point be established. Submit a request in writing to the

Contracting Officer and provide the following information (Attach Site Plan to the Request):

Contract Number	
Contractor	
Haz/Waste or Regulated Waste POC	
Phone Number	
Type of Waste	
Source of Waste	
Emergency POC	
Phone Number	
Location of the Site	

Attach a Waste Determination form for the expected waste streams. Allow 10 working days for processing this request. Additional compliance requirements (e.g. training and contingency planning) that may be required are the responsibility of the Contractor. Barricade the designated area where waste is being stored and post a sign identifying as follows:

"DANGER - UNAUTHORIZED PERSONNEL KEEP OUT"

3.7.3.3 Hazardous Waste Disposal

3.7.3.3.1 Responsibilities for Contractor's Disposal

Provide hazardous waste manifest to the Installations Environmental Office for review, approval, and signature prior to shipping waste off Government property.

3.7.3.3.1.1 Services

Provide service necessary for the final treatment or disposal of the hazardous material or waste in accordance with 40 CFR 260, local, and state, laws and regulations, and the terms and conditions of the Contract within 60 days after the materials have been generated. These services include necessary personnel, labor, transportation, packaging, detailed analysis (if required for disposal or transportation, include manifesting or complete waste profile sheets, equipment, and compile documentation).

3.7.3.3.1.2 Samples

Obtain a representative sample of the material generated for each job done to provide waste stream determination.

3.7.3.3.1.3 Analysis

Analyze each sample taken and provide analytical results to the Contracting Officer. See paragraph WASTE DETERMINATION DOCUMENTATION.

3.7.3.3.1.4 Labeling

Determine the Department of Transportation's (DOT's) proper shipping names for waste (each container requiring disposal) and demonstrate to the Contracting Officer how this determination is developed and supported by the sampling and analysis requirements contained herein. Label all containers of hazardous waste with the words "Hazardous Waste" or other words to describe the contents of the container in accordance with 40 CFR 262.31 and applicable state or local regulations.

3.7.3.4 Universal Waste Management

Manage the following categories of universal waste in accordance with federal, state, and local requirements and installation instructions:

- a. Batteries as described in 40 CFR 273.2
- b. Lamps as described in 40 CFR 273.5
- c. Mercury-containing equipment as described in 40 CFR 273.4
- d. Pesticides as described in 40 CFR 273.3

Mercury is prohibited in the construction of this facility, unless specified otherwise, and with the exception of mercury vapor lamps and fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, in rubbish containers is prohibited. Remove without breaking, pack to prevent breakage, and transport out of the activity in an unbroken condition for disposal as directed.

3.7.3.5 Electronics End-of-Life Management

Recycle or dispose of electronics waste, including, but not limited to, used electronic devices such computers, monitors, hard-copy devices, televisions, mobile devices, in accordance with 40 CFR 260-262, state, and local requirements, and installation instructions.

3.7.3.6 Disposal Documentation for Hazardous and Regulated Waste

Contact the Contracting Officer for the facility RCRA identification number that is to be used on each manifest.

Submit a copy of the applicable EPA and or state permit(s), manifest(s), or license(s) for transportation, treatment, storage, and disposal of hazardous and regulated waste by permitted facilities. Hazardous or toxic waste manifests must be reviewed, signed, and approved by the Contracting Officer before the Contractor may ship waste. To obtain specific disposal instructions, coordinate with the Installation Environmental Office.

3.7.4 Releases/Spills of Oil and Hazardous Substances

3.7.4.1 Response and Notifications

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated in accordance with 40 CFR 300. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt,

effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the Installation Fire Department, the Installation Command Duty Officer, the Installation Environmental Office, the Contracting Officer.

Submit verbal and written notifications as required by the federal (40 CFR 300.125 and 40 CFR 355), state, local regulations and instructions. Provide copies of the written notification and documentation that a verbal notification was made within 20 days. Spill response must be in accordance with 40 CFR 300 and applicable state and local regulations. Contain and clean up these spills without cost to the Government.

3.7.4.2 Clean Up

Clean up hazardous and non-hazardous waste spills. Reimburse the Government for costs incurred including sample analysis materials, clothing, equipment, and labor if the Government will initiate its own spill cleanup procedures, for Contractor- responsible spills, when: Spill cleanup procedures have not begun within one hour of spill discovery/occurrence; or, in the Government's judgment, spill cleanup is inadequate and the spill remains a threat to human health or the environment.

3.7.5 Mercury Materials

Immediately report to the Environmental Office and the Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction of the Contracting Officer.

Do not recycle a mercury spill cleanup; manage it as a hazardous waste for disposal.

3.7.6 Wastewater

3.7.6.1 Disposal of wastewater must be as specified below.

3.7.6.1.1 Treatment

Do not allow wastewater from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, and forms to enter water ways or to be discharged prior to being treated to remove pollutants. Dispose of the construction- related waste water off-Government property in accordance with 40 CFR 403, state, regional, and local laws and regulations.

3.7.6.1.2 Surface Discharge

For discharge of ground water. Surface discharge in accordance with the requirements of the NPDES or state STORMWATER DISCHARGES FROM CONSTRUCTION SITES permit.

3.7.6.1.3 Land Application

Water generated from the flushing of lines after disinfection or disinfection in conjunction with hydrostatic testing must be discharged into the sanitary sewer with prior approval and notification to the

Wastewater Treatment Plant's Operator.

3.8 HAZARDOUS MATERIAL MANAGEMENT

Include hazardous material control procedures in the Safety Plan, in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Do not bring hazardous material onto Government property that does not directly relate to requirements for the performance of this contract. Submit an SDS and estimated quantities to be used for each hazardous material to the Contracting Officer prior to bringing the material on the installation. Typical materials requiring SDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. Use hazardous materials in a manner that minimizes the amount of hazardous waste generated. Containers of hazardous materials must have National Fire Protection Association labels or their equivalent. Certify that hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste, in accordance with 40 CFR 261.

3.8.1 Contractor Hazardous Material Inventory Log

Submit the "Contractor Hazardous Material Inventory Log"(found at: <http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphic>), which provides information required by (EPCRA Sections 312 and 313) along with corresponding SDS, to the Contracting Officer at the start and at the end of construction (30 days from final acceptance), and update no later than January 31 of each calendar year during the life of the contract. Keep copies of the SDSs for hazardous materials onsite. At the end of the project, provide the Contracting Officer with copies of the SDSs, and the maximum quantity of each material that was present at the site at any one time, the dates the material was present, the amount of each material that was used during the project, and how the material was used.

The Contracting Officer may request documentation for any spills or releases, environmental reports, or off-site transfers.

3.9 PREVIOUSLY USED EQUIPMENT

Clean previously used construction equipment prior to bringing it onto the project site. Equipment must be free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. Consult with the U.S. Department of Agriculture jurisdictional office for additional cleaning requirements.

3.10 CONTROL AND MANAGEMENT OF ASBESTOS-CONTAINING MATERIAL (ACM)

Manage and dispose of asbestos- containing waste in accordance with 40 CFR 61. Refer to Section 02 82 00 ASBESTOS REMEDIATION. Manifest asbestos-containing waste and provide the manifest to the Contracting Officer. Notifications to the state and Installation Air Program Manager are required before starting any asbestos work.

3.11 CONTROL AND MANAGEMENT OF LEAD-BASED PAINT (LBP)

Manage and dispose of lead-contaminated waste in accordance with 40 CFR 745 and Section 02 83 00 LEAD REMEDIATION. Manifest any lead-contaminated

waste and provide the manifest to the Contracting Officer.

3.12 CONTROL AND MANAGEMENT OF POLYCHLORINATED BIPHENYLS (PCBS)

Manage and dispose of PCB-contaminated waste in accordance with 40 CFR 761 and Section 02 84 16 HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBS AND MERCURY.

3.13 CONTROL AND MANAGEMENT OF LIGHTING BALLAST AND LAMPS CONTAINING PCBS

Manage and dispose of contaminated waste in accordance with 40 CFR 761. Refer to Section 02 84 16 HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBS AND MERCURY.

3.14 MILITARY MUNITIONS

In the event military munitions, as defined in 40 CFR 260, are discovered or uncovered, immediately stop work in that area and immediately inform the Contracting Officer.

3.15 PETROLEUM, OIL, LUBRICANT (POL) STORAGE AND FUELING

POL products include flammable or combustible liquids, such as gasoline, diesel, lubricating oil, used engine oil, hydraulic oil, mineral oil, and cooking oil. Store POL products and fuel equipment and motor vehicles in a manner that affords the maximum protection against spills into the environment. Manage and store POL products in accordance with EPA 40 CFR 112, and other federal, state, regional, and local laws and regulations. Use secondary containments, dikes, curbs, and other barriers, to prevent POL products from spilling and entering the ground, storm or sewer drains, stormwater ditches or canals, or navigable waters of the United States. Describe in the EPP (see paragraph ENVIRONMENTAL PROTECTION PLAN) how POL tanks and containers must be stored, managed, and inspected and what protections must be provided. Storage of oil, including fuel, on the project site is not allowed. Fuel must be brought to the project site each day that work is performed.

3.15.1 Used Oil Management

Manage used oil generated on site in accordance with 40 CFR 279. Determine if any used oil generated while onsite exhibits a characteristic of hazardous waste. Used oil containing 1,000 parts per million of solvents is considered a hazardous waste and disposed of at the Contractor's expense. Used oil mixed with a hazardous waste is also considered a hazardous waste. Dispose in accordance with paragraph HAZARDOUS WASTE DISPOSAL.

3.15.2 Oil Storage Including Fuel Tanks

Provide secondary containment and overflow protection for oil storage tanks. A berm used to provide secondary containment must be of sufficient size and strength to contain the contents of the tanks plus 5 inches freeboard for precipitation. Construct the berm to be impervious to oil for 72 hours that no discharge will permeate, drain, infiltrate, or otherwise escape before cleanup occurs. Use drip pans during oil transfer operations; adequate absorbent material must be onsite to clean up any spills and prevent releases to the environment. Cover tanks and drip pans during inclement weather. Provide procedures and equipment to prevent overflowing of tanks. If tanks and containers with an aggregate

aboveground capacity greater than 1320 gallons will be used onsite (only containers with a capacity of 55 gallons or greater are counted), provide and implement a SPCC plan meeting the requirements of 40 CFR 112. Do not bring underground storage tanks to the installation for Contractor use during a project. Submit the SPCC plan to the Contracting Officer for approval.

Monitor and remove any rainwater that accumulates in open containment dikes or berms. Inspect the accumulated rainwater prior to draining from a containment dike to the environment, to determine there is no oil sheen present.

3.16 INADVERTENT DISCOVERY OF PETROLEUM-CONTAMINATED SOIL OR HAZARDOUS WASTES

If petroleum-contaminated soil, or suspected hazardous waste is found during construction that was not identified in the Contract documents, immediately notify the Contracting Officer. Do not disturb this material until authorized by the Contracting Officer.

3.17 PEST MANAGEMENT

In order to minimize impacts to existing fauna and flora, coordinate with the Installation Pest Management Coordinator (IPMC) or Project Pesticide Coordinator (PPC), through the Contracting Officer, at the earliest possible time prior to pesticide application. Discuss integrated pest management strategies with the IPMC and receive concurrence from the IPMC through the Contracting Officer prior to the application of any pesticide associated with these specifications. Provide Installation Project Office Pest Management personnel the opportunity to be present at meetings concerning treatment measures for pest or disease control and during application of the pesticide. For termiticide requirements, see Section 31 31 16.13 CHEMICAL TERMITE CONTROL. The use and management of pesticides are regulated under 40 CFR 152 - 186.

3.17.1 Application

Apply pesticides using a state-certified pesticide applicator in accordance with EPA label restrictions and recommendation. The certified applicator must wear clothing and personal protective equipment as specified on the pesticide label. The Contracting Officer will designate locations for water used in formulating. Do not allow the equipment to overflow. Inspect equipment for leaks, clogging, wear, or damage and repair prior to application of pesticide.

3.17.2 Pesticide Treatment Plan

Include and update a pesticide treatment plan, as information becomes available. Include in the plan the sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (that is, pounds of active ingredient applied), equipment used for application and calibration of equipment. Comply with 40 CFR 152-189, state, regional, and local pest management record-keeping and reporting requirements as well as any additional Installation Project Office specific requirements in conformance with DA AR 200-1 Chapter 5, Pest Management, Section 5-4 "Program requirements" for data required to be reported to the Installation.

3.18 CHLORDANE

Evaluate excess soils and concrete foundation debris generated during the demolition of housing units or other wooden structures for the presence of chlordane or other pesticides prior to reuse or final disposal.

3.19 SOUND INTRUSION

Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives are not permitted.

Keep construction activities under surveillance and control to minimize environment damage by noise. Comply with the provisions of the State of North Carolina rules.

3.20 POST CONSTRUCTION CLEANUP

Clean up areas used for construction in accordance with Contract Clause: "Cleaning Up". Unless otherwise instructed in writing by the Contracting Officer, remove traces of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. Grade parking area and similar temporarily used areas to conform with surrounding contours.

-- End of Section --

CONTRACTOR HAZARDOUS MATERIAL INVENTORY LOG
(EPRCA)

PRIME COMPANY NAME: _____ CONTRACT NO: _____

PROJECT TITLE / LOCATION: _____

Material Name	Manufacturer	MSDS Number	State (i.e. Liquid, Solid, Gas)	Storage Quantity		Quality (lbs/gals) used in Calendar Year []
				Average Daily	Max Daily	

Contractor(s) certifies that the hazardous material(s) removed from installation will be used/reused for its intended purpose.

Company Using Material Listed Above

Company Representative's Signature

Submitted By: _____
Printed Name

Phone: _____

Fax: _____

Date: _____

Contracting Officer _____
or ROICC Representative

Phone: _____

Fax: _____

Page ____ of ____

CONTRACTOR HAZARDOUS MATERIAL INVENTORY LOG
(EPRCA)
Continuation Sheet

PRIME COMPANY NAME: _____ CONTRACT NO: _____

PROJECT TITLE / LOCATION: _____

Material Name	Manufacturer	MSDS Number	State (i.e. Liquid, Solid, Gas)	Storage Quantity		Quality (lbs/gals) used in Calendar Year []
				Average Daily	Max Daily	

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SECTION 01 62 35.37

RECYCLED/RECOVERED/BIOBASED MATERIALS

05/14

PART 1 GENERAL

1.1 REFERENCES

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

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

40 CFR 247 Comprehensive Procurement Guideline for
Products Containing Recovered Materials

7 CFR 2902 Guidelines for Designating Biobased
Products for Federal Procurement

1.2 OBJECTIVES

Government procurement policy is to acquire, in a cost effective manner, items containing the highest percentage of recycled and recovered and biobased materials practicable consistent with maintaining a satisfactory level of competition without adversely affecting performance requirements or exposing suppliers' employees to undue hazards from the materials. The Environmental Protection Agency (EPA) has designated certain items which must contain a specified percent range of recovered or recycled materials. The U.S. Department of Agriculture (USDA) has designated certain items which must contain a specific percentage range of biobased content. The Contractor shall make all reasonable efforts to use recycled and recovered and biobased materials in providing the EPA and USDA designated products and in otherwise utilizing recycled and recovered and biobased materials in the execution of the work.

1.3 EPA AND USDA DESIGNATED ITEMS INCORPORATED IN THE WORK

Various sections of the specifications contain requirements for materials that have been designated by EPA as being products which are or can be made with recovered or recycled materials and materials that have been designated by USDA as being products which are or can be made with biobased materials. These items, when incorporated into the work under this contract, shall contain at least the specified percentage of recycled or recovered or biobased materials unless adequate justification for non-use is provided. The following are considered adequate justifications for non-use:

- a. The product does not meet appropriate performance standards.
- b. The product is not available within a reasonable time frame.
- c. The product is not available competitively (from two or more sources).
- d. The product is only available at an unreasonable price (compared

with a comparable non-recycled content/non-biobased product).

Where specification sections require a designated product recycled or biobased content submittal and the EPA/USDA recommended content is not being provided, include the justification for non-use in the submittal. When a designated item is specified as an option to a non-designated item, the designated item requirements apply only if the designated item is used in the work. More information on designated products can be found at www.bioprferred.gov and www.epa.gov/epawaste/consERVE/tools.cpg.

1.4 EPA AND USDA PROPOSED ITEMS INCORPORATED IN THE WORK

Products other than those designated by EPA and USDA are still being researched and are being considered for future designation. It is recommended that these items, when incorporated in the work under this contract, contain the highest practicable percentage of recycled or recovered or biobased materials, provided specified requirements are also met.

1.5 EPA AND USDA DESIGNATED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN THE WORK

There are many products listed in 40 CFR 247 and 7 CFR 2902 which have been designated or proposed by EPA or USDA to include recycled or recovered or biobased materials that may be used by the Contractor in performing the work but will not be incorporated into the work. These products include office products, temporary traffic control products, lubricants and pallets. It is recommended that these non-construction products, when used in the conduct of the work, contain the highest practicable percentage of recycled or recovered or biobased materials and that these products be recycled when no longer needed.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

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CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

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SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
02/19

PART 1 GENERAL

1.1 REFERENCES

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

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

40 CFR 273	Standards for Universal Waste Management
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Co-mingle

The practice of placing unrelated materials together in a single container, usually for benefits of convenience and speed.

1.2.2 Construction Waste

Waste generated by construction activities, such as scrap materials, damaged or spoiled materials, temporary and expendable construction materials, and other waste generated by the workforce during construction activities.

1.2.3 Demolition Debris/Waste

Waste generated from demolition activities, including minor incidental demolition waste materials generated as a result of Intentional dismantling of all or portions of a building, to include clearing of building contents that have been destroyed or damaged.

1.2.4 Disposal

Depositing waste in a solid waste disposal facility, usually a managed landfill, regulated in the US under the Resource Conservation and Recovery Act (RCRA).

1.2.5 Diversion

The practice of diverting waste from disposal in a landfill, by means of eliminating or minimizing waste, or reuse of materials.

1.2.6 Final Construction Waste Diversion Report

A written assertion by a material recovery facility operator identifying constituent materials diverted from disposal, usually including summary tabulations of materials, weight in short-ton.

1.2.7 Recycling

The series of activities, including collection, separation, and processing, by which products or other materials are diverted from the solid waste stream for use in the form of raw materials in the manufacture of new products sold or distributed in commerce, or the reuse of such materials as substitutes for goods made of virgin materials, other than fuel.

1.2.8 Reuse

The use of a product or materials again for the same purpose, in its original form or with little enhancement or change.

1.2.9 Salvage

Usable, salable items derived from buildings undergoing demolition or deconstruction, parts from vehicles, machinery, other equipment, or other components.

1.2.10 Source Separation

The practice of administering and implementing a management strategy to identify and segregate unrelated waste at the first opportunity.

1.3 CONSTRUCTION WASTE (INCLUDES DEMOLITION DEBRIS/WASTE)

Divert a minimum of 75 percent by weight of the project construction waste and demolition debris/waste from the landfill. Follow applicable industry standards in the management of waste. Apply sound environmental principles in the management of waste. (1) Practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction waste and demolition debris/waste from landfills and incinerators and to facilitate the recycling or reuse of excess construction materials.

1.4 CONSTRUCTION WASTE MANAGEMENT

Implement a construction waste management program for the project. Take a pro-active, responsible role in the management of construction waste, recycling process, disposal of demolition debris/waste, and require all subcontractors, vendors, and suppliers to participate in the construction waste management program. Establish a process for clear tracking, and documentation of construction waste and demolition debris/waste.

1.4.1 Implementation of Construction Waste Management Program

Develop and document how the construction waste management program will be implemented in a construction waste management plan. Submit a Construction Waste Management Plan to the Contracting Officer for approval. Construction waste and demolition debris/waste materials include un-used construction materials not incorporated in the final work, as well as demolition debris/waste materials from demolition activities or

deconstruction activities. In the management of waste, consider the availability of viable markets, the condition of materials, the ability to provide material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates.

1.4.2 Oversight

The Quality Control Manager, as specified in Section 01 45 00.00 10 QUALITY CONTROL, is responsible for overseeing and documenting results from executing the construction waste management plan for the project.

1.4.3 Special Programs

Implement any special programs involving rebates or similar incentives related to recycling of construction waste and demolition debris/waste materials. Retain revenue or savings from salvaged or recycling, unless otherwise directed. Ensure firms and facilities used for recycling, reuse, and disposal are permitted for the intended use to the extent required by federal, state, and local regulations.

1.4.4 Special Instructions

Provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the projects. Designation of single source separating or commingling will be clearly marked on the containers.

1.4.5 Waste Streams

Delineate and characterize at least three waste streams, each of which make up at least five percent of the total waste including estimated material types and quantities of waste, in the construction waste management plan. Manage all waste streams associated with the project. Typical waste streams are listed below. Include additional waste streams not listed:

- a. Asphalt
- b. Masonry and CMU
- c. Concrete
- d. Metals (e.g. banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, bronze, etc.)
- e. Wood (nails and staples allowed)
- f. Glass
- g. Paper
- h. Plastics (PET, HDPE, PVC, LDPE, PP, PS, Other)
- i. Gypsum
- j. Non-hazardous paint and paint cans
- k. Carpet
- l. Ceiling Tiles
- m. Insulation
- n. Beverage Containers

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office

that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Waste Management Plan; G, S

SD-06 Test Reports

Quarterly Reports; S

Annual Report; S

SD-11 Closeout Submittals

Final Construction Waste Diversion Report; S

1.6 MEETINGS

Conduct Construction Waste Management meetings. After award of the Contract and prior to commencement of work, schedule and conduct a meeting with the Contracting Officer to discuss the proposed construction waste management plan and to develop a mutual understanding relative to the management of the construction waste management program and how waste diversion requirements will be met.

The requirements of this meeting may be fulfilled during the coordination and mutual Understanding meeting outlined in Section 01 45 00.00 10 QUALITY CONTROL. At a minimum, discuss and document waste management goals at following meetings:

- a. Preconstruction and Pre-demolition meeting.
- b. Regular site meetings.
- c. Work safety meeting (if applicable).

1.7 CONSTRUCTION WASTE MANAGEMENT PLAN

Submit Construction Waste Management Plan within 15 days after notice to proceed. Revise and resubmit Construction Waste Management Plan until it receives final approval from the Contracting Officer, in order for construction to begin. Execute demolition or deconstruction activities in accordance with Section 02 41 00 DEMOLITION. Manage demolition debris/waste or deconstruction materials in accordance with the approved construction waste management plan.

An approved construction waste management plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations or meeting project cumulative waste diversion requirement. Ensure all subcontractors receive a copy of the approved Construction Waste Management Plan. The plan demonstrates how to meet the project waste diversion requirement. Also, include the following in the plan:

- a. Identify the names of individuals responsible for waste management and waste management tracking, along with roles and responsibilities on

the project.

- b. Actions that will be taken to reduce solid waste generation, including coordination with subcontractors to ensure awareness and participation.
- c. Description of the regular meetings to be held to address waste management.
- d. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas on site and equipment to be used for processing, sorting, and temporary storage of materials.
- e. Name of landfill and/or incinerator to be used.
- f. Identification of local and regional re-use programs, including non-profit organizations such as schools, local housing agencies, and organization that accept used materials such as material exchange networks and resale stores. Include the name, location, phone number for each re-use facility identified, and provide a copy of the permit or license for each facility.
- g. List of specific materials, by type and quantity, that will be salvaged for resale, salvaged and reused on the current project, salvaged and stored for reuse on a future project, or recycled. Identify the recycling facilities by name, address, and phone number.
- h. Identification of materials that cannot be recycled or reused with an explanation or justification, to be approved by the Contracting Officer.
- i. Description of the means by which any materials identified in item (g) above will be protected from contamination.
- j. Description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site).
- k. Copy of training plan for subcontractors and other services to prevent contamination by co-mingling materials identified for diversion and waste materials.
- l. Identification of at least three construction or demolition material streams for diversion, each of which must equal at least 5 percent of the total waste for the project.
- m. Detailed plan and distribution of waste diversion between buildings, when project is a part of a campus.
- n. Facilities or subcontractors offering construction waste transport on-site or off-site must ensure that proper shipping orders, bill of lading, manifests, or other shipping documents containing waste diversion information meet requirements of 40 CFR 273 Universal Waste Management, 49 CFR 173 Shippers - General Requirements for Shipments and Packagings, and 49 CFR 178 Specifications for Packaging. Individuals signing manifests or other shipping documents should meet the minimum training requirements.

- o. List each supplier who deliver construction materials, in bulk, or package products in returnable containers or returnable packaging, or have take-back programs. List each program and the applicable material to actively monitor and track to assist in meeting waste diversion requirements on the project.
- p. Identify any local jurisdiction requirements for waste management. Include those requirements, points of contact, etc.

Distribute copies of the waste management plan to each subcontractor, Quality Control Manager, and the Contracting Officer.

1.8 RECORDS (DOCUMENTATION)

1.8.1 General

Maintain records to document the types and quantities of waste generated and diverted through re-use, recycling and/or sale to third parties; through disposal to a landfill or incinerator facility. Provide explanations for any materials not recycled, reused or sold. Collect and retain manifests, weight tickets, sales receipts, and invoices specifically identifying diverted project waste materials or disposed materials.

1.8.2 Accumulated

Maintain a running record of materials generated and diverted from landfill disposal, including accumulated diversion rates for the project. Make records available to the Contracting Officer during construction or incidental demolition activities. Provide a copy of the diversion records to the Contracting Officer upon completion of the construction, incidental demolitions or minor deconstruction activities.

1.9 REPORTS

1.9.1 General

Maintain current construction waste diversion information on site for periodic inspection by the Contracting Officer. Include in the quarterly reports, annual reports and final reports: the project name, contract information, information for waste generated, diverted and disposed of for the current reporting period and show cumulative totals for each identified waste stream for the project. Reports must identify quantities of waste by type and disposal method. Also include in each report, supporting documentation to include manifests, weigh tickets, receipts, and invoices specifically identifying the project and waste material type and weighted sum.

1.9.2 Quarterly Reporting

Provide cumulative reports at the end of each quarter (December, March, June, and September, corresponding with the federal fiscal year for reporting purposes). Submit quarterly reports not later than 15 calendar days after the preceding quarter has ended. Submit Quarterly Reports to the appropriate office or identified point of contact.

1.9.3 Annual Reporting

Provide a cumulative construction waste diversion report annually. Submit annual report not later than 30 calendar days after the preceding fourth quarter has ended.

1.10 FINAL CONSTRUCTION WASTE DIVERSION REPORT

A Final Construction Waste Diversion Report is required at the end of the project. Provide Final Construction Waste Diversion Report 60 days prior to the Beneficial Occupancy Date (BOD). The final Construction Waste Diversion Report must be included in the Sustainability eNotebook in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

1.11 COLLECTION

Collect, store, protect, and handle reusable and recyclable materials at the site in a manner which prevents contamination, and provides protection from the elements to preserve their usefulness and monetary value. Provide receptacles and storage areas designated specifically for recyclable and reusable materials and label them clearly and appropriately to prevent contamination from other waste materials. Keep receptacles or storage areas neat and clean.

Train subcontractors and other service providers to either separate waste streams or use the co-mingling method as described in the construction waste management plan. Handle hazardous waste and hazardous materials in accordance with applicable regulations and coordinate with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS. Separate materials by one of the following methods described herein:

1.11.1 Source Separation Method

Separate waste products and materials that are recyclable from trash and sort as described below into appropriately marked separate containers and then transport to the respective recycling facility for further processing. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process). Separate materials into the category types as defined in the construction waste management plan.

1.11.2 Co-Mingled Method

Place waste products and recyclable materials into a single container and then transport to an authorized recycling facility, which meets all applicable requirements to accept and dispose of recyclable materials in accordance with all applicable local, state and federal regulations. The Co-mingled materials must be sorted and processed in accordance with the approved construction waste management plan. Co-Mingled waste is considered one waste stream unless separated waste is individually weighed by the authorized recycling facility.

1.11.3 Other Methods

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

1.12 DISPOSAL

Control accumulation of waste materials and trash. Recycle or dispose of collected materials off-site at intervals approved by the Contracting Officer and in compliance with waste management procedures as described in the waste management plan. Except as otherwise specified in other sections of the specifications, dispose of in accordance with the following:

1.12.1 Reuse

Give first consideration to reusing construction and demolition materials as a disposition strategy. Recover for reuse materials, products, and components as described in the approved construction waste management plan. Coordinate with the Contracting Officer to identify onsite reuse opportunities or material sales or donation available through Government resale or donation programs. Sale of recovered materials is not allowed on the Installation.

1.12.2 Recycle

Recycle non-hazardous construction and demolition/debris materials that are not suitable for reuse. Track rejection of contaminated recyclable materials by the recycling facility. Rejected recyclables materials will not be counted as a percentage of diversion calculation. Recycle all fluorescent lamps, HID lamps, mercury (Hg) -containing thermostats and ampoules, and PCBs-containing ballasts and electrical components as directed by the Contracting Officer. Do not crush lamps on site as this creates a hazardous waste stream with additional handling requirements.

1.12.3 Waste

Dispose by landfill or incineration only those waste materials with no practical use, economic benefit, or recycling opportunity.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used. -- End of Section --

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CLOSEOUT SUBMITTALS

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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 E 1971 (2005) Stewardship for the Cleaning of
Commercial and Institutional Buildings

GREEN SEAL (GS)

GS-37 (2000; R 2005) Industrial and
Institutional Cleaners

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-03 Product Data

As-Built Record of Equipment and Materials
Warranty Management Plan
Warranty Tags
Final Cleaning
Spare Parts Data

SD-08 Manufacturer's Instructions

Preventative Maintenance
Condition Monitoring (Predictive Testing)
Inspection
Posted Instructions

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G

SD-11 Closeout Submittals

Record Drawings
Certification of EPA and USDA Designated Items; G
Form DD1354; G
Checklist for Form DD1354; G

1.3 PROJECT RECORD DOCUMENTS

1.3.1 Record Drawings

This Paragraph covers record drawings complete, as a requirement of the Contract. The terms "working record drawings" and "final record drawings" refer to Contract Drawings which are revised to be used for final record drawings showing as-built conditions.

Submit to the Contracting Officer the final record drawings, consisting of one set of full-size black line prints; 2 sets each of corrected electronic (CADD and .pdf) files on CD-ROM or DVD disks; verification that the electronic (CADD and .pdf) files have been loaded and work on the designated computer systems and are error- and virus-free; the approved preliminary drawings; and the required reproduced items. Compile the corrected .pdf files into sets so that the files can be viewed and printed by the Adobe reader; bookmark the sets by sheet number and title. Paper prints and electronic CADD files shall become the property of the Government.

1.3.1.1 Government Furnished Materials

The Government will provide 1 set of electronic CADD files, in the specified software and format, revised to reflect bid amendments, at the preconstruction conference for projects requiring CADD file record drawings.

1.3.1.2 Working Record and Final Record Drawings

Revise 2 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. Keep these revised prints current on a weekly basis and at least one set available on the jobsite. Changes from the Contract Drawings which are made in the work or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes. Prepare final record drawings after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (foundations, utilities, structural steel, etc., as appropriate for the project). The Contracting Officer and the Contractor will jointly review the revised prints and final record drawings for accuracy and completeness prior to submission of each monthly pay estimate. If the Contractor fails to maintain the working and final record drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the record drawings. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of updated drawings. Show on the working and final record drawings, but not limit them to:

- a. The actual location, kinds and sizes of sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of

each run.

- b. The location and dimensions of changes within the building structure.
- c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if changes were made from Contract Drawings.
- d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.
- e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.
- f. Changes or modifications which result from the final inspection.
- g. Where Contract Drawings or specifications present options, show only the option selected for construction on the final as-built prints.
- h. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.
- i. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.
- j. Modifications (include within change order price the cost to change working and final record drawings to reflect modifications) and compliance with the following procedures.
 - (1) Follow directions in the modification for posting descriptive changes.
 - (2) Place a Modification teardrop at the location of each deletion.
 - (3) For new details or sections which are added to a drawing, place a Modification teardrop by the detail or section title.
 - (4) For minor changes, place a Modification teardrop by the area changed on the drawing (each location).
 - (5) For major changes to a drawing, place a Modification teardrop by the title of the affected plan, section, or detail at each location.
 - (6) For changes to schedules or drawings, place a Modification teardrop either by the schedule heading or by the change in the schedule.
 - (7) The Modification teardrop size shall be 1/2 inch diameter unless the area where the teardrop is to be placed is crowded. Smaller size teardrops shall be used for crowded areas.

1.3.1.3 Drawing Preparation

Modify the record drawings as necessary to correctly show the features of the project as it has been constructed by bringing the Contract set into

agreement with approved working record prints, and adding drawings as necessary. These working record prints shall be neat, legible, and accurate. These drawings are part of the permanent records of this project and shall be returned to the Contracting Officer after approval by the Government. Replace lost and damaged drawings to the satisfaction of, and at no expense to, the Government.

1.3.1.4 Computer Aided Design and Drafting (CADD) Drawings

Employ only personnel proficient in the preparation of CADD drawings to modify the Contract Drawings and prepare additional new drawings. Additions and corrections to the Contract Drawings shall be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols shall be the same as the original. If additional drawings are required, prepare them using the same electronic file format and graphic standards specified for original drawings. The title block and drawing border for new final record drawings shall be identical to that used on the Contract Drawings. Accomplish additions and corrections to the Contract Drawings using CADD files. The Government will furnish Revit files for building design and MicroStation V8 files for site design, compatible with a Windows 7 operating system. The electronic files will be supplied on CD/DVD. Provide program files and hardware necessary to prepare final record drawings. The Contracting Officer will review final record drawings for accuracy and return them to the Contractor for required corrections, changes, additions, and deletions.

a. Do not rename the Contract Drawings. Filenames shall follow the AEC standard to include the project code assigned to the specific project provided by COE. Changes shall be made on the layer/level as the original item.

b. When final revisions have been completed, show the wording "RECORD DRAWINGS/AS-BUILT CONDITIONS" followed by the name of the Contractor in letters at least 3/16 inch high on the cover sheet drawing. Mark other Contract Drawings either "Record" drawing denoting no revisions on the sheet or "Revised Record" denoting one or more revisions. Date original Contract Drawings in the revision block.

c. Within 10 20 days for contracts \$5 million and above after Government approval of the working record drawings for a phase of work, prepare the final CADD record drawings for that phase of work and submit 2 sets of blue-lined prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with necessary corrections. Within 10 days for contracts \$5 million and above revise the CADD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 10 days for contracts less than \$5 million 20 days for contracts \$5 million and above of substantial completion of work, submit the final record drawing package for the entire project. Submit one set of electronic files on compact disk, read-only memory (CD-ROM), two sets of blue-line prints and one set of the approved working record drawings. They shall be complete in detail and identical in form and function to the Contract Drawing files supplied by the Government. Transactions or adjustments necessary to accomplish this is the responsibility of the Contractor. The Government reserves the right to reject drawing files it deems incompatible with the customer's CADD system. Paper prints, drawing files and storage media submitted will become the

property of the Government upon final approval. Failure to submit final record drawing files and marked prints as specified will be cause for withholding payment due the Contractor under this Contract. Approval and acceptance of final record drawings shall be accomplished before final payment is made to the Contractor.

1.3.1.5 Payment

No separate payment will be made for record drawings required under this Contract, and costs accrued in connection with such drawings are considered a subsidiary obligation of the Contractor.

1.3.2 As-Built Record of Equipment and Materials

Furnish one copy of preliminary record of equipment and materials used on the project 15 days prior to final inspection. This preliminary submittal will be reviewed and returned 2 days after final inspection with Government comments. Submit 2 sets of final record of equipment and materials 10 days after final inspection. Key the designations to the related area depicted on the Contract Drawings. List the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA

Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used
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1.3.3 Final Approved Shop Drawings

Furnish final approved project shop drawings 30 days after transfer of the completed facility.

1.3.4 Construction Contract Specifications

Furnish final record construction Contract specifications, including modifications thereto, 30 days after transfer of the completed facility.

1.3.5 Real Property Equipment

Furnish a list of installed equipment furnished under this Contract. Include information usually listed on manufacturer's name plate. In the "EQUIPMENT-IN-PLACE LIST" include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. Furnish a draft list at time of transfer. Furnish the final list 30 days after transfer of the completed facility.

1.4 SPARE PARTS DATA

Indicate manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair. List those items that may be standard to the normal maintenance of the system.

Supply manufacturer's recommended quantity of items of each part for spare parts inventory. Provision of spare parts does not relieve the Contractor of responsibilities listed under the Contract guarantee provisions.

1.5 PREVENTATIVE MAINTENANCE

Submit Preventative Maintenance and Condition Monitoring (Predictive Testing) and Inspection schedules with instructions that state when systems should be retested.

Define the anticipated length of each test, test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a signoff blank for the Contractor and Contracting Officer for each test feature; e.g., gpm, rpm, psi. Include a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventative maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

Repair requirements shall inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

1.6 CERTIFICATION OF EPA AND USDA DESIGNATED ITEMS

Submit the Certification of EPA and USDA Designated Items as required by FAR 52.223-9 "Certification and Estimate of Percentage of Recovered Material Content for EPA Designated Items". Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification shall read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of the materials listed on this form comply with current EPA standards for recycled/recovered materials content and USDA standards for biobased materials content. The following exemptions may apply to the non-procurement of recycled/recovered/biobased content materials: 1) The product does not meet appropriate performance standards; 2) The product is not available within a reasonable time frame; 3) The product is not available competitively (from two or more sources); 4) The product is only available at an unreasonable price (compared with a comparable non-recycled/non-biobased content product)." Record each product used in the project that has a requirement or option of containing recycled or biobased content in accordance with Section 01 62 35.37 RECYCLED/RECOVERED MATERIALS, noting total price, total value of post-industrial recycled content, total value of post-consumer recycled content, total value of biobased content, exemptions (1, 2, 3, or 4, as indicated), and comments. Recycled and biobased content values may be determined by weight or volume percent, but shall be consistent throughout. Include a copy of certification in Sustainability eNotebook.

1.7 WARRANTY MANAGEMENT

1.7.1 Warranty Management Plan

Develop a warranty management plan which contains information relevant to the clause Warranty of Construction. At least 30 days before the planned pre-warranty conference, submit the warranty management plan for Government approval. Include within the warranty management plan the

required actions and documents to assure that the Government receives the warranties to which it is entitled. The plan shall be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this Contract. The term "status" as indicated below shall include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase shall be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period shall begin on the date of project acceptance and continue for the full product warranty period. A joint 4 month and 9 month warranty inspection will be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Include within the warranty management plan, but not limited to, the following:

- a. Roles and responsibilities of the personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subContractors, manufacturers or suppliers involved.
- b. Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.
- c. A list for each warranted equipment, item, feature of construction or system indicating:
 - (1) Name of item.
 - (1) Model and serial numbers.
 - (1) Location where installed.
 - (1) Name and phone numbers of manufacturers or suppliers.
 - (1) Names, addresses and telephone numbers of sources of spare parts.
 - (1) Warranties and terms of warranty. Include one-year overall warranty of construction. Items which have extended warranties shall be indicated with separate warranty expiration dates.
 - (1) Cross-reference to warranty certificates as applicable.
 - (1) Starting point and duration of warranty period.
 - (1) Summary of maintenance procedures required to continue the warranty in force.
 - (1) Cross-reference to specific pertinent Operation and Maintenance manuals.
 - (1) Organization, names and phone numbers of persons to call for warranty service.
 - (1) Typical response time and repair time expected for various warranted equipment.
- d. The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.
- e. Procedure and status of tagging of equipment covered by extended warranties.
- f. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

1.7.2 Performance Bond

The Contractor's Performance Bond shall remain effective throughout the construction period.

a. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

b. If the Contractor fails to commence and diligently pursue required construction warranty work, the Contracting Officer will have the work performed by others and, after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

c. If sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

1.7.3 Pre-Warranty Conference

Prior to Contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this Section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty will be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact shall be located within the local service area of the warranted construction, be continuously available, and sbe responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of its responsibilities in connection with other portions of this provision.

1.7.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. Submit a report on warranty items that have been repaired during the warranty period. Include within the report the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframes specified, the Government will perform the work and backcharge the construction warranty payment item established.

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. Other work to be initiated within 3 work days and work continuously to completion or relief.

d. The "Construction Warranty Service Priority List" is as follows:

Code 1-Air Conditioning Systems

- (1) Recreational support.
- (2) Air conditioning leak in part of building, if causing damage.
- (3) Air conditioning system not cooling properly.

Code 1-Doors

- (1) Overhead doors not operational, causing a security, fire, or safety problem.
- (2) Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

Code 3-Doors

- (1) Overhead doors not operational.
- (2) Interior/exterior personnel doors or hardware not functioning properly.

Code 1-Electrical

- (1) Power failure (entire area or buildings operational after 1600 hours).
- (2) Security lights
- (3) Smoke detectors

Code 2-Electrical

- (1) Power failure (no power to a room or part of building).
- (2) Receptacle and lights (in a room or part of building).

Code 3-Electrical

Street lights.

Code 1-Gas

- (1) Leaks and breaks.
- (2) No gas to family housing unit or cantonment area.

Code 1-Heat

- (1) Area power failure affecting heat.
- (2) Heater in unit not working.

Code 2-Kitchen Equipment

- (1) Dishwasher not operating properly.
- (2) Other equipment hampering preparation of a meal.

Code 1-Plumbing

- (1) Hot water heater failure.
- (2) Leaking water supply pipes.

Code 2-Plumbing

- (1) Flush valves not operating properly.
- (2) Fixture drain, supply line to commode, or water pipe leaking.
- (3) Commode leaking at base.

Code 3-Plumbing

Leaky faucets.

Code 3-Interior

- (1) Floors damaged.
- (2) Paint chipping or peeling.
- (3) Casework.

Code 1-Roof Leaks

Temporary repairs shall be made where major damage to property is occurring.

Code 2-Roof Leaks

Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 2-Water (Exterior)

No water to facility.

Code 2-Water (Hot)

No hot water in portion of building listed.

Code 3-Other work not listed above.

1.7.5 Warranty Tags

At the time of installation, tag each warranted item with a durable, oil and water resistant tag approved by the Contracting Officer. Attached each tag with a copper wire and spray with a silicone waterproof coating. The date of acceptance and the QC signature shall remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

- a. Type of product/material_____.
- b. Model number_____.
- c. Serial number_____.
- d. Contract number_____.
- e. Warranty period_____ from_____ to_____.
- f. Inspector's signature_____.
- g. Construction Contractor_____.
- Address_____.
- Telephone number_____.
- h. Warranty contact_____.
- Address_____.
- Telephone number_____.
- i. Warranty response time priority code_____.

j. WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.

1.8 MECHANICAL TESTING AND BALANCING

Contract requirements of Section 23 09 23.01 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS shall be fully completed, including testing, prior to Contract completion date. In addition, Contract requirements of Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC shall be fully completed, including testing and inspection, prior to Contract completion date. The time required to complete work and testing as prescribed by Sections 23 05 93 is included in the allotted calendar days for completion.

1.9 OPERATION AND MAINTENANCE MANUALS

Operation and Maintenance Manuals shall be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Bind information in manual format and grouped by technical Sections. Test data shall be legible and of good quality. Light-sensitive reproduction techniques are acceptable provided finished pages are clear, legible, and not subject to fading. Pages for vendor data and manuals shall have 0.3937-inch holes and be bound in 3-ring, loose-leaf binders. Organize data by separate index and tabbed sheets, in a loose-leaf binder. Binder shall lie flat with printed sheets that are easy to read. Caution and warning indications shall be clearly labeled.

Submit classroom and field instructions in the operation and maintenance of systems equipment where required by the technical provisions. These services shall be directed by the Contractor, using the manufacturer's factory-trained personnel or qualified representatives. Give the Contracting Officer 7 calendar days written notice of scheduled instructional services. Instructional materials belonging to the manufacturer or vendor, such as lists, static exhibits, and visual aids, shall be made available to the Contracting Officer.

1.10 CLEANUP

Provide final cleaning in accordance with ASTM E 1971. Leave premises "broom clean." Comply with GS-37 for general purpose cleaning and bathroom cleaning. Use only nonhazardous cleaning materials, including natural cleaning materials, in the final cleanup. Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Replace filters of operating equipment and comply with the Indoor Air Quality (IAQ) Management Plan. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site. Recycle, salvage, and return construction and demolition waste from project in accordance with the Waste Management Plan. Promptly and legally transport and dispose of trash. Do not burn, bury, or otherwise dispose of trash on the project site.

1.10.1 Extraordinary Cleanup Requirements

The following cleanup requirements apply: None.

1.11 REAL PROPERTY RECORD

Near the completion of Project, but a minimum of 60 days prior to final acceptance of the work, complete, update draft attached to this Section, and submit an accounting of the installed property on Form DD1354 "Transfer and Acceptance of Military Real Property." Contact the Contracting Officer for project specific information necessary to complete the DD Form 1354. For information purposes, a blank DD Form 1354 (fill-able) in ADOBE (PDF) may be obtained at the following web site:
<http://www.dtic.mil/whs/directives/infomgt/forms/eforms/dd1354.pdf>

Submit the completed Checklist for Form DD1354 of Government-Furnished and Contractor-Furnished/Contractor Installed items. Attach this list to the updated DD Form 1354. Instructions for completing the form and a blank checklist (fill-able) in ADOBE (PDF) may be obtained at the following web site:

<http://www.hnd.usace.army.mil/techinfo/UFC/UFC1-300-08/UFC1-300-08.pdf>
See Appendix D of this pdf for the checklist.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

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SECTION 01 78 23

OPERATION AND MAINTENANCE DATA
08/15

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-10 Operation and Maintenance Data

O&M Database; G

Training Plan; G

Training Outline; G

Training Content; G

SD-11 Closeout Submittals

Validation of Training Completion; G

1.2 OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data for the provided equipment, product, or system, defining the importance of system interactions, troubleshooting, and long-term preventive operation and maintenance. Compile, prepare, and aggregate O&M data to include clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00.00 37 SUBMITTAL PROCEDURES.

1.2.1 Package Quality

Documents must be fully legible. Operation and Maintenance data must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions.

1.2.2 Package Content

Provide data package content in accordance with paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES. Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows. Use Data

Package 345 for commissioned items without a specified data package requirement in the individual technical sections. Provide a Data Package 345 instead of Data Package 1 or 2, as specified in the individual technical section, for items that are commissioned.

1.2.3 Changes to Submittals

Provide manufacturer-originated changes or revisions to submitted data if a component of an item is so affected subsequent to acceptance of the O&M Data. Submit changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data within 30 calendar days of the notification of this change requirement.

1.2.4 Commissioning Authority Review and Approval

Submit the commissioned systems and equipment submittals to the Commissioning Authority (CxA) to review for completeness and applicability. Obtain validation from the CxA that the systems and equipment provided meet the requirements of the Contract documents and design intent, particularly as they relate to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. The CxA communicates deficiencies to the Contracting Officer. Submit the O&M manuals to the Contracting Officer upon a successful review of the corrections, and with the CxA recommendation for approval and acceptance of these O&M manuals. This work is in addition to the normal review procedures for O&M data.

1.3 O&M DATABASE

Develop an editable, electronic spreadsheet based on the equipment in the Operation and Maintenance Manuals that contains the information required to start a preventive maintenance program. As a minimum, provide list of system equipment, location installed, warranty expiration date, manufacturer, model, and serial number.

1.4 OPERATION AND MAINTENANCE MANUAL FILE FORMAT

Assemble data packages into electronic Operation and Maintenance Manuals. Assemble each manual into a composite electronically indexed file using the most current version of Adobe Acrobat or similar software capable of producing PDF file format. Provide compact disks (CD) or data digital versatile disk (DVD) as appropriate, so that each one contains operation, maintenance and record files, project record documents, and training videos. Include a complete electronically linked operation and maintenance directory.

1.4.1 Organization

Bookmark Product and Drawing Information documents using the current version of CSI Masterformat numbering system, and arrange submittals using the specification sections as a structure. Use CSI Masterformat and UFGS numbers along with descriptive bookmarked titles that explain the content of the information that is being bookmarked.

1.4.2 CD or DVD Label and Disk Holder or Case

Provide the following information on the disk label and disk holder or case:

- a. Building Number
- b. Project Title
- c. Activity and Location
- d. Construction Contract Number
- e. Prepared For: (Contracting Agency)
- f. Prepared By: (Name, title, phone number and email address)
- g. Include the disk content on the disk label
- h. Date
- i. Virus scanning program used

1.5 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

The following are a detailed description of the data package items listed in paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES.

1.5.1 Operating Instructions

Provide specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

1.5.1.1 Safety Precautions and Hazards

List personnel hazards and equipment or product safety precautions for operating conditions. List all residual hazards identified in the Activity Hazard Analysis provided under Section 01 35 26 GOVERNMENT SAFETY REQUIREMENTS. Provide recommended safeguards for each identified hazard.

1.5.1.2 Operator Prestart

Provide procedures required to install, set up, and prepare each system for use.

1.5.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.5.1.4 Normal Operations

Provide Control Diagrams with data to explain operation and control of systems and specific equipment. Provide narrative description of Normal Operating Procedures.

1.5.1.5 Emergency Operations

Provide Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Provide Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable

contingencies. Provide guidance and procedures for emergency operation of utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.5.1.6 Operator Service Requirements

Provide instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gauge readings.

1.5.1.7 Environmental Conditions

Provide a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.5.1.8 Operating Log

Provide forms, sample logs, and instructions for maintaining necessary operating records.

1.5.1.9 Additional Requirements for HVAC Control Systems

Provide Data Package 5 and the following for control systems:

- a. Narrative description on how to perform and apply functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.
- b. Full as-built sequence of operations.
- c. Copies of checkout tests and calibrations performed by the Contractor (not Cx tests).
- d. Full points list. Provide a listing of rooms with the following information for each room:
 - (1) Floor
 - (2) Room number
 - (3) Room name
 - (4) Air handler unit ID
 - (5) Reference drawing number
 - (6) Air terminal unit tag ID
 - (7) Heating or cooling valve tag ID
 - (8) Minimum cfm
 - (9) Maximum cfm
- e. Full print out of all schedules and set points after testing and acceptance of the system.

- f. Full as-built print out of software program.
- g. Marking of system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

1.5.2 Preventive Maintenance

Provide the following information for preventive and scheduled maintenance to minimize repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.5.2.1 Lubrication Data

Include the following preventive maintenance lubrication data, in addition to instructions for lubrication required under paragraph OPERATOR SERVICE REQUIREMENTS:

- a. A table showing recommended lubricants for specific temperature ranges and applications.
- b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.
- c. A Lubrication Schedule showing service interval frequency.

1.5.2.2 Preventive Maintenance Plan, Schedule, and Procedures

Provide manufacturer's schedule for routine preventive maintenance, inspections, condition monitoring (predictive tests) and adjustments required to ensure proper and economical operation and to minimize repairs. Provide instructions stating when the systems should be retested. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

- a. Define the anticipated time required to perform each of each test (work-hours), test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize repairs.
- b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

1.5.3 Repair

Provide manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and

features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.5.3.1 Troubleshooting Guides and Diagnostic Techniques

Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.5.3.2 Wiring Diagrams and Control Diagrams

Provide point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

1.5.3.3 Repair Procedures

Provide instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

1.5.3.4 Removal and Replacement Instructions

Provide step-by-step procedures and a list of required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Use a combination of text and illustrations.

1.5.3.5 Spare Parts and Supply Lists

Provide lists of spare parts and supplies required for repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.5.3.6 Repair Work-Hours

Provide manufacturer's projection of repair work-hours including requirements by type of craft. Identify, and tabulate separately, repair that requires the equipment manufacturer to complete or to participate.

1.5.4 Real Property Equipment

Provide a list of installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. In the "EQUIPMENT-IN-PLACE LIST" include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. Submit the final list 30 days after transfer of the completed facility.

Key the designations to the related area depicted on the contract drawings.

1.5.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.5.5.1 Product Submittal Data

Provide a copy of SD-03 Product Data submittals documented with the required approval.

1.5.5.2 Manufacturer's Instructions

Provide a copy of SD-08 Manufacturer's Instructions submittals documented with the required approval.

1.5.5.3 O&M Submittal Data

Provide a copy of SD-10 Operation and Maintenance Data submittals documented with the required approval.

1.5.5.4 Parts Identification

Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing must show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Group the parts shown in the listings by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog.

1.5.5.5 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components of the system. Provide copies of warranties required by Section 01 78 00.00 37 CLOSEOUT SUBMITTALS.

1.5.5.6 Extended Warranty Information

List all warranties for products, equipment, components, and sub-components whose duration exceeds one year. For each warranty listed, indicate the applicable specification section, duration, start date, end date, and the point of contact for warranty fulfillment. Also, list or reference the specific operation and maintenance procedures that must be performed to keep the warranty valid. Provide copies of warranties required by Section 01 78 00.00 37 CLOSEOUT SUBMITTALS.

1.5.5.7 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.5.5.8 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. Provide final set points.

1.5.5.9 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms. Provide final set points.

1.5.5.10 Field Test Reports

Provide a copy of Field Test Reports (SD-06) submittals documented with the required approval.

1.5.5.11 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.6 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Provide the O&M data packages specified in individual technical sections. The information required in each type of data package follows:

1.6.1 Data Package 1

- a. Safety precautions and hazards
- b. Cleaning recommendations
- c. Maintenance and repair procedures
- d. Warranty information
- e. Extended warranty information
- f. Contractor information
- g. Spare parts and supply list

1.6.2 Data Package 2

- a. Safety precautions and hazards
- b. Normal operations

- c. Environmental conditions
- d. Lubrication data
- e. Preventive maintenance plan, schedule, and procedures
- f. Cleaning recommendations
- g. Maintenance and repair procedures
- h. Removal and replacement instructions
- i. Spare parts and supply list
- j. Parts identification
- k. Warranty information
- l. Extended warranty information
- m. Contractor information

1.6.3 Data Package 3

- a. Safety precautions and hazards
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations
- f. Environmental conditions
- g. Operating log
- h. Lubrication data
- i. Preventive maintenance plan, schedule, and procedures
- j. Cleaning recommendations
- k. Troubleshooting guides and diagnostic techniques
- l. Wiring diagrams and control diagrams
- m. Maintenance and repair procedures
- n. Removal and replacement instructions
- o. Spare parts and supply list
- p. Product submittal data
- q. O&M submittal data

- r. Parts identification
- s. Warranty information
- t. Extended warranty information
- u. Testing equipment and special tool information
- v. Testing and performance data
- w. Contractor information
- x. Field test reports

1.6.4 Data Package 4

- a. Safety precautions and hazards
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations
- f. Operator service requirements
- g. Environmental conditions
- h. Operating log
- i. Lubrication data
- j. Preventive maintenance plan, schedule, and procedures
- k. Cleaning recommendations
- l. Troubleshooting guides and diagnostic techniques
- m. Wiring diagrams and control diagrams
- n. Repair procedures
- o. Removal and replacement instructions
- p. Spare parts and supply list
- q. Repair work-hours
- r. Product submittal data
- s. O&M submittal data
- t. Parts identification
- u. Warranty information
- v. Extended warranty information

- w. Personnel training requirements
 - x. Testing equipment and special tool information
 - y. Testing and performance data
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 - aa. Field test reports
- 1.6.5 Data Package 5
- a. Safety precautions and hazards
 - b. Operator prestart
 - c. Start-up, shutdown, and post-shutdown procedures
 - d. Normal operations
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 - h. Wiring and control diagrams
 - i. Maintenance and repair procedures
 - j. Removal and replacement instructions
 - k. Spare parts and supply list
 - l. Product submittal data
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 - o. Parts identification
 - p. Testing equipment and special tool information
 - q. Warranty information
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 - s. Testing and performance data
 - t. Contractor information
 - u. Field test reports
 - v. Additional requirements for HVAC control systems

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 TRAINING

Prior to acceptance of the facility by the Contracting Officer for Beneficial Occupancy, provide comprehensive training for the systems and equipment specified in the technical specifications. The training must be targeted for the building maintenance personnel, and applicable building occupants. Instructors must be well-versed in the particular systems that they are presenting. Address aspects of the Operation and Maintenance Manual submitted in accordance with Section 01 78 00.00 37 CLOSEOUT SUBMITTALS.. Training must include classroom or field lectures based on the system operating requirements. The location of classroom training requires approval by the Contracting Officer.

3.1.1 Training Plan

Submit a written training plan to the Contracting Officer for approval at least 60 calendar days prior to the scheduled training. Training plan must be approved by the Commissioning Authority (CxA) prior to forwarding to the Contracting Officer. Also, coordinate the training schedule with the Contracting Officer and CxA. Include within the plan the following elements:

- a. Equipment included in training
- b. Intended audience
- c. Location of training
- d. Dates of training
- e. Objectives
- f. Outline of the information to be presented and subjects covered including description
- g. Start and finish times and duration of training on each subject
- h. Methods (e.g. classroom lecture, video, site walk-through, actual operational demonstrations, written handouts)
- i. Instructor names and instructor qualifications for each subject
- j. List of texts and other materials to be furnished by the Contractor that are required to support training
- k. Description of proposed software to be used for video recording of training sessions.

3.1.2 Training Content

The core of this training must be based on manufacturer's recommendations and the operation and maintenance information. The CxA is responsible for overseeing and approving the content and adequacy of the training. pend

95 percent of the instruction time during the presentation on the OPERATION AND MAINTENANCE DATA. Include the following for each system training presentation:

- a. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.
- b. Relevant health and safety issues.
- c. Discussion of how the feature or system is environmentally responsive. Advise adjustments and optimizing methods for energy conservation.
- d. Design intent.
- e. Use of O&M Manual Files.
- f. Review of control drawings and schematics.
- g. Interactions with other systems.
- h. Special maintenance and replacement sources.
- i. Tenant interaction issues.

3.1.3 Training Outline

Provide the Operation and Maintenance Manual Files (Bookmarked PDF) and a written course outline listing the major and minor topics to be discussed by the instructor on each day of the course to each trainee in the course. Provide the course outline 14 calendar days prior to the training.

3.1.4 Unresolved Questions from Attendees

If, at the end of the training course, there are questions from attendees that remain unresolved, the instructor must send the answers, in writing, to the Contracting Officer for transmittal to the attendees, and the training video must be modified to include the appropriate clarifications.

3.1.5 Validation of Training Completion

Ensure that each attendee at each training session signs a class roster daily to confirm Government participation in the training. At the completion of training, submit a signed validation letter that includes a sample record of training for reporting what systems were included in the training, who provided the training, when and where the training was performed, and copies of the signed class rosters. Provide two copies of the validation to the Contracting Officer, and one copy to the Operation and Maintenance Manual Preparer for inclusion into the Manual's documentation.

3.1.6 Quality Control Coordination

Coordinate this training with the CxA in accordance with 01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM).

-- End of Section --

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COMMISSIONING
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PART 1 GENERAL

1.1 REFERENCES

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

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

- | | |
|----------------------|--|
| ASHRAE Guideline 0 | (2013) The Commissioning Process |
| ASHRAE Guideline 1.1 | (2007) HVAC&R Technical Requirements for
The Commissioning Process |
| ASHRAE 189.1 | (2014) Standard for the Design of
High-Performance Green Buildings Except
Low-Rise Residential Buildings |

U.S. GREEN BUILDING COUNCIL (USGBC)

- | | |
|---------------------|--|
| LEED GBDC Ref Guide | (2009; R 2010) LEED Reference Guide for
Green Building Design, Construction and
Major Renovations of Commercial and
Institutional Buildings including Core &
Shell and K-12 Projects |
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1.2 DEFINITIONS

- a. "Basis of design" is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent.
- b. "Commissioning (Cx)" is a comprehensive and systematic process to verify that the building systems perform as designed to meet Government requirements and the design intent.
- c. The "Commissioning Plan" (Cx Plan) is an overall plan that provides the structure, schedule and coordination planning for the Cx process.
- d. "Data logging" records data such as flows, currents, status, and pressures over time using stand-alone data loggers separate from the control system.
- e. "Deferred functional tests" are performed after substantial completion, due to partial occupancy, equipment, seasonal requirements, design, or other site conditions that disallow the test from being performed before substantial completion.
- f. A "deficiency" is a condition in the installation or function of a

component, piece of equipment, or system that is not in compliance with the Contract documents.

- g. The "design intent" represents the ideas, concepts, and criteria that are conveyed through the Contract documents.
- h. "Factory testing" tests equipment on-site or at the factory by factory personnel.
- i. A "functional performance test" (FPT) tests the dynamic function and operation of equipment and systems under full operation using manual (direct observation) or monitoring methods. For example, the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint.
- j. "Indirect indicators" indicate a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed.
- k. A "manual test" uses hand-held direct reading instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the observation).
- l. "Nonconformance" means a piece of equipment or a system does not perform properly or comply with the design intent.
- m. An "overwritten value" is a sensor value in the building control system that is overridden to see the response of a system. For example, changing the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation. See also "simulated signal".
- n. Owner's Project Requirements (OPR) is a written document that details the functional requirements of the project and the expectations of how it will be used and operated.
- o. "Phased commissioning" is completed in phases (by floors or buildings, for example) due to the size of the structures or other scheduling issues, in order to minimize the total construction time.
- p. A "prefunctional test checklist" (PFT checklist) is a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment. Prefunctional tests (PFTs) are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors Calibrated). However, some PFT checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). PFT checklists augment and are combined with the manufacturer's startup checklist.
- q. "Sampling" functionally tests only a fraction of the total number of identical or near identical pieces of equipment.
- r. "Seasonal performance tests" are FPTs that are deferred until the system(s) will experience conditions closer to their design conditions.

- s. "Simulated conditions" are created conditions for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).
- t. A "simulated signal" uses a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.
- u. "Startup" includes the initial starting or activating of dynamic equipment after executing PFTs.
- v. "Test requirements" specify what modes, functions, and conditions shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the individual sections of the Contract documents.
- w. "Trending" uses the building control system for monitoring.
- x. The "warranty period" involves the entire project, including equipment components. Warranty begins at substantial completion and extends for at least 1 year, unless specifically noted otherwise in the Contract documents and accepted submittals.

1.3 DESCRIPTION

The Fundamental Cx process shall encompass and coordinate system documentation, equipment startup, control system Calibration, testing and balancing, performance testing, and training. Fundamental Cx shall be completed before substantial completion. Enhanced Cx continues into the warranty period with post-occupancy Verification of performance. Cx does not take away from or reduce the responsibility of the General Contractor to provide a finished and fully functioning product.

1.3.1 Applicable Criteria

The work shall conform to the following:

- a. LEED GBDC Ref Guide
- b. ASHRAE Guideline 0
- c. ASHRAE Guideline 1.1 with the following exception: sampling techniques are not allowed for HVAC systems. 100 percent of the HVAC systems and their controls are required to be commissioned.
- d. ASHRAE 189.1, paragraphs 10.3.1.1 Building Acceptance Testing and 10.3.1.2 Building Project Commissioning

1.3.2 Commissioning Agent (CxA)

The CxA will be provided by the Government. All submittals and correspondence for the CxA shall be submitted to the CxA through the Contracting Officer's Representative (COR). Descriptions of tasks and products provided by the Government's CxA are included in this Section for General Contractor information and coordination purposes.

1.3.3 LEED

See Section 01 33 29 SUSTAINABILITY REPORTING. Project shall meet the

requirements for LEED Energy & Atmosphere (EA) Prerequisite 1, Fundamental Commissioning and EA Credit 3, Enhanced Commissioning.

1.3.4 Process

The following activities outline the Cx tasks and the general order in which they occur. The Commissioning Authority (CxA) shall coordinate all activities.

- a. Review construction documents, basis of design and design intent documents prepared by Designer of Record (DOR).
- b. Conduct a scoping meeting to review the Cx process with the Cx team members.
- c. Develop a Cx Plan. Preliminary CX Plan is attached.
- d. Schedule additional meetings throughout construction with necessary parties attending, to plan, scope, coordinate, schedule future activities, and resolve problems.
- e. Collect equipment documentation during normal submittals, including detailed startup procedures.
- f. Review submittals.
- g. Develop startup plans, startup documentation formats, and PFTs to be completed prior to startup. Preliminary PFT Checklist Forms are attached.
- h. Perform startup and initial checkout.
- i. Develop and execute FPT procedures. Preliminary Functional Performance Test Forms are attached.
- j. Correct items of nonconformance in materials, installation, or setup and retest the system.
- k. Document deficiencies and their resolution.
- l. Review documentation for completeness.
- m. Complete and submit the Final Cx Report.
- n. Review, pre-approve and coordinate Government personnel training and verify completion.
- o. Perform deferred testing as specified and required, including unforeseen deferred tests, seasonal testing and short-term diagnostic testing.
- p. Complete and submit the Systems Manual.
- q. Perform end-of-warranty review.

1.3.5 Written Work Products

The Cx process generates a number of written work products. The Cx Plan shall list all the formal written work products, describe briefly their

contents (including Specification references as applicable), who is responsible to create them, their due dates and who receives and approves them. In summary, the written products are:

<u>Product</u>	<u>Developed By</u>
Design document review	CxA
Draft and Final Cx Plan	CxA
Meeting minutes	General Contractor (GC)and CxA
Cx schedules	GC primary responsibility, CxA, Contracting Officer's Representative (COR)assisting
Equipment documentation submittals	GC
Sequence clarifications	GC
PFT checklists	CxA with GC assistance
Startup and initial checkout plan	GC
Completely filled out startup, initial checkout, and PFT forms and checklists	GC
TAB Plan	GC with CxA review
Final TAB report	GC with CxA review
Commissioned systems issues log	CxA (deficiencies)
Cx Progress Record	CxA
Commissioned systems deficiency reports	GC
FPT forms	CxA with GC assistance
Completely filled out FPT forms	GC, with CxA review
O&M Manual	GC
Systems Manual	GC with CxA review
Cx record book	CxA
Training Plan	GC, with CxA review
Specific training agendas	GC
Final Cx Report	CxA
Miscellaneous approvals	COR

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Control Drawings; G, CxA

SD-06 Test Reports

Pipe Pressure Test Reports; G; CxA

Completed PFT checklists; G; CxA

PFT Nonconformance Reports; G; CxA

Filled out functional test readiness forms; G, RO; CxA

Completed FPT forms; G; CxA

FPT Nonconformance Reports; G; CxA

Approval in PFT checklists and Startup; CxA

Statement of Corrections; G; CxA

SD-07 Certificates

Commissioning Superintendent Qualifications; G; CxA

Certificate of Mechanical Readiness; G; CxA

Certificate of Electrical Readiness; G; CxA

Certificate of Plumbing Readiness; G; CxA

Certificate of Controls Readiness; G; CxA

Certificate of Readiness for Re-Tests; G; CxA

Calibration Documentation; G; CxA

Calibration Certifications; G; CxA

SD-08 Manufacturer's Instructions

Startup and Checkout Plan; G; CxA

Completed Startup and Checkout Sheets; G; CxA

SD-10 Operation and Maintenance Data

Training Plan; G; CxA

Training Documentation; G; CxA

Training Attendance Sign-In Sheet; G; CxA

Training Video; G; CxA

Systems Manual; G; CxA

1.5 QUALITY ASSURANCE

1.5.1 Responsibilities

Perform all Commissioning work specified herein and in related sections under the direct guidance of the Commissioning Authority.

1.6 SYSTEMS TO BE COMMISSIONED

See attached preliminary commissioning plan for systems to be commissioned.

The following equipment and systems shall be commissioned in accordance with the procedures described in this section.

- a. Heating, Ventilating, Air Conditioning, and Refrigeration Systems (HVAC&R) Systems (mechanical and passive) and associated controls
- b. Indoor Air Quality (IAQ) systems and associated controls

- c. Interior and exterior lighting, daylighting and shading controls including automatic controls and occupancy sensors
- d. Plumbing and domestic hot water systems including solar water heating
- e. Domestic and process water pumping and mixing systems
- f. Building envelope including thermal and moisture integrity and air tightness
- g. Irrigation systems
- h. Water and energy measurement devices
- i. Renewable energy systems
- j. Water treatment systems
- k. Central energy plant
- l. Steam generation/chilled water systems
- m. Bio-mass generation
- n. Fuel cell generation
- o. EMCS/UMCS systems

1.7 COORDINATION

1.7.1 Commissioning Team

The members of the Cx team shall consist of the CxA, the General Contractor, the COR, sub Contractors, QC Specialists, Designers of Record and Government representative(s) including operation and maintenance (O&M) staff. All members shall work together and with vendors to fulfill their contracted responsibilities and meet the objectives of the Contract documents and Cx process.

The CxA shall regularly communicate with all members of the Cx team, keeping them apprised of Cx progress and scheduling changes through memos, progress reports, or other methods of communication.

1.7.2 Cx Schedule

The CxA shall work with the General Contractor and the COR to schedule the Cx activities within the GC's Master Schedule. The CxA shall provide a list of the initial commissioning activities to the GC. The GC shall sequence and include the list of Cx activities in the Master Schedule.

The General Contractor shall integrate all Cx activities into the master schedule. As construction progresses the GC shall update the Cx schedule with more details. Notify the Contracting Officer and CxA ahead of time when Cx activities not yet performed or not yet scheduled will impact the construction schedule.

1.7.3 Meetings

1.7.3.1 Scoping Meeting

The Cx scoping meeting shall be scheduled by the CxA within 90 days of award of the construction Contract. The CxA shall plan and conduct the Cx scoping meeting with the entire Cx team in attendance. Meeting minutes shall be distributed to all parties within one week. The agenda shall include a review of each building system to be commissioned, including its intended operation, Cx requirements, and completion and startup schedules. The scope of work, tasks, schedules, deliverables, and responsibilities for implementation of the Cx Plan shall be established. Information gathered from this meeting will allow the CxA to update the Cx Plan, which shall also be distributed to all parties.

1.7.3.2 Miscellaneous Meetings

Other meetings will be planned and conducted by the CxA as construction progresses. These meetings will cover coordination, deficiency resolution, and planning issues. These meetings shall be held monthly, until the final three months of construction when they shall be held weekly. Cx shall also be discussed in all weekly progress meetings.

1.8 RESPONSIBILITIES

The responsibilities of various parties in the Cx process are as specified. The COR and CxA are not responsible for construction means, methods, job safety, or management function related to Cx on the job site.

1.8.1 CxA Responsibilities

The CxA is responsible for writing and verification of compliance with the Cx Plan and the preparation of Cx checklists and reports. This shall involve coordinating and directing the Cx activities in a logical, sequential, and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules, and technical expertise. All submittals applicable to systems being commissioned shall be reviewed by the CxA for compliance with Cx needs and the Contract documents. The CxA shall ensure proper coordination and submission of all documents. During construction, the CxA shall perform site visits as necessary to observe component and system installations; attend selected planning and job-site meetings to obtain information on construction progress; review construction meeting minutes for potential revisions or substitutions related to the Cx process; and assist in resolving any discrepancies.

1.8.2 General Contractor Responsibilities

The General Contractor shall include and itemize the cost of Cx in the contract price, including but not limited to the cost of sheaves and belts that may be required by testing, adjusting, and balancing (TAB) as well as the cost of fuel for backup generator testing. The GC shall employ a Commissioning Superintendent to manage and oversee the GC commissioning requirements and sub Contractors. The Commissioning Superintendent may also be the Contractor's Field Superintendent or Quality Control Manager. The GC shall provide all calibrated testing instrumentation necessary for the complete commissioning of all systems, equipment and devices during the Construction, Acceptance and Warranty phases. In each purchase order

or subcontract written, requirements for submittal data, Cx documentation, Cx participation, O&M data, and training shall be included. During construction, the General Contractor shall maintain as-built red-line drawings for all drawings and final CAD as-builts for General Contractor-generated coordination drawings. These drawings shall be updated after completion of Cx (excluding deferred testing). See attached Commissioning Plan for additional General Contractor responsibilities.

a. Commissioning Superintendent Qualifications

1.9 COMMISSIONING PLAN

The CxA shall develop a Draft Cx Plan to identify how Cx activities will be integrated into general construction and trade activities. The Plan shall identify how Cx responsibilities are distributed. In the event of conflict, the Commissioning Plan will take precedence over the requirements stated in this section. The Cx Plan shall include the following components:

- a. A brief overview of the Cx process, including goals, objectives, and general project information.
- b. A list of systems to be commissioned.
- c. Identification of Cx participants and responsibilities.
- d. A description of the management, communication, and reporting of the Cx Plan.
- e. An outline of the Cx process scope including:
 1. Documentation of Basis of Design (BOD) and Owner's Project Requirements (OPR) prepared by DOR.
 2. Startup and testing procedures, including sampling procedures and applicable excerpts from CQC Plan.
 3. Observation procedures, highlighting the requirements for verification of the correct installation of all systems.
 4. System performance verification.
 5. Submittal review procedures.
 6. O&M documentation describing the information to be provided to the Government as required by Section 01 78 23 OPERATION AND MAINTENANCE DATA.
 7. Training activities.
 8. Warranty period activities.
- f. A list and description of the written work products, as specified in the paragraph Written Work Products.
- g. A list of Cx activities to be included in the GC's Master Schedule.
- h. A description of the rigor, scope, and procedures of testing and acceptance.

The Draft Cx Plan and schedule shall be submitted to the Contracting Officer before the scoping meeting. Within 30 days after the initial Cx scoping meeting the CxA shall update and submit the Draft Cx Plan for Contracting Officer final review. The CxA shall adjust the Draft Cx Plan as required. The Cx Plan shall include required testing procedures for commissioned equipment and systems. Changes to the Cx test procedures and scheduling after approval of final Cx Plan during construction will be documented in the Cx Report.

1.10 COMMISSIONED EQUIPMENT DATA

The CxA shall request in writing from the General Contractor specific information needed about each piece of commissioned equipment or system to fulfill requirements of the Cx Plan, and shall review and evaluate this information for compliance with Cx needs, in accordance with this section and Section 01 33 00.00 37 SUBMITTAL PROCEDURES. This information shall include normal cut sheets; addenda; change orders; full details of any required testing; full factory testing reports, if any. In addition, the installation, startup, test procedures and checkout materials and the startup and checkout plans that are shipped inside the equipment and the actual field checkout forms to be used by the factory or field technicians shall be submitted and reviewed by the CxA. The CxA may request further documentation as necessary for the Cx process. Any request for additional data shall be made through the Contracting Officer's Representative and prior to receipt of normal submittal data from equipment manufacturers. This information is to be used in the Cx process prior to the regular formal O&M manual submittals, and shall be compiled and maintained in the O&M manuals and Systems Manual.

1.11 REPORTING

The CxA shall provide Cx schedule and progress reports monthly to the Contracting Officer and Cx team, with increasing frequency as construction and Cx progress. Sample standard forms shall be provided and referenced in the Cx Plan. Testing or review approvals and nonconformance and deficiency reports shall be made regularly.

1.11.1 Final Cx Reports

The CxA shall compile a Final Cx Report focusing on evaluating Cx process issues, and provide two electronic copies to the Contracting Officer. The report shall include an executive summary and shall summarize all of the tasks, findings, conclusions, and recommendations of the Cx process. A list of participants and roles, brief building description, overview of Cx and testing scope, and general description of testing and verification methods shall be included. The CxA shall provide the following for each piece of equipment:

- a. Assessment of how the equipment meets the specification and design intent.
- b. PFT checklists, start-up tests and FPT forms.
- c. O&M documentation evaluation.
- d. Operator training evaluation.
- e. Assessment of the value of the Cx process.

Specifically list all outstanding nonconformance items. Each nonconformance issue shall be referenced to the specific item where the deficiency is documented. List any uncorrected compromises in the environmentally responsive features. List recommendations such as improvements to equipment or operations, future actions including testing justified by seasonal conditions, or Cx process changes. Include a brief description of the verification method used and observations and conclusions from the testing of each piece of equipment. All acquired Cx documentation, including completed FPTs, logs, minutes, reports, deficiency lists, communications, findings, and unresolved issues, shall be compiled in appendices and provided with the Final Cx Report. A Commissioning Agent Certification Letter signed by the CxA shall be included in the report, certifying the Cx Plan has been successfully executed.

1.11.2 Systems Manual

The General Contractor shall develop an indexed systems manual to be submitted in a 3 ring binder or series of 3 ring binders as well as an electronic version on a compact disc (CD). The Systems Manual contains the following information, compiled into a single manual, regardless of repetition with the O&M manuals:

- a. As-built sequences of operations for all equipment as provided by General Contractor, including time-of-day schedules and schedule frequency, control drawings, and detailed point listings with ranges and initial setpoints.
- b. Ongoing operating instructions for all integrated building systems.
- c. FPT results, blank test forms, and recommended schedule for ongoing testing.
- d. Seasonal operational guidelines.
- e. Recommendations for recalibration frequency of sensors and actuators by type and use.
- f. Single line diagrams of each commissioned system.
- g. Troubleshooting table for ongoing achievement of the design intent.
- h. Guidelines for continuous maintenance of the design intent and basis of design.
- i. Full warranty information for all commissioned equipment and systems.

1.11.3 Certificate Of Readiness

Prior to scheduling Functional Performance Tests for each system, issue a Certificate of Readiness for the system certifying that the system is ready for Functional Performance Testing. The Certificate of Readiness must include, for each system to be commissioned, all equipment and system start-up reports; completed Pre-Functional Checklists; Testing, Adjusting, and Balancing (TAB) Report; HVAC Controls Start-Up Reports; and the Air Leakage Test Reports and Diagnostic Test Reports to the extent applicable to the system. The General Contractor; the Lead Commissioning Specialist; the Contractor's Quality Control Representative; the Mechanical, Electrical, Controls, and TAB subcontractor representatives must sign and

date the Certificate of Readiness. Submit the Certificate of Readiness for each system no later than 14 calendar days prior to Functional Performance Tests of that system. Submit an electronic copy. Do not schedule Functional Performance Tests for a system until the Certificate of Readiness for that system receives approval by the Government.

- a. Certificate of Mechanical Readiness
- b. Certificate of Electrical Readiness
- c. Certificate of Plumbing Readiness
- d. Certificate of Controls Readiness

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

Equipment shall be maintained in good repair and operational condition throughout the duration of use on this project.

2.1.1 Equipment Provisions

The General Contractor shall provide all test equipment necessary to perform startup and initial checkout and required Commissioning FPTs. Special equipment, tools and instruments available only from the vendor, specific to a piece of equipment, and required for testing equipment shall be turned over to the Government after testing has been completed, except for stand-alone data logging equipment. Data logging equipment and software required to test equipment shall not become the property of the Government.

2.1.2 Equipment Calibration

The General Contractor is responsible for testing equipment Calibration. All testing equipment shall be of sufficient quality and accuracy to test and measure system performance within the tolerances specified. Unless otherwise noted, the following minimum requirements apply. Temperature sensors and digital thermometers shall have a certified Calibration within the past year to an accuracy of 0.9 degrees F and a resolution of plus or minus 0.2 degrees F. Pressure sensors shall have an accuracy of plus or minus 2.0 percent of the value range being measured (not the full range of the meter) and have been Calibrated within the last year. All equipment shall be Calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or Certificates readily available. Calibration documentation of all testing equipment shall be turned in with each testing episode. Serial numbers of equipment and standards used for QC, zeroing, and Calibration shall be included.

- a. Calibration Certifications

PART 3 EXECUTION

3.1 STARTUP AND PREFUNCTIONAL CHECKOUT

Each piece of equipment or system to be commissioned shall receive a full prefunctional checkout. No sampling strategies shall be used. Equipment shall not be temporarily started for Cx.

3.1.1 Responsibilities

The General Contractor has startup responsibility and shall complete systems and subsystems so they are fully functional and meeting the design objectives of the Contract documents. Start-up of equipment shall not occur until PFT are completed and the checklists have been approved by the CxA. The Cx procedures and FPT do not relieve or lessen this responsibility or shift that responsibility partially to the CxA or the Government. Parties responsible for PFT execution and startup shall be identified in the Cx scoping meeting and in the PFT checklists.

3.1.2 PFT Checklists and Startup Plan

The General Contractor shall assist the CxA in developing the PFT checklists. The manufacturer and General Contractor shall develop the detailed startup plans for all equipment. The primary role of the CxA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed.

3.1.2.1 PFT Checklists

The PFT checklists shall indicate required procedures to be executed to verify the systems are ready for start-up. The attached PFT checklists are preliminary checklists and shall be finalized by the CxA 2 weeks minimum prior to PFTs being performed. The General Contractor shall determine which trade is responsible for executing and documenting each of the line item tasks and note that trade on the PFT checklists. Each task may have more than one trade responsible for its execution.

- a. Pipe Pressure Test Reports
- b. Completed PFT checklists
- c. PFT Nonconformance Reports

3.1.2.2 Startup Plan

The General Contractor shall develop the full startup plan and submit the plan to the CxA for review and approval. The CxA shall review and evaluate the procedures and the procedure documentation format, noting any procedures that need to be revised or added. The plan shall contain a minimum of the following:

- a. The manufacturer's standard written startup procedures copied from the installation manuals with check boxes by each procedure and a summary statement with a signature block added at the end.
- b. The manufacturer's field checkout sheets.

3.1.3 Execution of PFTs

Two weeks prior to PFT, the General Contractor shall schedule PFT activities with the Contracting Officer and CxA. The General Contractor shall execute the PFTs of all equipment and systems defined in the commissioning plan. The CxA may attend the PFTs. The General Contractor shall fill out the PFT checklists and submit the completed PFT checklists to the CxA for review and approval.

3.1.4 Execution of Startup

Two weeks prior to startup, the General Contractor shall schedule startup and checkout activities with the Contracting Officer and CxA. Prior to start-up of all commissioned equipment the pre-functional checklists must be approved by the CxA. The General Contractor shall execute the start-up of all equipment and systems defined in the commissioning plan. The General Contractor shall provide skilled technicians to execute starting of equipment and shall ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments, and problem-solving. The CxA may attend the startup.

3.1.4.1 Startup Documentation

After startup completion, the General Contractor shall provide the CxA with a signed and dated copy of the completed startup checklists. Only individuals that have direct knowledge and witnessed that a line item task of the startup was actually performed shall initial or check that item off. Witnessing supervisors shall not fill out these forms.

a. Completed Startup and Checkout Sheets

3.1.5 Nonconformance and Approval in PFT Checklists and Startup

The General Contractor shall clearly list any outstanding items of the startup and PFT procedures that were not completed successfully at the bottom of the applicable checklist or on an attached sheet. The completed checklist and any outstanding deficiencies shall be provided to the Contracting Officer and the CxA within 2 days of test completion. The CxA shall review the report and submit either a nonconformance report or an approval form to the Contracting Officer. The General Contractor shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CxA as soon as outstanding items have been corrected and resubmit an updated report and a Statement of Correction on the original nonconformance report. When satisfactorily completed, the CxA shall recommend approval of the execution of the PFTs and startup of each system to the Contracting Officer using a standard form. General Contractor shall notify CxA 2 weeks minimum prior to any re-inspection and get approval from the CxA prior to starting re-inspection.

a. PFT Nonconformance Reports

b. Statement of Corrections

3.2 SENSOR AND ACTUATOR CALIBRATION

General Contractor shall Calibrate all field-installed temperature, relative humidity, CO2 and pressure sensors and gages, and actuators (dampers and valves) on all equipment. Test instruments shall have had a certified Calibration within the last 12 months. Sensors installed in the unit at the factory with Calibration Certification provided need not be field Calibrated. Procedures used shall be fully documented on the PFT checklists or other suitable forms, along with written Calibration documentation of initial, intermediate and final results.

a. Calibration Certifications

3.2.1 Calibration Methods

Alternate methods may be used, if approved by the Government beforehand.

3.2.1.1 All Sensors

The General Contractor shall verify that all sensor locations are appropriate and away from Causes of erratic operation. Verify that sensors with shielded Cables are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, verify they are reading within 0.4 degrees F of each other for temperature and within a tolerance of each other equal to two percent of the reading for pressure. Tolerances for Critical Applications may be tighter.

3.2.1.2 Sensors Without Transmitters

The General Contractor shall make a reading with a Calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage, or building automation system (BAS)) is within the tolerances listed in the table below in paragraph Tolerances, Standard Applications of the instrument-measured value. If not, install offset in BAS, Calibrate, or replace sensor.

3.2.1.3 Sensors With Transmitters

The General Contractor shall disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the BAS. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship, and P/I reaction. Reconnect sensor. Make a reading with a Calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage, or BAS) is within the tolerances listed in the table below in paragraph Tolerances, Standard Applications of the instrument-measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.

3.2.2 Tolerances, Standard Applications

Sensor Required Tolerance (+/-)
Cooling coil, chilled and condenser water temps 0.7 F
Flow rates, water 4% of design
Relative humidity 4% of design
AHU wet bulb or dew point 3.6 F
Combustion flue temps 9.0 F
Hot water coil and boiler water temp 2.7 F
Oxygen or CO2 monitor 0.1% pts
Outside air, space air, duct air temps 0.7 F
CO monitor 0.01% pts
Watt-hour, voltage & amperage 1% of design
Natural gas and oil flow rate 1% of design
Pressures, air, water and gas 3% of design
Steam flow rate 3% of design
Flow rates, air 10% of design
Barometric pressure 1.0 inch of Hg

3.2.3 Valve and Damper Stroke Setup and Check

3.2.3.1 EMS Readout

For all damper actuator positions checked, the General Contractor shall verify the actual position against the BAS readout. Set pumps or fans to normal operating mode. Command damper closed, visually verify that damper is closed and adjust output zero signal as required. Command damper open, verify position is full open and adjust output signal as required. Command damper to three intermediate positions. If actual damper position does not reasonably correspond, replace actuator.

3.3 CONTROLS

Controls shall be tested and verified after PFT and startup and after sensor and actuator Calibration, as specified in Section 23 09 23.01 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS. The General Contractor shall be responsible for Cx activities related to controls. Before initial startup, the General Contractor shall gather and review the current control sequences and interlocks and with the CxA write detailed testing procedures. All submittals indicated in Section 23 09 23.01 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS shall be reviewed and approved by the CxA. Controls sub Contractor shall perform functional performance tests with CxA directing and witnessing the tests. Controls sub Contractor shall provide their controls proprietary software for the CxA and TAB General Contractor to install on their computers so they are Capable of controlling and viewing the control system.

3.4 TAB

TAB shall be completed after controls are tested, checked out, and adjusted. The General Contractor shall be responsible for TAB preparation and activities, as specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC. All TAB submittals indicated in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC shall be reviewed and approved by the CxA. TAB will be present during functional performance tests for all equipment groups in quantities as indicated in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC, paragraphs "Tab Field Acceptance Testing" and "Additional COTR TAB Field Acceptance Testing".

3.5 LIGHTING AND LIGHTING CONTROL SYSTEMS

3.5.1 General

Commissioning of lighting and lighting control systems shall comply with commissioning procedures of the Lighting Controls Association (LCA), available online at <http://www.aboutlightingcontrols.org/education>. Commissioning of lighting and lighting control systems shall not begin until the building envelope is enclosed; ceiling tiles, floor coverings, and window coverings are in place; lamps have completed a minimum 100-hour burn-in period; and the furniture is in place. 100 percent% of spaces shall be commissioned.

3.5.2 Performance Parameters and Commissioning Procedures

3.5.2.1 Lighting Controls

- a. Lighting control commissioning shall verify that sensor type, quantity, placement, aiming, sensitivity, and time delay match the requirements of Section 26 51 00 INTERIOR LIGHTING.
- b. Sensor delays shall be set to 15 minutes in classrooms and 10 minutes elsewhere, except wall-mounted sensor switches in small non-toilet spaces shall be set for 5 minutes.
- c. Controlled spaces with automatic-on/automatic off controls shall detect an entering occupant within 3 feet of doorway and within 1 second of entry.
- d. Controlled spaces with manual-on/automatic off controls shall operate as indicated.
- e. Controlled spaces shall be tested for walking motion to verify the LED indicator lights on sensors detect properly. Lighting may be on for this test.
- f. Controlled office, classroom, and conference room spaces shall be tested for hand motion to verify the LED indicator lights on sensors detect properly. Lighting may be on for this test.
- g. Controlled spaces shall be tested for 100 percent occupancy sensor coverage.
- h. Testing shall verify lighting within a controlled space is not triggered on by movement in adjacent work or traffic areas.

3.5.2.2 Lighting Control Panels

- a. Verify channels are programmed as indicated on the Contract Drawings.
- b. Verify channels are assigned to rooms/spaces as indicated on the Contract Drawings.
- c. Verify auxiliary controls (e.g., sensors and switches) operate as indicated on the Contract Drawings.
- d. Verify auxiliary switch type, quantity, and placement.
- e. Verify programming is PC-based and the software is installed and functional.
- f. Verify system warns occupants prior to sweeping off.
- g. Verify switch override time duration.
- h. Verify programming is not lost upon power failure.
- i. Verify the lighting control panel communicates with the basewide energy system via the LonWorks BAS.

3.5.2.3 Exterior Lighting Photo Sensors

- a. Test the photo sensor controls for exterior lights during the daytime when conditions are such that controls should be turning off electric lighting.
- b. Verify that the fixture turns off during the daytime.
- c. Verify that the fixture turns on when the photo sensor is completely covered.
- d. Verify that the photo sensor is in an appropriate location for the lights being controlled and is not affected by direct sunlight or obstructions in a way that causes incorrect operation.

3.5.2.4 Dimming

Verify dimming in spaces with removable partitions operate autonomously when partitions are in place and operate together when partitions are removed.

3.6 AIR BARRIER SYSTEM

Air barrier system quality control, performance and testing requirements are as specified in Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS and Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM.

The General Contractor shall prepare testing plans and checklists and coordinate them with CxA.

3.7 FUNCTIONAL PERFORMANCE TESTING

The General Contractor shall provide FPT of all commissioned equipment and systems. The CxA shall direct, witness, and document the FPT of all HVAC equipment and systems and a sampling of all other equipment and systems. Sampling shall be in accordance with ASHRAE Guideline 0. The General Contractor shall document the FPT of all equipment and systems that are not witnessed by the CxA. The General Contractor shall notify the CxA and the COR a minimum of 2 weeks prior to start of functional tests and shall get approval from the CxA prior to starting functional tests. General Contractor shall also provide filled out functional test readiness forms prior to functional tests for approval. Attached FPT forms are preliminary test procedure forms and will be finalized by the CxA 2 weeks minimum prior to FPTs being performed. The General Contractor shall execute the tests with skilled technicians provided under the direction of the CxA. Systems shall be tested under all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, full range of part- and full-load) and under abnormal modes and conditions (power failure, interlocks with other equipment, alarms, no flow, equipment failure). The General Contractor shall verify that systems are run through all the building control system's sequences of operation, and components shall be verified to be responding as the sequences state. Systems shall not leak. The General Contractor shall assist the CxA to develop the FPT procedures in a sequential written form, and coordinate, oversee, and document the actual testing.

- a. Certificate of Mechanical Readiness
- b. Certificate of Electrical Readiness

c. Certificate of Plumbing Readiness

3.7.1 Development of Test Procedures

Before test procedures are completed, the General Contractor shall provide to the CxA all requested documentation regarding equipment sequence of operation and testing procedures, including procedures for equipment installed by factory representatives and a current list of change orders affecting equipment or systems. The change orders shall include an updated points list, program code, control sequences, and parameters. Using the testing parameters and requirements found in the technical sections of commissioned equipment and systems the CxA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. The General Contractor shall assist the CxA in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings, or equipment documentation is not sufficient for writing detailed testing procedures. Prior to execution, the CxA shall provide the test procedures to the General Contractor for review. The General Contractor shall review to verify the test procedures for feasibility with installed equipment and programmed sequence of operation. The test procedure forms shall include the following, at a minimum:

- a. System and equipment or component name(s) and configuration(s).
- b. Equipment location and ID number.
- c. Unique test ID number, and reference to unique PFT checklist and startup documentation ID numbers.
- d. Date.
- e. Project name.
- f. Participating parties.
- g. A copy of the section describing the test requirements.
- h. A copy of the specific sequence of operations or other specified parameters being verified.
- i. Formulas used in any Calculations.
- j. Required pre-test field measurements.
- k. Instructions for setting up the test, including special Cautions, alarm limits, or other equipment-specific information.
- l. Specific step-by-step procedures to execute the test in a clear, sequential, and repeatable format.
- m. Acceptance criteria of proper performance with a Yes / No check box to allow for clear marking of whether or not proper performance of each part of the test was achieved.
- n. A section for comments.
- o. Signature and date blocks for the CxA, General Contractor, and

Contracting Officer.

3.7.2 Test Methods

3.7.2.1 Functional Performance

FPT and verification shall be achieved by manual testing or by monitoring the performance and analyzing the results using the energy management control system's trend log Capabilities or by stand-alone data loggers. A combination of methods may be required to test the complete sequence of operations. The General Contractor and CxA shall determine which method, or combination of methods, is most appropriate for tests that do not have a method specified. The General Contractor shall provide FPT of commissioned equipment and systems. The CxA or Contracting Officer's representative shall analyze any functional performance trend logs and monitoring data to verify performance, and witness and evaluate manual FPTs performed by the General Contractor. The General Contractor shall assist the CxA in interpreting the monitoring data, as necessary.

3.7.2.2 Simulated Conditions

Simulating conditions (not by an overwritten value) shall be allowed only when timing the testing to experience actual conditions is not practical. Sensors, transducers, and devices shall have been Calibrated before simulating conditions.

3.7.2.3 Overwritten Values

Overwriting sensor values to simulate a condition shall be allowed only when simulating conditions in other ways is not practical, and shall be used with Caution. Sensors, transducers and devices shall have been Calibrated before overwriting values.

3.7.2.4 Altering Setpoints

Altering setpoints to test a sequence is an acceptable alternative to overwriting sensor values when simulating conditions in other ways is not practical.

3.7.2.5 Indirect Indicators

Relying on indirect Indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the building control system represent actual conditions and responses. Much of this verification shall be completed during prefunctional testing.

3.7.2.6 Setup

Each function and test shall be performed under conditions that simulate actual conditions as close as possible. The General Contractor shall provide materials, system modifications, and other necessities to produce the flows, pressures, temperatures, or other values necessary to execute the test according to the specified conditions. Where equipment requires integral safety devices to stop or prevent equipment operation unless minimum safety standards or conditions are met, FPT procedures shall demonstrate the actual performance of safety shutoffs in real or closely-simulated conditions of failure. At completion of the test, the General Contractor shall return all affected building equipment and

systems, due to these temporary modifications, to their pre-test conditions.

3.7.3 Coordination and Scheduling

FPT shall be performed after PFTs, startup, Calibration, and TAB are complete for a given system. The CxA shall schedule FPTs through the General Contractor and Contracting Officer. Testing shall proceed from components to subsystems to systems; when the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems shall be checked.

- a. Certificate of Mechanical Readiness
- b. Certificate of Electrical Readiness
- c. Certificate of Plumbing Readiness

3.7.4 Documentation, Review and Approval

The CxA shall document the results of all FPTs witnessed by the CxA (as indicated in paragraph FUNCTIONAL PERFORMANCE TESTING) using the specific test procedures and forms developed by the CxA for that purpose. For all equipment and systems not witnessed by the CxA, the General Contractor shall document the results of all FPT and submit the completed FPT forms for CxA review. The CxA shall validate that the testing requirements of this Contract are accomplished, and shall note each satisfactorily demonstrated function on the test form. Formal approval of the FPT shall be made after witnessing or review by the Contracting Officer. The Contracting Officer shall give final approval on each test using the same form, and provide signed copies to the CxA and the General Contractor. The CxA shall submit copies of the approved FPT forms with the O&M manual data and as part of the Cx Report.

3.8 NONCONFORMANCE

Every effort shall be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. The CxA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so by direction from the Contracting Officer. Nonconformance and deficiencies observed in materials, installation, or operation shall be addressed immediately, in terms of notification to responsible parties, and providing recommended actions to correct deficiencies. The General Contractor shall have responsibility for resolving construction deficiencies, and the CxA shall assist with problem solving as necessary. If a design revision is deemed necessary and approved by the Contracting Officer, the designer shall have responsibility for providing design revision. The CxA shall maintain a master deficiency and resolution log, and shall provide the Contracting Officer with written progress reports and test results with recommended actions.

- a. FPT Nonconformance Reports

3.8.1 Procedure

All deficiencies or nonconformance issues shall be noted and reported to the Contracting Officer and CxA. The General Contractor shall report in

writing to the CxA and Contracting Officer weekly, or at a minimum as often as Cx meetings are being scheduled, concerning the status of each apparent outstanding discrepancy identified during Cx. The report shall include explanations of any disagreements and proposals for their resolution, and a copy shall be included in the deficiency report and resolution record.

Corrections of minor deficiencies may be made during the tests at the discretion of the CxA, and the deficiency and resolution shall be documented on the test procedure form.

3.8.1.1 Non-Disputed Deficiencies

When a deficiency is identified, the CxA shall discuss the issue with the General Contractor. When there is no dispute on the deficiency and the General Contractor accepts responsibility to correct it, the CxA shall document the deficiency, the adjustments or alterations required to correct it, and the General Contractor's response and intentions. The next test or sequence may then be performed. After the day's work, the CxA shall submit all the nonconformance reports to the Contracting Officer for signature. Copies shall be provided to the General Contractor and Contracting Officer. The General Contractor shall correct the Deficiency, submit a Certificate of Readiness for Re-Test and notify the CxA and COR that the equipment is ready to be retested. The CxA shall reschedule the test and the test shall be repeated as specified in the paragraph Retesting.

- a. Statement of Corrections
- b. Certificate of Readiness for Re-Tests

3.8.1.2 Disputed Deficiencies

If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible, the deficiency shall be documented on the nonconformance report form with the General Contractor's response and a copy given to the Contracting Officer and General Contractor. Resolutions shall be made at the lowest management level possible. Additional parties shall be brought into the discussions as needed. Final interpretive and acceptance authority is with the Contracting Officer. The CxA shall document the resolution process. Once the interpretation and resolution have been decided, the General Contractor shall correct the deficiency, sign the statement of correction on the nonconformance report form and provide it to the CxA. The CxA shall reschedule the test and the test shall be repeated as specified in the paragraph Retesting.

- a. Statement of Corrections
- b. Certificate of Readiness for Re-Tests

3.8.2 Retesting

The cost, including additional CxA labor and costs, to retest a prefunctional test or FPT shall be solely the responsibility of the General Contractor. Any required retesting by the General Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the General Contractor. The CxA or Contracting Officer's representative shall witness retesting as necessary until satisfactory performance is achieved. Notify the CxA a minimum of 2 weeks prior to any retesting and get approval from the CxA prior to starting any retesting.

- a. Certificate of Readiness for Re-Tests

3.8.3 Failure Due to Manufacturer Defect

If 3 or 10 percent, whichever is greater, of identical pieces of equipment (size alone does not constitute a difference) fail to perform to the Contract documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the Contracting Officer. In such case, the General Contractor shall provide the Contracting Officer with the following:

- a. Within 1 week of notification from the Contracting Officer, the General Contractor or manufacturer's representative shall examine all other identical units making a record of the findings.
- b. Within 2 weeks of the original notification, the General Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation. The Contracting Officer shall determine whether a replacement of all identical units or a repair is acceptable.
- c. Two examples of the proposed solution shall be installed by the General Contractor and the Contracting Officer shall be allowed to test the installations for up to 1 week, upon which the Contracting Officer will decide whether to accept the solution.
- d. Upon acceptance, the General Contractor and manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within 1 week from when parts can be obtained.

3.8.4 Deficiency Report and Resolution Record

The CxA shall submit original nonconformance forms with the deficiency report and resolution record at the end of the project. The deficiency report and resolution record shall contain documented items of nonconformance in materials, installation, or operation, including the master deficiency and resolution log, and documented results from startup, PFTs, FPT, and short-term diagnostic monitoring, as specified. Details of the components or systems found to be noncompliant with the drawings and specifications shall be included. Adjustments and alterations performed or required to correct the deficiencies and the responsible parties shall be identified.

3.9 DEFERRED TESTING

3.9.1 Unforeseen Deferred Tests

If any check or test cannot be completed due to the building structure, required occupancy condition, or other deficiency, execution of checklists and FPT may be delayed upon approval of the Contracting Officer. These tests shall be conducted as soon as possible in the same manner as seasonal testing. Services of necessary parties shall be negotiated.

3.9.2 Seasonal Testing

The CxA shall schedule, coordinate, and observe additional testing for seasonal variation in operations and control strategies during the opposite season to verify performance of the HVAC system and controls as indicated in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC. The

General Contractor shall execute and document tests and correct deficiencies with facilities staff and the CxA and Contracting Officer's representative witnessing. Testing shall be completed during the warranty period to fully test all sequences of operation. The General Contractor shall make necessary revisions to O&M manuals, systems' manual and records due to the testing.

3.9.3 Short-Term Diagnostic Testing

After initial occupancy, the General Contractor shall perform short-term diagnostic testing, using data acquisition equipment or the building automation system to record system operation over a two- to three-week period. The dynamic interactions between components in the building system shall be investigated. The scheduling, interaction between heating and cooling, and effectiveness of the HVAC system in meeting the comfort requirements shall be evaluated. The General Contractor shall document tests and findings, and correct deficiencies according to the original testing requirements.

3.10 TRAINING

For each commissioned system, the General Contractor shall conduct a training course for building operating staff members designated by the Government in the maintenance and operation of the system, including specified hardware and software. Duration of each training course shall be in accordance with the approved training plan. The training courses shall be conducted at the project site and the General Contractor shall make audiovisual recordings of all training sessions and add them to the O&M systems' manuals. A training day is defined as 8 hours of classroom instruction, including two 15-minute breaks and excluding lunchtime, DPW only available for training Tuesday through Thursday, during the daytime shift in effect at the training facility. Training courses on similar commissioned systems that would be maintained by the same building operating staff members may be scheduled to occur consecutively with Government approval.

3.10.1 Training Plan and Schedule

The General Contractor shall prepare the training plan which shall be reviewed by the CxA and approved by the COR. Training plan shall include, for each commissioned system, an outline of the course content with proposed duration of each portion, dates, start and finish times, location(s), names and qualifications of the instructors and a list of texts and other materials that will be provided to support the training course. The training plan shall be submitted within 14 days after approval of the O&M manuals. The General Contractor shall work with the CxA and the COR to schedule the training activities and shall include a training schedule in the training plan.

3.10.2 Training Course Content

The training course for each commissioned system shall include, as a

minimum, the following (as applicable to the system):

- a. General purpose of the system (design intent)
- b. Use of O&M manuals
- c. Review of control drawings and schematics
- d. Startup, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, control setup and programming troubleshooting, and alarms
- e. Interactions with other systems
- f. Adjustments and optimizing methods for energy conservation
- g. Health and safety issues
- h. Special maintenance and replacement sources
- i. Occupant interaction issues
- j. System response to different operating conditions

See also the individual technical specifications for commissioned systems for system-specific training content requirements. In the event of conflict between this and other sections on duration of individual training sessions, this section shall take precedence.

3.10.3 Training Documentation

General Contractor shall prepare training documentation consisting of:

- a. Training Attendance Sign-in Sheet: A list of course attendees which shall be signed and dated by all attendees including the instructor. Provide (two) 2 copies of the completed sign-in sheet to the COR for archive.
- b. Training Manuals: Training manuals shall include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson. Where the General Contractor presents portions of the course material by audiovisuals, copies of those audiovisuals shall be delivered to the Government as a part of the printed training manuals. Training manuals shall be delivered for each trainee with 2 (two) additional copies delivered to the COR for archive.
- c. Training Video: Contractor to video record the training sessions and submit to the government.

3.10.4 Training Verification

General Contractor shall provide one copy of each completed sign-in sheet, one copy of each training manual and one copy of each videotaped course to the CxA for inclusion in the Cx Report. The CxA shall verify that all training in the approved training plan has been conducted.

-- End of Section --

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U.S. Army Human Performance Training Center (HPTC)
SOF Human Platform
Force Generation (FORGE) Facility
Ft. Bragg, NC

APPENDIX A — SAMPLE PREFUNCTIONAL CHECKLISTS

Pre-Functional Performance Test Checklist - Exhaust Fan

For Exhaust Fan: [_____]

Checklist Item

Installation	A	M	E	T	C	O
a. Fan belt adjusted.	___	___	X	___	X	___

Electrical	A	M	E	T	C	O
a. Power available to fan disconnect.	___	___	___	X	___	___
b. Proper motor rotation verified.	___	___	___	___	X	___
c. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___

Controls	A	M	E	T	C	O
a. Control interlocks properly installed.	___	___	___	X	___	___
b. Control interlocks operable.	___	___	___	X	___	___
c. Dampers/actuators properly installed.	___	___	X	___	___	___
d. Dampers/actuators operable.	___	___	X	___	___	___
e. Verify proper location and installation of thermostat.	___	___	X	___	___	___

Testing, Adjusting, and Balancing (TAB)	A	M	E	T	C	O
a. TAB Report approved.	___	___	X	___	X	___

Pre-Functional Performance Test Checklist - HVAC System Controls

For HVAC System: [_____]

Checklist Item

Installation	A	M	E	T	C	O
a. Layout of control panel matches drawings.	___	___	X	X	___	___
b. Framed instructions mounted in or near control panel.	___	___	X	X	___	___
c. Components properly labeled (on inside and outside of panel).	___	___	X	X	___	___
d. Control components piped and/or wired to each labeled terminal strip.	___	___	X	X	___	___
e. EMCS connection made to each labeled terminal strip as shown.	___	___	X	X	___	___
f. Control wiring and tubing labeled at all terminations, splices, and junctions.	___	___	X	X	___	___

Main Power and Control Air

a. 120 volt AC power available to panel.	___	___	___	X	___	___
b. 138 kPa gauge20 psig compressed air available to panel.	___	___	X	X	___	___

Testing, Adjusting, and Balancing (TAB)

Testing, Adjusting, and Balancing (TAB)	A	M	E	T	C	O
a. TAB Report submitted.	___	___	X	___	X	___

Pre-Functional Performance Test Checklist - Pumps

For Pump: [_____]

Checklist Item	A	M	E	T	C	O
Installation						
a. Piping system installed.	___	___	X	X	X	___
Electrical						
a. Power available to pump disconnect.	___	X	___	X	X	___
b. Pump rotation verified.	___	X	___	X	X	___
c. Control system interlocks functional.	___	X	___	X	___	___
Testing, Adjusting, and Balancing (TAB)						
a. Pressure/temperature gauges installed.	___	___	X	___	X	___
b. TAB Report approved.	___	___	X	___	X	___

Pre-Functional Performance Test Checklist - Packaged Air Cooled Chiller

For Chiller: [_____]

Checklist Item	A	M	E	T	C	O
Installation						
a. Chiller properly piped.	___	___	X	___	___	___
Electrical						
a. Power available to unit disconnect.	___	X	___	X	___	___
b. Power available to unit control panel.	___	X	___	X	___	___
c. Separate power is supplied to electric heating tape.	___	X	___	X	___	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	X	___	X	___	___
Controls						
a. Factory startup and checkout complete.	___	___	X	X	___	___
b. Chiller safety/protection devices tested.	___	___	X	X	___	___
c. Chilled water flow switch installed.	___	___	X	X	___	___
d. Chilled water flow switch tested.	___	___	X	X	___	___
e. Chilled water pump interlock installed.	___	___	X	X	X	___
f. Chilled water pump interlock tested.	___	___	___	X	___	___

Pre-Functional Performance Test Checklist - Single Zone Air Handling Unit

For Air Handling Unit: [_____]

Checklist Item

Installation	A	M	E	T	C	O
a. Inspection and access doors are operable and sealed.	___	___	X	___	X	___
b. Condensate drainage is unobstructed.	___	___	X	X	X	___
c. Fan belt adjusted [Supply/Return/Relief]	___	___	X	___	X	___

Electrical	A	M	E	T	C	O
a. Power available to unit disconnect.	___	___	___	X	X	___
b. Power available to unit control panel.	___	___	___	X	___	___
c. Proper motor rotation verified.	___	___	___	___	X	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___
e. Power available to electric heating coil.	___	___	___	X	___	___

Coils	A	M	E	T	C	O
[a. Chilled water piping properly connected.	___	___	X	___	___	___]
[a. Refrigerant piping properly connected.	___	___	X	X	X	___]
[c. Hot water piping properly connected.	___	___	X	___	___	___]
[c. Steam and condensate piping properly connected.	___	___	X	X	X	___]

Controls	A	M	E	T	C	O
a. Control valves/actuators properly installed.	___	___	X	___	___	___
b. Control valves/actuators operable.	___	___	X	___	___	___
c. Dampers/actuators properly installed.	___	___	X	___	___	___
d. Dampers/actuators operable.	___	___	X	___	___	___
e. Verify proper location and installation of thermostat.	___	___	X	___	___	___

Testing, Adjusting, and Balancing (TAB)	A	M	E	T	C	O
---	---	---	---	---	---	---

a. TAB Report approved.

___ ___ X ___ X ___

Pre-Functional Performance Test Checklist - Unit Heater

For Unit Heater: [_____]

Checklist Item

Installation	A	M	E	T	C	O
[a. Hot water piping properly connected.	___	___	X	___	___	___]
[a. Steam and condensate piping properly connected.	___	___	X	X	X	___]

Electrical	A	M	E	T	C	O
a. Power available to unit disconnect.	___	___	___	X	___	___
b. Proper motor rotation verified.	___	___	___	X	X	___
c. Verify that power disconnect is located within sight of the unit it controls.	___	___	___	X	___	___
d. Power available to electric heating coil.	___	___	___	X	___	___

Controls	A	M	E	T	C	O
a. Control valves properly installed.	___	___	X	___	___	___
b. Control valves operable.	___	___	X	X	___	___
c. Verify proper location and installation of thermostat.	___	___	X	___	___	___

Testing, Adjusting, and Balancing (TAB)	A	M	E	T	C	O
a. TAB Report approved.	___	___	X	___	X	___

Pre-Functional Performance Test Checklist - Variable Volume Air Handling Unit

For Air Handling Unit: [_____]

Checklist Item	A	M	E	T	C	O
Installation						
a. Inspection and access doors are operable and sealed.	___	___	X	___	X	___
b. Condensate drainage is unobstructed. (Visually verify drainage by pouring a cup of water into drain pan.)	___	___	X	X	X	___
c. Fan belt adjusted.	___	___	X	___	X	___

Electrical	A	M	E	T	C	O
a. Power available to unit disconnect.	___	X	___	X	X	___
b. Power available to unit control panel.	___	X	___	X	X	___
c. Proper motor rotation verified.	___	X	___	___	X	___
d. Verify that power disconnect is located within sight of the unit it controls.	___	X	___	X	X	___
[e. Power available to electric heating coil.	___	X	___	X	X	___]

Coils	A	M	E	T	C	O
[a. Chilled water piping properly connected.	___	___	X	X	X	___]
[a. Refrigerant piping properly connected.	___	___	X	X	X	___]
[b. Hot water piping properly connected.	___	___	X	X	X	___]
[b. Steam and condensate piping properly connected.	___	___	X	X	X	___]

Pre-Functional Performance Test Checklist - Variable Volume Air Handling Unit

Controls	A	M	E	T	C	O
a. Control valves/actuators properly installed.	___	X	X	X	___	___
b. Control valves/actuators operable.	___	X	X	X	___	___
c. Dampers/actuators properly installed.	___	X	X	X	___	___
d. Dampers/actuators operable.	___	X	X	X	___	___
e. Verify proper location, installation and calibration of duct static pressure sensor.	___	X	X	X	___	___
f. Fan air volume controller operable.	___	X	X	X	___	___
g. Air handler controls system operational.	___	X	X	X	___	___
 Testing, Adjusting, and Balancing (TAB)	 A	 M	 E	 T	 C	 O
a. Construction filters removed and replaced.	___	___	X	___	___	___
b. TAB report approved.	___	X	X	___	X	___

Pre-Functional Performance Test Checklist - DX Air Cooled Condensing Unit

For Condensing Unit: [_____]

Checklist Item	A	M	E	T	C	O
Installation						
a. Check condenser fans for proper rotation.	___	___	X	___	X	___
Electrical						
a. Power available to unit disconnect.	___	X	___	X	X	___
b. Power available to unit control panel.	___	X	___	X	___	___
c. Verify that power disconnect is located within sight of the unit it controls	___	X	___	X	___	___
Controls						
a. Unit safety/protection devices tested.	___	___	X	X	___	___
b. Control system and interlocks installed.	___	___	X	X	___	___
c. Control system and interlocks operational.	___	___	X	X	___	___

Pre-Functional Performance Test Checklist - VAV Terminal

For VAV Terminal: [_____]

Checklist Item	A	M	E	T	C	O
Installation						
[a. Reheat coil connected to hot water pipe.	___	___	X	___	X	___]
[b. Electric reheat coil connected to local disconnect.	___	X	___	___	X	___]
Controls						
a. Cooling only VAV terminal controls set.	___	X	X	X	___	___
b. Cooling only VAV controls verified.	___	X	X	X	___	___
c. Reheat VAV terminal controls set.	___	X	X	X	___	___
d. Reheat terminal/coil controls verified.	___	X	X	X	___	___
Testing, Adjusting, and Balancing (TAB)						
a. TAB report approved.	___	___	X	___	X	___

U.S. Army Human Performance Training Center (HPTC)
SOF Human Platform
Force Generation (FORGE) Facility
Ft. Bragg, NC

APPENDIX B — SAMPLE FUNCTIONAL PERFORMANCE TESTS

Functional Performance Test Checklist - HVAC Controls

For HVAC System: [_____]

The Contracting Officer will select HVAC control systems to undergo functional performance testing. The number of systems shall not exceed 10 percent. Perform this test simultaneously with FPT for AHU or other controlled equipment.

1. Functional Performance Test: Contractor shall verify operation of HVAC controls by performing the Performance Verification Test (PVT) test for that system. Contractor to provide blank PVT test procedures previously done by the controls Contractor.

2. Verify interlock with UMCS system_____.

3. Verify all required I/O points function from the UMCS system_____.

4. Certification: We the undersigned have witnessed the Performance Verification Test and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Specialist _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's TAB Representative _____

Contractor's Controls Representative _____

Design Agency Representative _____

Contractor's Officer's Representative _____

Using Agency's Representative _____

Functional Performance Test Checklist - Variable Volume Air Handling Unit

For Air Handling Unit: [_____]

1. Functional Performance Test: Contractor shall verify operation of air handling unit in accordance with specification including the following:

a. Ensure that a slight negative pressure exists on inboard side of the outside air dampers throughout the operation of the dampers. Modulate OA, RA, and EA dampers from fully open to fully closed positions_____.

b. The following shall be verified [supply fan operating][supply and return fans operating] mode is initiated:

(1) All dampers in normal position prior to fan start_____.

(2) All valves in normal position prior to fan start_____.

(3) System safeties allow start if safety conditions are met._____

(4) VAV fan controller shall "soft-start" fan. _____

(5) Modulate all VAV boxes to minimum air flow and verify that the static pressure does not exceed the high static pressure shutdown setpoint_____.

(6) Return all VAV boxes to auto _____.

c. Occupied mode of operation - economizer de-energized.

(1) Outside air damper at minimum position. _____

(2) Return air damper open. _____

(3) Relief air damper [at minimum position] [closed]. _____

(4) Chilled water control valve modulating to maintain leaving air temperature set point. Setpoint _____deg CF Actual _____deg CF

(5) Fan VAV controller receiving signal from duct static pressure sensor and modulating fan to maintain supply duct static pressure set point. Setpoint _____kpainches-wg Actual _____kpainches-wg

d. Occupied mode of operation - economizer energized.

(1) Outside air damper modulated to maintain mixed air temperature set point. Setpoint _____deg CF, Actual _____deg CF, Outside air damper position _____ percent.

(2) Relief air damper modulates with outside air damper according to sequence of operation. Relief air damper position_____ percent.

(3) Chilled water control valve modulating to maintain leaving air temperature set point. Setpoint _____deg CF Actual _____deg CF

(4) Hot water control valve modulating to maintain leaving air

temperature set point. Setpoint _____deg CF Actual _____deg CF

Functional Performance Test Checklist (cont) - Variable Volume Air Handling Unit

(5) Fan VAV controller receives signal from duct static pressure sensor and modulates fan to maintain supply duct static pressure set point. Setpoint kpainches-wg_____ Actual kpainches-wg_____

e. Unoccupied mode of operation

- (1) Observe fan starts when space temperature calls for heating and/or cooling. _____ Note: This does not apply to series boxes.
- (2) All dampers in normal position. _____
- (3) Verify space temperature is maintained as specified in sequence of operation. _____

f. The following shall be verified when the [supply fan off][supply and return fans off] mode is initiated:

- (1) All dampers in normal position. _____
- (2) All valves in normal position. _____
- (3) Fan de-energizes. _____

g. Verify the chilled water coil control valve operation by setting all VAV's to maximum and minimum cooling.

Max Cooling

Supply air temp. _____ deg CF Verify cooling valve operation_____.

Min cooling

Supply air temp. _____ deg CF Verify cooling valve operation_____.

h. Verify safety shut down initiated by low temperature protection thermostat. _____

i. Verify occupancy schedule is programmed into time clock/UMCS_____.

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Specialist _____
Contractor's Mechanical Representative _____
Contractor's Electrical Representative _____
Contractor's TAB Representative _____
Contractor's Controls Representative _____
Design Agency Representative _____

Contracting Officer's Representative

Using Agency's Representative

Functional Performance Test Checklist - VAV Terminals

The Contracting officer will select VAV terminals to be spot-checked during the functional performance test. The number of terminals selected shall not exceed 10 percent.

1. Functional Performance Test: Contractor shall demonstrate operation of selected VAV boxes in accordance with specifications including the following:

a. Cooling only VAV boxes:

(1) Verify VAV box response to room temperature set point adjustment. Turn thermostat to 3 degrees C/5 degrees F below ambient and measure maximum airflow. Turn thermostat to 3 degrees C/5 degrees F above ambient and measure minimum airflow.

	Setting	Measured	Design	
Maximum flow	[_____]	[_____]	[_____]	L/scfm
Minimum flow	[_____]	[_____]	[_____]	L/scfm

b. Cooling with reheat VAV boxes:

(1) Verify VAV box response to room temperature set point adjustment. Turn thermostat to 3 degrees C/5 degrees F above ambient and measure maximum airflow. Turn thermostat to 3 degrees C/5 degrees F below ambient and measure minimum airflow.

	Setting	Measured	Design	
Maximum flow	[_____]	[_____]	[_____]	L/scfm
Minimum flow	[_____]	[_____]	[_____]	L/scfm

(2) Verify reheat coil operation range (full closed to full open) by turning room thermostat 3 degrees C/5 degrees F above ambient _____.

With heating water system and boiler in operation providing design supply hot water temperature record the following:

Design HW supply temperature_____ deg CF
Actual HW supply temperature_____ deg CF
AHU supply air temperature_____ deg CF
VAV supply air temperature_____ deg CF
Calculate coil capacity and compare to design:
Design _____ WBTU/hr Actual _____WBTU/hr

Functional Performance Test Checklist (cont)- VAV Terminals

c. Parallel Fan powered VAV boxes:

(1) Verify VAV box responses to call for heating via set point adjustment. Change from cooling set point to heating set point. Verify cooling damper closes to minimum position, blower fan energizes according to sequence of operation, and upon further drop in space temperature, heating coil activation. _____

With heating water system in operation providing design supply hot water temperature record the following:

Design HW supply temperature _____ deg CF
Actual HW supply temperature _____ deg CF
AHU supply air temperature _____ deg CF
VAV supply air temperature _____ deg CF
Calculate coil capacity and compare to design:
Design _____ WBTU/hr Actual _____ WBTU/hr

(2) Check primary air damper maximum/minimum flow settings and compare to actual measured flows.

	Setting	Measured	Design
Maximum flow	[_____]	[_____]	[_____] L/scfm
Minimum flow	[_____]	[_____]	[_____] L/scfm

(3) Check blower fan flow. [_____] L/scfm

(4) Verify free operation of fan backdraft damper (insure no primary air is being discharged into plenum space).

d. Series Fan Powered VAV boxes

(1) Ensure VAV fan starts prior to AHU fan

(2) Verify VAV box response to sensor call for heating via set point adjustment. Change from cooling set point to heating set point. Verify cooling damper closes to minimum position and upon further drop in space temperature, heating coil activation. With heating water system and boiler in operation providing design supply hot water temperature record the following:

Design HW supply temperature _____ deg CF
Actual HW supply temperature _____ deg CF
AHU supply air temperature _____ deg CF
VAV supply air temperature _____ deg CF
Calculate coil capacity and compare to design:
Design _____ WBTU/hr Actual _____ WBTU/hr

(3) Check primary air damper maximum/minimum flow settings and compare to actual measured flows.

	Setting	Measured	Design
Maximum flow	[_____]	[_____]	[_____] L/scfm

Minimum flow [] [] [] L/scfm

Functional Performance Test Checklist (cont)- VAV Terminals

(4) Verify that minimal primary air is discharging into the plenum space when in full cooling mode.

(5) Verify that no plenum air is being induced from the plenum space into the supply air during full cooling by measuring supply air temperature and comparing to primary air temperature

Primary air temp _____ deg CF
Supply air temp _____ deg CF

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Specialist	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's TAB Representative	_____
Contractor's Controls Representative	_____
Contracting Officer's Representative	_____
Design Agency Representative	_____
Using Agency's Representative	_____

Functional Performance Test Checklist - Packaged Air Cooled Chiller

For Chiller: [_____]

1. Functional Performance Test: Contractor shall demonstrate operation of chilled water system in accordance with specifications including the following: Start building air handler to provide load for chiller. Activate controls system chiller start sequence as follows.

a. Start chilled water pump and establish chilled water flow. Verify chiller-chilled water proof-of-flow switch operation. _____ Record outdoor air temperature. _____

b. Verify control system energizes chiller start sequence. _____

c. Verify chiller senses chilled water temperature above set point and control system activates chiller start. Setpoint_____deg CF Actual_____deg CF

d. Verify functioning of "soft start" sequence. _____

e. Verify and record chiller data in accordance with 2, 3 and 4 below on fully loaded chiller.

f. Shut off air handling equipment to remove load on chilled water system. Verify chiller shutdown sequence is initiated and accomplished after load is removed. _____

g. Restart air handling equipment one minute after chiller shut down. Verify chiller restart sequence. _____

2. Verify chiller inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report, chiller design conditions, and chiller manufacturer's performance data.

		DESIGN	TAB TEST	ACTUAL
Chiller inlet pressure	(kPa gauge)	_____	_____	_____
Chiller inlet pressure	(psig)	_____	_____	_____
Chiller outlet pressure	(kPa gauge)	_____	_____	_____
Chiller outlet pressure	(psig)	_____	_____	_____
Chiller flow	L/secGPM	_____	_____	_____

3. Verify chiller amperage each phase and voltage phase-to-phase and phase-to-ground.

				Motor F/L AMPS
Amperage	Phase 1 _____	Phase 2 _____	Phase 3 _____	_____
Voltage	Ph1-Ph2 _____	Ph1-Ph3 _____	Ph2-Ph3 _____	
Voltage	Ph1-gnd _____	Ph2-gnd _____	Ph3-gnd _____	

Functional Performance Test Checklist (cont) - Packaged Air Cooled Chiller

4. a. Record the following information:

Outdoor air temperature _____ degrees CF	Design
Ambient dry bulb temperature _____ degrees CF	_____degrees CF
Entering chilled water temperature _____ degrees CF	_____degrees CF
Leaving chilled water temperature _____ degrees CF	_____degrees CF

b. Calculate chiller load at ambient conditions and compare to chiller rated capacity from manufacturer's literature. Calculated _____ KWSTon
Rated _____ KWSTon.

5. Unusual vibration, noise, etc.

6. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Specialist	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's TAB Representative	_____
Contractor's Controls Representative	_____
Design Agency Representative	_____
Contracting Officer's Representative	_____
Using Agency's Representative	_____

Functional Performance Test - Pump [_____]

NOTE: Prior to performing this test, for closed loop systems ensure that the system is pressurized and the make-up water system is operational, or for open loop systems ensure that the sumps are filled to the proper level.

1. Activate pump start using control system commands.

a. Verify correct operation in:

HAND_____ OFF_____ AUTO_____

b. Verify pressure drop across strainer:

Strainer inlet pressure _____ kPa gaugepsig

Strainer outlet pressure _____ kPa gaugepsig

c. Verify pump inlet/outlet pressure reading, compare to Testing, Adjusting, and Balancing (TAB) Report and pump design conditions.

	DESIGN	TAB	ACTUAL
Pump inlet pressure kPa gaugepsig	_____	_____	_____
Pump outlet pressure kPa gaugepsig	_____	_____	_____

d. Operate pump at shutoff and at 100 percent of designed flow when all components are in full flow. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure kPa gaugepsig	_____	_____
Pump outlet pressure kPa gaugepsig	_____	_____
Pump flow rate L/sgpm	_____	_____

	SETPOINT
Differential Pressure Transmitter	_____

Functional Performance Test (cont) - Pump [_____]

e. For variable speed pumps, operate pump at shutoff (shutoff to be done in manual on variable speed drive at the minimum rpm that the system is being controlled at) and at minimum flow or when all components are in full by-pass. Plot test readings on pump curve and compare results against readings taken from flow measuring devices.

	SHUTOFF	100 percent
Pump inlet pressure kPa gauge	_____	_____
Pump outlet pressure kPa gauge	_____	_____
Pump flow rate L/s	_____	_____
	SETPOINT	
Differential Pressure Transmitter	_____	

2. Measure motor amperage each phase and voltage phase to phase and phase to ground for both the full flow and the minimum flow conditions. Compare amperage to nameplate FLA.

a. Full flow:

Nameplate FLA	_____		
Amperage Phase 1	_____	Phase 2 _____	Phase 3 _____
Voltage Ph1-Ph2	_____	Ph1-Ph3 _____	Ph2-Ph3 _____
Voltage Ph1-gnd	_____	Ph2-gnd _____	Ph3-gnd _____

b. Minimum flow:

Amperage Phase 1	_____	Phase 2 _____	Phase 3 _____
Voltage Ph1-Ph2	_____	Ph1-Ph3 _____	Ph2-Ph3 _____
Voltage Ph1-gnd	_____	Ph2-gnd _____	Ph3-gnd _____

3. Note unusual vibration, noise, etc.

Functional Performance Test (cont) - Pump [_____]

4. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Specialist	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's TAB Representative	_____
Contractor's Controls Representative	_____
Contracting Officer's Representative	_____
Design Agency Representative	_____
Using Agency's Representative	_____

Functional Performance Test Checklist - Unit Heaters

The Contracting Officer will select unit heaters to be spot-checked during the functional performance test. The number of terminals shall not exceed 10 percent. Hot water systems (for hot water unit heaters) must be in operation and supplying design hot water supply temperature water.

1. Functional Performance Test: Contractor shall demonstrate operation of selected unit heaters:

- a. Verify unit heater response to room temperature set point adjustment. _____
- b. Check heating mode inlet air temperature. _____ deg CF
- c. Check heating mode outlet air temperature. _____ deg CF
- d. Record manufacturer's submitted fan capacity _____L/scfm
- e. Calculate unit heater capacity using manufacturer's fan capacity and recorded temperatures and compare to design.
- f. Calculated _____WattsBTU/hr Design _____WattsBTU/hr

2. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Specialist	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's TAB Representative	_____
Contractor's Controls Representative	_____
Design Agency Representative	_____
Contracting Officer's Representative	_____
Using Agency's Representative	_____

Functional Performance Test Checklist - Air Cooled Condensing Unit

For Condensing Unit: [_____]

1. Functional Performance Test: Contractor shall demonstrate operation of refrigeration system in accordance with specifications including the following: Start building air handler to provide load for condensing unit. Activate controls system start sequence as follows.

a. Start air handling unit. Verify control system energizes condensing unit start sequence. _____

b. Verify and record data in 2 and 3 below.

c. Shut off air handling equipment to verify condensing unit de-energizes. _____

d. Restart air handling equipment one minute after condensing unit shut down. Verify condensing unit restart sequence. _____

2. Verify condensing unit amperage each phase and voltage phase to phase and phase to ground.

Motor Full-Load Amps _____

Amperage Phase 1 _____ Phase 2 _____ Phase 3 _____

Voltage Ph1-Ph2 _____ Ph1-Ph3 _____ Ph2-Ph3 _____

Voltage Ph1-gnd _____ Ph2-gnd _____ Ph3-gnd _____

3. Record the following information:

Ambient dry bulb temperature _____ degrees CF
Suction pressure _____ kPa gaugepsig
Discharge pressure _____ kPa gaugepsig

4. Unusual vibration, noise, etc.

5. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

Contractor's Commissioning Specialist _____

Contractor's Mechanical Representative _____

Contractor's Electrical Representative _____

Contractor's TAB Representative _____

Contractor's Controls Representative _____

Design Agency Representative _____

Contracting Officer's Representative _____

Using Agency's Representative

Functional Performance Test Checklist - Energy Recovery System

For Energy Recovery System: [_____]

1. Functional Performance Test: Contractor shall demonstrate operation of energy recovery system in accordance with specifications including the following: Start equipment to provide energy source for recovery system.

- a. Verify energy source is providing recoverable energy. _____
- b. Verify recovery system senses available energy and activates. _____

2. Verify recovery system inlet/outlet readings, compare to design conditions and manufacturer's performance data.

	Design	Actual
Primary loop inlet temp (degrees CF)	_____	_____
Primary loop outlet temp (degrees CF)	_____	_____
Primary loop flow rate L/s[gpm][cfm]	_____	_____
Secondary loop inlet temp (degrees CF)	_____	_____
Secondary loop outlet temp (degrees CF)	_____	_____
Secondary loop flow rate L/s[gpm][cfm]	_____	_____
Primary loop energy WattsBTU/hr	_____	_____
Secondary loop energy WattsBTU/hr	_____	_____

3. Verify that recovery system deactivates when recoverable energy is no longer available. _____

4. Check and report unusual vibration, noise, etc.

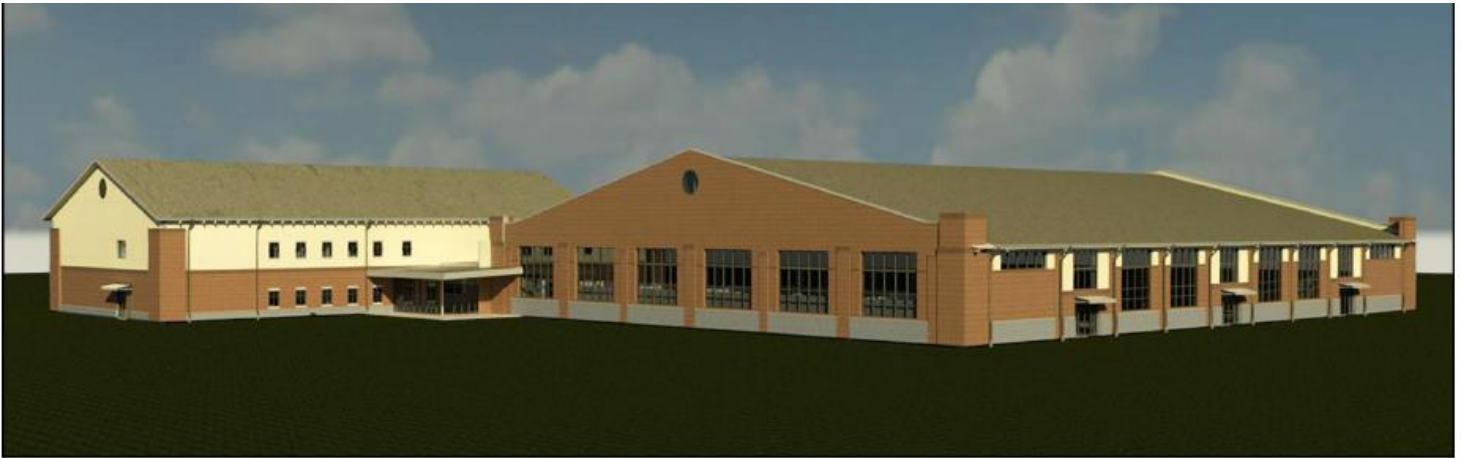
5. Certification: We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

Signature and Date

- Contractor's Commissioning Specialist _____
- Contractor's Mechanical Representative _____
- Contractor's Electrical Representative _____
- Contractor's TAB Representative _____
- Contractor's Controls Representative _____
- Design Agency Representative _____
- Contractor's Officer's Representative _____
- Using Agency's Representative _____

U.S. Army Human Performance Training Center (HPTC)
SOF Human Platform-Force
Generation (FORGE) Facility
Ft. Bragg, NC

Project No. 81165



Design Phase Commissioning Plan

Prepared By



[Final Design Submittal]

The Commissioning Process is a quality-focused process for enhancing the delivery of a project. The process focuses upon evaluating and documenting that all of the commissioned systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements (OPR).

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A. REVISION TABLE

Revision	Author/Editor	Date
1		
2		
3		
4		
5		

B. COMMISSIONING PLAN

The Commissioning Plan outlines and guides the commissioning activities during the design, construction, acceptance and occupancy phases of the project. It defines the project team’s roles and responsibilities, communication protocols, Commissioning activities, and the schedule of those activities.

The purpose of the Commissioning Plan is to outline the scope and format of the commissioning process for this Project. The Commissioning Plan is based on the DOR’s and GC’s obligation to provide systems that function in accordance with the project requirements. The role of the Commissioning Authority (CxA) is to develop and manage the commissioning process for the systems that are included in the Commissioning Plan and to verify that the building systems function interactively, within the limits of the contract.

The Commissioning Plan will also evolve throughout the construction and occupancy phases of the Project. The revisions of the Cx Plan are:

1. Design Phase
2. Interim Construction Phase
3. Final Construction Phase

C. BUILDING OVERVIEW

The purpose of this project is to provide new construction of the 97,500 square feet Human Performance Training Center at Fort Bragg, North Carolina. The project includes a multi-story facility with administrative, cardio / strength / nutrition training and physical / hydrotherapy for special operations students. The facility will include additional space for cognitive enhancement performance, human engagement, adaptive thinking training, shower / locker spaces, classrooms, break rooms, and associated support spaces.

The building includes facilities for Human Dynamics & Performance, Interpersonal Enhancement & Performance, Cognitive Enhancement & Performance with shared spaces (“Synthetic Training Gym” & High Tech Secure Storage), special spaces and support spaces. The building systems will include fire detection and suppression energy management control integrated to match the local system, unclassified and classified communications networks, protected distribution system, intrusion detection, surveillance, and electronic access control.

Construction consists of concrete foundation and floor slab with metal frame structure. Built-in building systems include fire alarm / mass notification, fire suppression, energy management control, telephone and advanced unclassified and classified communications networks, cable TV, intrusion detection, closed circuit surveillance, electronic access control systems and a hardened protected distribution system. Department of Defense (DoD) principles for high performance and sustainable building requirements will be included in the design and

construction of the project in accordance with federal laws and Executive Orders. Low Impact Development features will be included in the design and construction of this project as appropriate.

The building will be commissioned in accordance with USACE guidelines and the contract documents. The Government has retained the services of a Commissioning Authority (CxA) under separate contract from the general contractor, for commissioning services. The general contractor shall participate fully in the commissioning process, as described in the contract documents. The CxA shall report results, recommendations, and findings directly to the Government.

D. REFERENCES

1. Contract Documents
2. Basis of Design (BOD)
3. Owner's Project Requirements (OPR)
4. LEED Reference Guide for Green Building Design and Construction, 2009 Edition
5. ASHRAE Guideline 0: (2013) The Commissioning Process
6. ASHRAE Guideline 1.1 (2007) HVAC&R Technical Requirements for The Commissioning Process
7. ASHRAE 189.1 (2014) Standard for the Design of High-Performance Green Buildings
8. SAS UFGS 01 91 00.37 Commissioning
9. UFC 1-200-02 High Performance and Sustainable Building Requirements, 01 DEC 2016

E. COMMISSIONING PROCESS

The Commissioning (Cx) Process is a quality-focused quality control process for enhancing the delivery of a project. The process focuses upon evaluating and documenting that all of the commissioned systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements (OPR). This is an Enhanced Commissioning process because it is a total building system commissioning program that started early in the design phase and continues through the warranty phase.

The purpose of the Commissioning process is to verify and document that the performance of the various systems meets the Owner's Project Requirements (OPR). During the design and/or construction phases of the project, the commissioning process identifies potential building system issues, which may prevent the building from operating to the Owner's expectations. Commissioning is a systematic process of verifying that the building systems perform interactively according to the design intent and operational needs.

The goal of the commissioning process is to verify that the project's mechanical systems, electrical systems, plumbing systems and DDC control system function interactively in compliance with the OPR and the Basis of Design (BOD). The commissioning process facilitates the orderly and efficient transfer of the systems to the government's facility operations and maintenance personnel. Commissioning also documents system performance parameters for fine-tuning control sequences, operational procedures, and facilitates future troubleshooting. Commissioning is not intended to be redundant with the contractor's obligations for testing and proof of performance of the project systems. The Commissioning process and activities are separate from, and in addition to, the quality assurance process of Government Acceptance Testing for the project.

The Commissioning process requires a team effort, and the entire project team is part of the Commissioning Process. The Commissioning Plan defines the project team's roles and responsibilities, communication protocols, Commissioning activities, and the schedule of those activities. Success is dependent on each team member's understanding of what is expected of them and to understand the roles, responsibility and part of all other commissioning team members.

(1) Culture of Partnering:

Commissioning is a collaborative quality effort between the owner and all Cx Team contractors and subcontractors. The collaborative approach establishes a culture of partnership that requires mutual trust, respect, cooperation, patience and an environment where contractors are productive as commissioning team members.

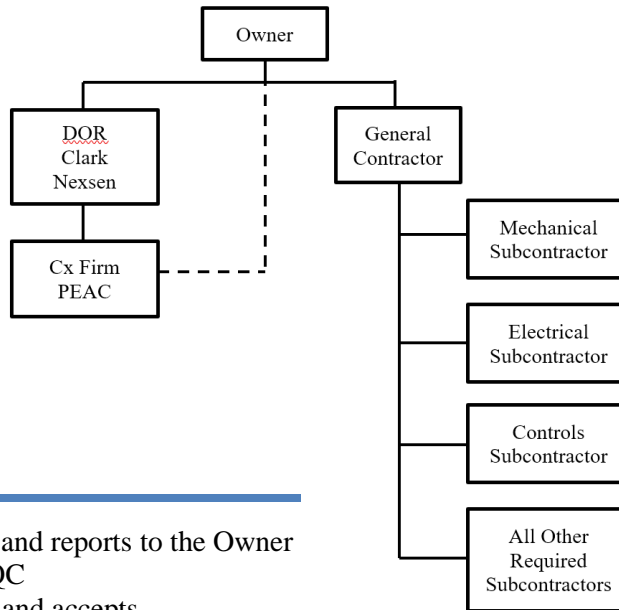
(2) Authority:

Only the government’s Contracting Officer has authority to add, delete or otherwise change the Contractor’s scope of work, contract requirements, schedule and or etc. The CxA has no authority to give scope direction, add, delete or otherwise change the Contractor’s scope of work, contract requirements, schedule and or etc.


The owner shall provide direction, reviews and acceptance as required throughout the project and the Cx Process. The owner has selected a qualified CxA professional. The CxA directs the Cx Process and shall be an objective advocate of the owner.

(3) Commissioning Team:

The entire project team is part of the Commissioning Process. Success is dependent on each team member’s understanding of what is expected of them and to understand the roles, responsibility and part of all other commissioning team members.



CxA observes, documents and reports to the Owner
GC installs, inspects and QC
Government conducts QA and accepts

Cx Team Member	Firm	Contact Name	Contact Number	Contact Email
Contracting Officer (CO)	USACE	John Hill	910-251-4451	John.t.hill@usace.army.mil
Contracting Officer (CO)	USACE	Tamara Murphy		Tamara.C.Murphy@usace.army.mil
Project Manager	USACE	Daniel (Chris) Moore	910-251-4483	Daniel.c.moore@usace.army.mil
Design Manager (DM)	USACE	Brian Ballweg	910-251-4881	Brian.ballweg@usace.army.mil
Construction Manager (CM) and (COR)	USACE	Michael (Adam) Gabzdyl	910-908-4129	Michael.a.gabzdyl@usace.army.mil
Supervisor Mechanical Engineer (AE)	USACE	Dan Daloia	910-308-8612	Daniel.M.Daloia@usace.army.mil
Project Engineer (PE)	USACE	Anthony Byrd		Anthony.D.Byrd@usace.army.mil
AE Program Manager (DOR)	Clark Nexsen	Sam Estep	757-455-5800	Ssestep@clarknexsen.com
AE Project Manager (DOR)	Clark Nexsen	Steve Bennett	757-351-1159	sbennett@clarknexsen.com
AE Architect	Clark Nexsen	Anne Jenkins	757-961-7975	ajenkins@clarknexsen.com
AE Mechanical Engineer (DOR)	Clark Nexsen	Jon Dover	757-961-7757	jdover@clarknexsen.com
AE Electrical Engineer (DOR)	Clark Nexsen	Matt Samson		matthew.Samson@clarknexsen.com
AE Plumbing Engineer	Clark Nexsen	Joe Withers	757-961-7771	jwithers@clarknexsen.com
Commissioning Authority Project Manager (CxA)		Barry Cromuel	804-852-4996	Barry@peaccs.com
Lead Commissioning Authority (CxA)		Troy Byers	803-391-0427	Troy@peaccs.com
General Contractor (GC)	TBD			
GC Superintendent (Supt)	TBD			
GC Cx Superintendent (GCCS)	TBD			
GC Quality Control Manager (QCM)	TBD			
Mechanical SubContractor (MC)	TBD			
Electrical SubContractor (EC)	TBD			
Plumbing SubContractor (PC)	TBD			
Controls SubContractor (CC)	TBD			
TAB SubContractor (TC)	TBD			

(4) Roles and Responsibilities:

The success of the commissioning effort is dependent upon the participation of the entire project team, including the government, designer, contractor and all installing subcontractors. Communications with the CxA are to flow through the established project communication protocols. The government has included in the design and construction team’s contracts the Cx activities, Cx roles and Cx responsibilities contained in this project Cx Plan. The members of the commissioning team play the following roles in the commissioning process:

Owner – USACE Contracting

Key responsibilities include, but are not limited to, the following:

1. Ensure the development of the OPR and review the updates
2. Ensure the development of the BOD and review the updates
3. Provide direction to the team when needed to meet the OPR
4. Determine the systems and assemblies to be commissioned
5. Review the Cx Process design review comments
6. Review the Cx Plan
7. Review and Accept the Design Submittals
8. Review Testing Documents
9. Attend Cx Meetings

10. Review Cx Checklists
11. Review the Commissioning Issue Logs
12. Participate in the issue resolution process
13. Witness the Functional Performance Testing
14. Coordinate operation and maintenance personnel for training

Commissioning Authority – PEAC

Key responsibilities include, but are not limited to, the following:

1. Review the OPR and the BOD and offer updates
2. Develop the Cx specifications
3. Develop the Cx Plan
4. Submit Design Review Comments
5. Lead the Cx Program
6. Facilitate all Cx Meetings
7. Identify Cx activities for the GC's master schedule
8. Review submittals of commissioned equipment
9. Review RFIs
10. Review contractor and sub-contractor data forms
11. Develop PFC
12. Collaborate with the installing contractors to develop, document and distribute test procedures
13. Record and track all issues and their resolutions
14. Lead the efforts to resolve all issues in collaboration with the Cx Team
15. Review control system point-to-point testing
16. Perform periodic site observations; and attend construction progress meetings.
17. Sample devices for compliance with checklists.
18. Develop FPT procedures
19. Develop IST procedures
20. Coordinate and witness FPT and IST
21. Review the O&M Binders
22. Witness Customer Training
23. Develop Commissioning Report
24. Perform the 10th month warranty visit

Design Team – Clark Nexsen

Key responsibilities include, but are not limited to, the following:

1. Develop the OPR document. Update the OPR throughout Construction
2. Develop the BOD document. Update the BOD throughout Construction
3. Develop the design of the AE DOR contract
4. Certify the design meets the contract requirements
5. Establish standards for measurement and verification for the testing of commissioned systems
6. Include commissioning requirements in the MEP specifications UFGS Divisions 22, 23, 25 and 26
7. Consider the CxA's comments and provide responses in accordance with the designer's best professional judgment.
8. Participate in the issue resolution process to resolve issues
9. Provide timely response to the CxA for Requests for Information including clarification of system design, calculations, control, or intent.

General Contractor – TBD

Mechanical SubContractor – TBD

Electrical SubContractor – TBD

Controls SubContractor – TBD

Key responsibilities include, but are not limited to, the following:

1. Developing and implement a QC Management Plan that incorporates the commissioning requirements of the contract documents.
2. Assigning a Commissioning Superintendent (GCCS) as the lead Cx point of contact and administrator. The Commissioning Superintendent can also serve other responsibilities and roles.
3. Conduct all preliminary testing, checking, correcting and verifying of the commissioned systems
4. Provide submittals to the owner, designer and the CxA for review
5. Provide blank startup sheets to the CxA for review
6. Attend all commissioning meetings
7. Implement the functional tests on all systems under the direction of the commissioning authority until successful completion.
8. Direct contractors to cooperate with the CxA and the Cx process for all Cx activities
9. Inform the CxA of installation or equipment changes from the contract documents
10. Notify the Owner of any system performance issues that arise or are identified during construction
11. Integrate the Cx process into the construction schedule and updates
12. Address any design/construction related non-conformance issues, documented in the Commissioning Issues Logs, in an expeditious manner
13. Flush all piping before pipe pressure testing
14. Clean all duct before duct leakage tests
15. Submit all startup sheets, PFC, controls trend data and test results prior to calling for FPTs
16. Submit controls diagrams, graphic screen shoots, 72 hour trend data in graphic format, and sequences of operations prior to FPT
17. Submit a Certificate of Readiness for FPT for all equipment and systems that successfully completed startup, PFC, GC testing and issue resolution.
18. Submit a Certificate of Readiness for Re-FPT for all equipment and systems that failed FPT
19. Start-up and test all mechanical equipment including successful functional testing
20. Start-up and test all electrical equipment including successful functional testing
21. Submit controls point to point verification
22. Demonstrate controls point to point values and functions
23. Provide extended trending and endurance testing reports and graphics from the Controls
24. The technical work associated with electrical systems including Lighting Systems, Power Distribution Systems, Power Generation Systems must be performed by an engineering technician certified by the InterNational Electrical Testing Association (NETA) or the National Institute for Certification in Engineering Technologies (NICET) with five years of experience inspecting, testing, and calibrating electrical distribution and generation equipment, systems, and devices
25. Provide qualified personnel, equipment and materials (including ladders, etc.) for participation in demonstration of FPTs.
26. Participate in fine-tuning or trouble-shooting of system performance if necessary
27. Provide equipment, materials, and labor necessary to correct deficiencies found during the FPT process
28. Operate equipment and systems as required by the specifications for testing
29. Provide O&M information for verification, organization and distribution
30. Provide training for the systems specified in the contract documents
31. Video record all training and submit to the CO on CD
32. Provide O&M binders

33. Participate on seasonal / deferred testing
34. Participate on warranty phase walkthrough and commissioning
35. Provide postoccupancy training and seasonal tests and problem resolutions

F. ABBREVIATIONS

AE	Architect and Design Engineers (DOR)	FT	Functional Test
BOD	Basis of Design	GC	General Contractor
CC	Controls SubContractor	GCCS	General Contractor Cx Superintendent
CM	Construction Manager	HVAC	Heating Ventilating and Air Conditioning
CO	Contracting Officer	IST	Integrated Systems Testing
COR	Contracting Officer’s Representative	MC	Mechanical SubContractor
Cx	Commissioning	MEP	Mechanical, Electrical, Plumbing
CxA	Commissioning Authority	O&M	Operation and Maintenance
Cx Plan	Commissioning Plan	OPR	Owner’s Project Requirements
DALT	Duct Air Leakage Test	PC	Plumbing SubContractor
DM	Design Manager	PE	Project Engineer
DOR	Designer of Record	PFC	Pre-functional Checklist
EC	Electrical SubContractor	PM	Project Manager
EN	End User – Facility User / Occupant	QCM	Quality Control Manager
ET	Engineering Technician	SOR	Site Observation Report
FPC	Fire Protection Contractor	TAB	Test and Balance Contractor
FPT	Function Performance Test	TC	TAB SubContractor

G. DEFINITIONS

Acceptance: a formal action, taken by a person with appropriate authority (which may or may not be contractually defined) to declare that some aspect of the project meets defined requirements, thus permitting subsequent activities to proceed.

Architect Engineer (AE): *The architectural and design engineering firm – design firm, the DOR*

Basis of Design (BOD) or Design Analysis (DA): a document that records the concepts, calculations, decisions, and product selections used to meet the Owner’s Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

Checklists: project and element-specific checklists that are developed and used during all phases of the commissioning Process to verify that the Owner's Project Requirements are being achieved. Checklists are used for general Evaluation, testing, training, and other design and construction requirements.

Commissioning (Cx): The systematic quality control process of verifying that all building systems are installed and perform in accordance with the design and specification intent

Commissioning Authority (CxA): an entity identified by the owner who leads, plans, schedules, and coordinates the Commissioning Team to implement the Commissioning Process.

Commissioning Firm: An entity identified by the Owner and is responsible for the coordination of the commissioning process. The primary role of the CxA is to verify achievement of the OPR throughout the project

Commissioning Plan: a document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.

Commissioning Process: a quality-focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that all of the commissioned systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.

Commissioning Process Activities: components of the Commissioning Process.

Commissioning Team: the individuals and agencies who, through coordinated actions, are responsible for implementing the Commissioning Process.

Commissioning Testing and verification: the Evaluation and documentation of the equipment and assemblies delivery and condition, installation, proper function according to the manufacturer's specifications, and project documentation to meet the criteria in the Owner's Project Requirements.

Construction Checklist: a form used by the Commissioning Team to verify that appropriate materials and components are on site, ready for installation, correctly installed, functional, and in compliance with the Owner's Project Requirements. Also see *checklists*.

Construction Documents: this includes a wide range of documents, which will vary from project to project, and with the owner's needs and regulations, laws, and jurisdictional requirements. Construction documents usually include the project manual (specifications), plans (drawings), and general terms and conditions of the contract.

Contract Documents: this includes a wide range of documents, which will vary from project to project and with the owner's needs, regulations, laws, and jurisdictional requirements. Contract documents frequently include price agreements; construction management process; subcontractor agreements or requirements; requirements and procedures for submittals, changes, and other construction requirements; timeline for completion; and the construction documents.

Coordination Drawings: drawings showing the work of all trades to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances.

Designer of Record (DOR): The firm designing the plans and specifications – design firm, AE

Enhanced Commissioning: The commissioning program that starts in the design phase and continues through the warranty phase.

Evaluation: the process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems and their performance are confirmed with respect to the criteria required in the Owner's Project Requirements.

Final Commissioning Report: a document that records the activities and results of the Commissioning Process and is developed from the final Commissioning Plan with all of its attached appendices.

Functional Performance Test (FPT): performance testing is the process of verifying that a material, product, assembly, or system meets defined performance criteria. The methods and conditions under which performance is verified are described in one or more test protocols.

General Contractor (GC): The construction contractor contracted by the owner to construct the building and its systems and assemblies according to the requirements prescribed in the contract documents.

General Contractor Commissioning Superintendent (GCCS): Individual employed or contracted by the General Contractor and is responsible for overseeing the general Contractor's commissioning requirements, deliverables, activities, processes and subcontractors. The GCCS can also hold other roles and responsibilities such as the GC's site superintendent and / or quality control manager if the GCCS' can also meet all other qualifications.

Integrated Systems Testing (IST): The functional testing of systems' integration with other systems

Issues And Resolution Log: a formal and ongoing record of problems or concerns and their resolutions that have been compiled by members of the Commissioning Team during the Commissioning Process.

O&M Binder: a system-focused composite 3-ring binder that includes the design, construction, O&M documentation, facility guide and training information.

Owner's Project Requirements (OPR): a written document that details the requirements of a project and the expectations of how it will be used and operated. This includes project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. (The term *project intent* or *design intent* is used by some owners for their Commissioning Process Owner's Project Requirements.). The purpose of this document is to provide clear and concise documentation of the Owner's goals, expectations and requirements for commissioned systems. The intent of this document is to detail the functional requirements of a project and the expectations of the building's use and operation as it relates to commissioned systems.

Prefunctional Checklist (PFC): Functional checklists completed by the general contractor during startup and before certifying the system is ready for FPTs.

Performance Test: A formal and ongoing record of problems or concerns and their resolutions that have been raised by members of the Commissioning Team during the course of the Commissioning Process.

Quality Control Manager (QCM): The qualified supervisor meeting the requirements of the contract documents for the project's quality control.

Test Procedure: a written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems to verify compliance with the OPR.

Training Plan: a written document that details the expectations, schedule, duration and deliverables of Commissioning Process Activities related to training of project operating and maintenance personnel, users, and occupants.

Vendor: a company that furnishes products to project contractors and/or subcontractors for on-site installation.

Verification: the process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the OPR.

H. DESIGN ACTIVITIES

(1) Design Reviews

The CxA will review mechanical, plumbing and electrical design documentation for systems that pertain to the commissioned systems as outlined in Section I of this document. This review is for observation purposes only and does not position the CxA as an agent of the AE or government. This review does not relieve the AE or government of design certification, compliance or acceptance. The AE DOR shall review and respond to the CxA's design comments. The AE DOR shall certify that the final design package meets the requirements of the government and is fit for construction as well as the government's intent of the design.

(2) OPR

The OPR will be the foundation for the design, construction, and occupancy and operation of the facility and is the basis for the Cx Plan and schedule. It contains key owner's requirements, general project description, objectives and an overview of the project as well as general reasons why the project is being undertaken. A summary description of the owner's Commissioning requirements is contained in the OPR. The OPR document evolves throughout the project. It is the primary tool for benchmarking success and quality at all phases of project delivery and throughout the life of the facility.

The OPR document must list and define the systems, functional uses and assemblies to be commissioned, including sampling strategies accepted by the owner. The systems and assemblies being commissioned shall have defined project performance, economic requirements, budget considerations, efficiency requirements, performance benchmarks and acceptance criteria. The OPR includes environmental and sustainability goals, maintainability and maintenance program requirements and operations training requirements

The OPR shall be reviewed by the CxA and approved by the owner during design. Updates to the OPR made during subsequent project activities shall also be formally accepted by the owner.

(3) Cx Plan

The Cx Plan shall be a written document and provide organization, documentation requirements, and tools to evaluate and document that the design, construction, and operation of the project or facility, systems, and assemblies meet the OPR.

(4) BOD (or DA)

The BOD is a written document that shall provide detailed information on the design team's approach to meeting the OPR to provide the owner with a better understanding of design issues and secure the owner's approval of critical design decisions.

The BOD shall be developed by the design team in accordance with the OPR. The BOD shall be updated and expanded during design and construction to provide increasing levels of detail as the design evolves to reflect changes to design criteria and systems during the subsequent phase of the project and the reason for those changes as the project evolves. The function of the BOD shall be to define the following:

I. CONSTRUCTION ACTIVITIES

Following is a list of equipment that will be functionally tested and the features that will be tested. The participants who will participate or witness the functional testing includes the Cx Team. The CxA will provide test procedures for the commissioned items to be witnessed. Participation by the Owner is at its discretion. The CxA will coordinate, witness, and document Functional Performance Testing (FPT) for systems commissioned. Functional Testing of the systems will not take place until the final TAB report has been submitted, approved by the A/E Team, accepted by the government and the General Contractor has submitted the Certification of Readiness for each system. Functional testing of the systems to be commissioned will take place within a day period on site in conjunction with the GC's schedule.

(1) System functional testing that will be witnessed by the CxA:

HVAC

1. Air Handling Units
2. Energy Recovery Units
3. Variable Air Volume Terminal Units
4. Slit System Units
5. Hot Water Boilers
6. Air Cooled Chiller
7. Hot Water Unit Heaters
8. Exhaust Fans
9. Pumps

Controls

1. Sequence of Operations
2. Analog I/O
3. Digital I/O
4. Systems Integration
5. Trending
6. Logging
7. Front End Interface

Electrical

1. Lighting and Lighting Controls

Plumbing

1. Domestic Fixtures
2. Gas Water Heater
3. Electric Water Heater
4. Hot Water Storage Tanks

(2) Meetings

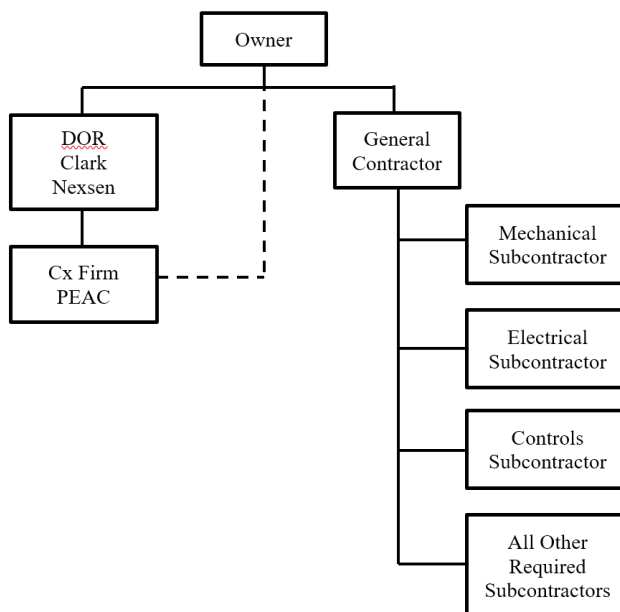
Commissioning meetings are a critical function of the Commissioning process. Periodic Cx progress meetings will be held on site during construction. During Functional Testing and Integrated Systems Testing, the meetings will be held weekly or as deemed appropriate by the CxA. The Commissioning meetings include:

1. Cx Scope Kickoff
2. Controls Integration
3. Site Observations
4. Commissioning Coordination
5. Mechanical PFCs
6. Pre-Mechanical FPTs
7. Electrical PFCs
8. Pre-Electrical FPTs
9. Plumbing PFCs
10. Pre-Plumbing FPTs
11. Systems Manual
12. O&M Training

These meetings will be the primary venue for discussing issues relating to commissioning. It is important that the appropriate individuals attend from the General contractor, subcontractors, design team and Owner.

(3) Communication

Between meetings, it is appropriate to communicate via e-mail, phone, or face-to face. The CxA will direct all communications through the established contract communication protocols set forth by the government.



(4) Submittal Review

The CxA will review all submittals that pertain to the commissioned systems as outlined in Section I of this document. This review will allow the CxA to gather information pertinent to the development of the Pre-functional Checklists, the Functional Performance Test and the Integrated Systems Test procedures. The CxA shall review the construction submittals concurrently with the designers and provide comments to the designer. The designer of record shall consider the CxA's comments and provide direction to the general contractor in accordance with the designer of record's best professional judgment. This review does not supplant or otherwise replace the technical and document compliance review required of the AE.

The CxA shall review the equipment submittals of the equipment listed in Section I subpart (1) of this document.

(5) Site Observations

The routine inspection of the quality of construction and quality control is the responsibility of the General Contractor and not the CxA. The CxA's observations are made to reflect the progress and quality of the work on the date of the observation and are not intended to be exhaustive evaluations of the quality or quantity of the Work. The CxA shall make periodic site observations of the construction. The CxA's site observation visit shall concentrate on the commissioned systems, equipment accessibility and the ability to be functionally tested. The CxA's site observation visit will also review how well the construction lends itself to operation and maintenance by the end user. During the CxA site observation visits, deficiencies observed shall be brought to the attention of the owner's representative, design team, and contractors with an expectation of a collaborative solution. The contractor is responsible for correction of construction contract deficiencies identified during site observations. The design team is responsible for correction of design deficiencies found during site observations. A construction phase Commissioning Issues Log will be generated to identify any non-compliant items for resolution by the respective discipline before the construction phase is completed.

(6) Issues and Resolution Logs

The CxA keeps a log of all commissioning-related issues that require current or future attention and the resolutions provided by the general Contractor and / or AE. At any point during construction, any commissioning team member finding deficiencies may communicate those deficiencies in writing to the government Commissioning Authority for inclusion into the Issues Log. Track construction deficiencies identified in the Issues Log as specified in Specification. At any point during construction, any commissioning team member finding deficiencies must communicate those deficiencies in writing to the CxA within three working days of the discrepancy discovery for inclusion into the Issues Log.

Note: It is not recommended to start Function Testing or performing Integrated Systems Testing until all construction work non-compliance issues and deficiencies documented have been responded to, resolved and verified.

(7) PreFunctional Checklist, Test and Startup

Pre-functional checklists (PFC) are important to ensure that the equipment and systems are installed and operational and that functional performance testing (FPT) may proceed without unnecessary delays. The CxA will assist/develop with commissioning team members detailed pre-functional checklists and start up plans. The General Contractor shall provide completely filled out pre-functional checklists and start up sheets to CxA for review. The general contractor shall fully complete all pre-functional checkout, checklists and manufacturer's required startup for each system and the equipment in those systems. No sampling strategies are permitted. The general contractor

shall checkout 100% of every system and the equipment within that system. The pre-functional checkout for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

Pre-functional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (oil levels, fan belt tension, labels affixed, gages in place, sensor calibration, controls' sequencing and etc.). Some pre-functional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). Pre-functional checklists augment and are combined with the manufacturer's start-up checklist.

Contractors should have already performed all of the pre-functional checklist items before the commissioning authority will recommend performance testing. Few contractors actually document in writing the execution of these checklist items. This project requires the general contractor assure that the procedures are documented in writing by the installing technician. To document the pre-functional testing and startup process, site technicians performing line item tasks must test and verify functionality then initial and date each checklist item. Only individuals having direct knowledge of a line item being completed shall check and initial forms. The CxA may or may not witness all of the pre-functional checks but will perform sampling checks and will witness pre-functional testing of larger or more critical pieces of equipment.

(8) System Start-Up

Each subcontractor of the general contractor is responsible for the start-up of its installed equipment. The contractor should follow the manufacturer recommendations during equipment start-up. As part of the equipment start-up process, the appropriate subcontractor will complete its respective approved start-up checklists and submit to the CxA for distribution and review.

(9) Point-to-Point and Controls Checkout

It is critical that the controls contractor perform point-to-point testing of all control Input / Output (I/O) points at every component terminal prior to functional performance testing. At its option, the point-to-point testing may be witnessed by Owner. Sensor calibration and damper and valve actuation (full open and full closed) will be verified by the CxA.

The controls subcontractor develops and submits a written step-by-step plan to the CxA which describes the process they intend to follow in checking out the control system for proper operation. This Controls Checkout Plan shall include forms for the documentation of individual component verification which is considered the Point-to-Point test. Components that are tested and verified on an individual basis are part of the Pre-functional Checks and are documented in conjunction with these forms.

The GC shall verify that the controls contractor reviews the TAB plan with the TAB contractor prior to starting TAB work in order to determine the control system capabilities to aid in executing TAB work. The controls contractor will provide the TAB with any necessary unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.). The controls contractor shall also provide a technician qualified to operate the controls to assist the TAB contractor in performing TAB and the CxA in performing all functional testing.

(10) Testing, Adjusting and Balancing

The TAB is not included in the commissioning scope of work.

However, the CxA will review the TAB plan and weekly reports of discrepancies without comment. The TAB must be completed before functional performance testing begins. TAB should not begin until the control system has been pre-functionally tested and trended by the general contractor.

(11) Commissioning Prerequisites

The following activities must be completed, approved and accepted before Commissioning can start:

1. Building Envelope Enclosed
2. Electrical Power
3. Piping Pressure Testing
4. Piping Flushing
5. Equipment Startup by Factory
6. Equipment Startup Sheets
7. PreFunctional Checks
8. Controls Point-to-Point Verification
9. Certificates of Readiness
10. Floor Coverings and Ceiling
11. Lighting Burn-In
12. Controls Trending
13. TAB
14. Furniture Installed

(12) Certificate of Readiness

The GC shall issue a Certificate of Readiness certifying that all equipment, systems, and controls are complete and ready for Functional Performance Testing. The Certificate of Readiness shall include all equipment and system start-up reports, Performance Verification Test Reports, Pre-functional Checklists, TAB Report and all other prerequisites for PFC. The GCCS, MC, EC, PC, CC, and TC representatives shall sign and date the Certificate of Readiness. Certificate of Readiness can be broken down by Phases or complete systems.

(13) Certificate of Readiness for Re-Test

The GC shall issue a Certificate of Readiness for Re-Test for all systems and equipment failing the initial FPT. The Certificate of Readiness for Re-Test shall certify that the deficiencies discovered during the initial FPT have been corrected, re-tested and verified by the general contractor that the respective equipment, systems, and controls are now ready for a second FPT. The GCCS, MC, EC, PC, CC, and TC representatives shall sign and date the Certificate of Readiness for Re-Test. Certificate of Readiness for Re-Test can be broken down by Phases or complete systems.

(14) Development of Functional Performance Test and Verification Procedures

Functional Performance Testing (FPT) is the dynamic testing of systems (rather than just components) under fully automatic operation (e.g., the closed circuit cooling pump is tested interactively with the controls to see if the pump ramps up and down to maintain the differential pressure setpoint, etc). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, fire protection, power failure, etc. The systems are run through all of the control system's sequences of operation and components are verified to be responding as the sequences state. The CxA develops the functional performance test procedures in a sequential written format and coordinates, oversees and documents the actual testing, which is performed by the general contractor.

Functional testing and verification shall be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data loggers. A combination of methods may be required to test the complete sequence of operations. The CxA shall determine which method, or combination of methods, is most appropriate for tests that do not have a method specified. The general contractor shall support functional performance testing of commissioned equipment and systems. CxA shall analyze any functional performance trend logs and monitoring data to verify performance, and witness and evaluate manual FPTs performed by the general contractor. The general contractor shall assist the CxA in interpreting the monitoring data, as necessary.

The CxA develops a testing plan overview to provide the Cx Team with a better idea of where functional testing lies in the schedule, what issues prevent the start of testing, which contractors are needed for each test and how much time might be expected from them. This is developed after most equipment has been started up and when functional testing dates are not too far off. The testing plan overview is provided to the contractors to assist in moving more efficiently to functional testing.

(15) Execution of Functional Performance Testing Procedures

Effective FPT cannot begin until the contractors have completed all portions of their work and the systems satisfy design intent and the sequence of operation. This includes the completion of the equipment installation, equipment start-up PFCs, controls' point-to-point and TAB. The actual FPT will be performed in compliance with the OPR by the appropriate GC subcontractor(s) under the coordination of the CxA.

FPT shall be performed after the general contractor completes the PFCs, startup, calibration, control checkout, TAB and the Certificate of Readiness has been submitted for a given system. The CxA schedules functional tests through the Owner and GC. The CxA directs, witnesses, and documents the functional testing of all equipment and systems according to the Specifications and the Cx Plan. The CxA will oversee/witness the functional testing. The Subs execute the tests, unless otherwise specified. The control system shall be successfully tested before it can be used to verify dependent system and/or component performance. Testing proceeds from components to subsystems to systems and finally to interlocks and connections between systems. The CxA documents the results of the test.

FPTs shall be demonstrated to the satisfaction of the CxA. FPTs shall be witnessed and endorsed by the CxA upon satisfactory completion. The CxA recommends acceptance of each test to the Owner. The Owner gives final approval on each test. The actual testing program shall be conducted in accordance with the approved FPT procedures and shall be documented as required. The GC shall notify the CxA and Owner at least 14 calendar days prior to date of each functional performance tests. Following successful completion of FPT for HVAC systems perform an Endurance Test of the HVAC systems in accordance with the contract specification 23 09 00. Use the building control system to trend all points shown as requiring a trend on the project controls points schedules. Perform the test with all equipment and systems in fully automatic mode. Restart the test if the equipment and systems or setpoints are overridden to manual mode at any time during the test. Poll all points shown in the project schedules with an alarm condition at 5 minute intervals. Poll all points shown in the Point Schedule required for trending, overrides, or graphical displays at 15 minute intervals. Provide an Endurance Test Report that includes a graphical representation of all trends with all trend data clearly identified. If insufficient buffer capacity exists to trend the entire endurance test, upload trend logs during the course of the endurance test to ensure that no trend data is lost.

(16) Facility Staff Participation

The Owner's facilities operating staff are encouraged to attend and participate in the testing process. The CxA will notify the Owner, who will then notify the facility staff when the commissioning events will occur.

(17) Sampling

Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. The 01 91 00.00 37 Specifications specify the sampling strategies that are used on this project.

Equipment Identifier	Sample Size (Percent)
DOAS	100
WSHP	At least 20
Equipment Identifier	Sample Size (Percent)
Pumps	100
CCC	100
CRAC	100
Boilers	100
UH	100
Diffusers	At least 20
DWH loop	100
Plumbing Fixtures	At least 20
Lighting Controls	At least 20
Backup Generators	100
UPS	100

(18) Commissioning Reporting and Deficiency Tracking

Throughout the commissioning process, items requiring attention will be reported through site observation reports and tracked in the Cx Issues Logs. Items recorded in the Cx Issues Logs will be handled in the same manner as any other punch-list item. The reports and the issue logs will become part of the Final Cx Report.

Note: It is not recommended to start Function Testing or performing Integrated Systems Testing until all construction work non-compliance issues and deficiencies documented have been responded to, resolved and verified.

(19) Training

The O&M personnel and occupants shall be trained on the systems being commissioned, in accordance with the OPR, to operate and maintain the building systems and assemblies. The training plan is considered an essential

element in designing, preparing, and delivering the training to the participants. As described in the project specifications and OPR, the general contractor is responsible for equipment and system training of the Owner's maintenance personnel. The General Contractor is responsible for coordinating the scheduled training for dates and times convenient for the Owner. The General Contractor shall video record all training and submit the recordings on CD to the CO. The CxA will review the training agenda, the training material and verify that the training is accomplished according to the contract documents.

(20) Systems' Manual Binder

The Systems Manual Binder shall be provided to the owner for use in building operation and the training of personnel. The 3-ring binder shall provide the information needed to understand, operate, and maintain the building's systems and assemblies. As described in the project specifications and OPR, the general contractor is responsible for submitting operation and maintenance information for each piece of equipment and/or system in its respective sections. Unless otherwise stated in the specifications, the Systems' Manual data shall include: mechanical, electrical and plumbing O&M instructions for installation, maintenance, replacement, start-up, special maintenance and replacement sources, parts lists, list of special tools, performance data and warranty information.

Unless otherwise stated in the specifications, the controls data shall include: as-built documentation package that includes a narrative for normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls setup and programming, troubleshooting, alarms, control drawings, and schematics and final sequences of operation, as-built sequences of operation and controls drawings, as-built control setpoints, recommended schedule for sensor and actuator calibration, recommended schedule of maintenance, recommended re-testing schedule with proposed testing forms, and full equipment warranty information. The O&M manuals will be reviewed by the CxA.

The Systems' Manual shall be divided by tabs and include a table of contents. Tabbed sections shall include:

1. OPR
2. BOD
3. As-built Design Drawings
4. Specification Sections for Division 22, 23 and 26
5. Approved Equipment Submittals for Division 22, 23 and 26
6. Controls Data
7. Manufacturers' O&M
8. Warranties
9. Contractor and Supplier Listing and Contact Information
10. Copy of Training Plan, Records and CD video

(21) The Commissioning Final Report

The CxA will produce and distribute the Commissioning Final Report. A Cx Report will be provided to summarize the Cx Process and the building operation for delivery to the owner and end user. The final Cx Report will include the final Cx Plan and the results of the implementation of that plan. The report will include an executive summary describing the Cx Process and identifying the systems and assemblies commissioned. The report will identify the location of the final OPR and BOD documents or contain a copy if these documents are not otherwise available. The location of the project record drawings shall be identified.

J. POSTOCCUPANCY / OPERATIONS ACTIVITIES

Postoccupancy operation commissioning, including deferred and seasonal testing, will be provided prior to the time of warranty completion and will complete at the end of the warranty period.

(1) Seasonal Deferred Testing

The seasonal, delayed, and incomplete testing of facility systems and assemblies shall be completed. The CxA shall determine when the Cx Testing shall be performed based on weather conditions, load conditions, or occupant interactions that are required to complete the activities for all systems and assemblies being commissioned. The general contractor or owner shall coordinate contractor callbacks to resolve issues identified during the Cx Process and provide written documentation to the CxA that the issues have been resolved and/or the owner has accepted the final conditions. Additional training shall be performed during the postoccupancy and operations activities in accordance with the Cx Plans.

During the postoccupancy operations activities, the operation, maintenance, and modification of the facility systems and assemblies, and their associated documentation, shall be evaluated to comply with the updated OPR. By the conclusion of the postoccupancy operation commissioning activities, the systems manual, testing documentation, issue and resolution logs, training report, and a final Cx Report shall be updated and submitted for acceptance.

The GC's Commissioning Superintendent and commissioning team of subcontractors must visit the building site concurrent with the warranty inspection to assist the CxA in the inspection of the building systems' equipment and review building operation with the building operating/maintenance staff. The CxA will identify any deficiency of the building systems to operate in accordance with the contract and accepted design requirements and the general contractor will make the required contract corrections. The GCCS must advise the Contracting Officer's Representative of any identified deficiencies and the proposed corrective action.

(2) Meetings

Postoccupancy Commissioning meetings are a critical function of the Commissioning process.

1. Pre-Seasonal FPT
2. Warranty phase 10th month commissioning

K. GC MASTER SCHEDULE REQUIREMENTS

The GC's master schedule shall include and maintain all Commissioning activities. The CxA will confirm all Commissioning activities required to be included in the GC's master schedule. All Commissioning activities shall share a common identifier, and each shall have a unique identifier for easy filtering and grouping of all Commissioning activities. The Commissioning activities shall be updated weekly as the project progress or slip. Some Commissioning activities are listed below but they are not necessarily listed in logical sequence. Please refer to specification section 01 91 00.00 37 for additional Commissioning activities:

1. Cx Kickoff Meeting
2. Partnering Meeting
3. Controls Integration Meeting
4. Cx Coordination Meetings
5. Site Observations (Actual Schedule only)
6. Submittals Submission
7. Submission of the Design Review Report
8. Installation of permanent utilities (gas, water, electric)
9. Drainage and Vent, Building Sewers, Water Supply Systems and Backflow Prevention Assembly Tests

10. Factory Acceptance Testing for each of the systems to be commissioned as required, and if required, by technical specifications
11. Manufacturer's Equipment Start-Up for each of the systems to be commissioned
12. Potable Water System Flushing
13. Operational Tests of the plumbing system
14. Potable Water System Disinfection
15. Submission and approval of the TAB Schematic Drawings, Report Forms, Design Review Report and Procedures
16. Submission and approval of Duct Air Leakage Test Procedures
17. Duct Air Leakage Test Execution
18. Submission and approval of the Final Duct Air Leakage Test Report
19. Testing, Adjusting, and Balancing (TAB) Field Work
20. Submission and approval of the TAB Report
21. TAB Field Acceptance Testing
22. Submission and approval of Manufacturers' Start-Up Sheets / Testing Report
23. Submission and approval of the PVT Procedures
24. Mechanical PFCs Submittal
25. Electrical PFCs Submittal
26. Plumbing PFCs Submittal
27. Certificate of Readiness for Each Systems
28. Certificates of Readiness for Re-Tests of Required Systems
29. FPT for each system to be commissioned
30. Integrated Systems Tests
31. Post-Test Deficiency Corrections
32. Endurance Tests
33. PVTs
34. PVT Report
35. Training for each O&M System
36. Systems Manual Submittal
37. Deferred Seasonal Testing

L. EXTENDED TRENDING FOR ENDURANCE TEST

Following successful completion of FPT for HVAC systems perform an Endurance Test of the HVAC systems in accordance with the contract specification 23 09 00. Use the building control system to trend all points shown as requiring a trend on the project controls points schedules. Perform the test with all equipment and systems in fully automatic mode. Restart the test if the equipment and systems or setpoints are overridden to manual mode at any time during the test. Poll all points shown in the project schedules with an alarm condition at 5-minute intervals. Poll all points shown in the Point Schedule required for trending, overrides, or graphical displays at 15-minute intervals. Provide an Endurance Test Report that includes a graphical representation of all trends with all trend data clearly identified. If insufficient buffer capacity exists to trend the entire endurance test, upload trend logs during the course of the endurance test to ensure that no trend data is lost.

M. GOVERNMENT ACCEPTANCE OF CRITICAL SYSTEMS

System acceptance is an end-to-end process that begins at receipt of initial design submittals and is completed with final performance testing of the system prior to beneficial occupancy. USACE has identified critical systems and associated sub-systems that have consistently experienced performance issues. The critical systems on this contract include heating, ventilation, & air-conditioning (HVAC) and electrical.

Government in-house technical oversight and the USACE acceptance testing processes are Government quality assurance (QA) functions which are focused to ensure that the General Contractor's construction quality control (CQC) program delivers high quality and properly functioning critical systems.

Critical Systems on this Contract:

1. HVAC Systems
 - a) Ductwork Air Leakage and Tests (DALT) of all air moving systems
 - b) Testing, Adjusting, and Balancing (TAB) of all HVAC systems
 - c) PVT of all energy consuming systems and HVAC control systems
 - d) Interface HVAC control systems with cyber requirements

2. Electrical Systems
 - a) Single operation generator sets
 - b) Automatic transfer switches
 - c) Uninterruptible power supplies
 - d) 400-hertz solid state frequency converters
 - e) Cathodic protection
 - f) Transformers

--- END ---

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DEMOLITION
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PART 1 GENERAL

1.1 REFERENCES

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

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI Guideline K (2009) Guideline for Containers for Recovered Non-Flammable Fluorocarbon Refrigerants

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.6 (2006) Safety & Health Program Requirements for Demolition Operations - American National Standard for Construction and Demolition Operations

CARPET AND RUG INSTITUTE (CRI)

CRI 104 (2015) Carpet Installation Standard for Commercial Carpet

CRI 105 (2015) Carpet Installation Standard for Residential Carpet

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA 4145.25 (Jun 2000; Reaffirmed Oct 2010) Storage and Handling of Liquefied and Gaseous Compressed Gases and Their Full and Empty Cylinders
<http://www.aviation.dla.mil/UserWeb/aviationengineerir>

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 4000.25-1-M (2006) MILSTRIP - Military Standard Requisitioning and Issue Procedures

MIL-STD-129 (2014; Rev R) Military Marking for Shipment and Storage

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

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

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

40 CFR 61 National Emission Standards for Hazardous
Air Pollutants

40 CFR 82 Protection of Stratospheric Ozone

49 CFR 173.301 Shipment of Compressed Gases in Cylinders
and Spherical Pressure Vessels

1.2 PROJECT DESCRIPTION

1.2.1 Definitions

1.2.1.1 Demolition

Demolition is the process of wrecking or taking out any load-supporting structural member of a facility together with any related handling and disposal operations.

1.2.1.2 Demolition Plan

Demolition Plan is the planned steps and processes for managing demolition activities and identifying the required sequencing activities and disposal mechanisms.

1.2.2 Demolition

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 and 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 in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL. Provide procedures for safe conduct of the work in accordance with EM 385-1-1.

1.2.3 General Requirements

Do not begin demolition until authorization is received from the Contracting Officer. The work of this section is to be performed in a manner that maximizes the value derived from the salvage and recycling of materials. 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 agreed to by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 ITEMS TO REMAIN IN PLACE

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract. Do not overload structural elements and pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove snow, dust, dirt, and debris from work areas daily.

1.3.2 Trees

Protect trees within the project site which might be damaged during demolition or deconstruction, and which are indicated to be left in place, by a 6 foot high fence. Erect and secure fence a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Contracting Officer.

1.3.3 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 or deconstructed, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.

1.4 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted. Where burning is permitted, adhere to federal, state, and local regulations.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Demolition Plan; G
Existing Conditions

SD-07 Certificates

Notification; G

SD-11 Closeout Submittals

Receipts

1.6 QUALITY ASSURANCE

Submit timely notification of demolition projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the 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 ASSP A10.6. Comply with the Environmental Protection Agency requirements specified. Use of explosives will not be permitted.

1.6.1 Dust and Debris Control

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Sweep pavements as often as necessary to control the spread of debris and dust.

1.7 PROTECTION

1.7.1 Traffic Control Signs

a. Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor barricades in a manner to prevent displacement by wind, jet or prop blast or vehicle impact. Notify the Contracting Officer prior to beginning such work. Water and sand filled barricade or concrete barrier are acceptable and must comply with MUTCD requirements.

Provide a minimum of 2 FAA type L-810 steady burning red obstruction lights on temporary structures (including cranes) over 100 feet, but less than 200 ft, above ground level. The use of LED based obstruction lights are not permitted. For temporary structures (including cranes) over 200 ft above ground level provide obstruction lighting in accordance with FAA AC 70/7460-1. Light construction and installation shall comply with FAA AC 70/7460-1. Lights shall be operational during periods of reduced visibility, darkness, and as directed by the Contracting Officer. Maintain the temporary services during the period of construction and remove only after permanent services have been installed and tested and are in operation.

1.7.2 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair or replace items to be relocated which are damaged by the Contractor with new undamaged items as approved by the Contracting Officer.

1.9 EXISTING CONDITIONS

Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results.

PART 2 PRODUCTS

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 in accordance with SECTION EARTHWORK 31 00 00, Satisfactory Materials.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures onsite for reuse. Existing construction scheduled to be removed for reuse shall be disassembled. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified. Materials shall be designated for reuse onsite whenever possible.

3.1.1 Structures

- a. Remove existing structures indicated to be removed in their entirety. Remove sidewalks, curbs, gutters and street light bases as indicated.
- b. Demolish structures in a systematic manner from the top of the structure to the ground. Complete demolition work above each tier or floor before the supporting members on the lower level are disturbed. Demolish concrete and masonry walls in small sections. Remove structural framing members and lower to ground by means of derricks, platforms hoists, or other suitable methods as approved by the Contracting Officer.
- c. Locate demolition and deconstruction equipment throughout the structure and remove materials so as to not impose excessive loads to supporting walls, floors, or framing.
- d. Building, or the remaining portions thereof, not exceeding 80 feet in height may be demolished by the mechanical method of demolition.

3.1.2 Utilities and Related Equipment

3.1.2.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.2.2 Disconnecting Existing Utilities

Demolition of utilities shall be coordinated with the private utility provider. Potable Water and Sanitary Sewer disconnections, demolition, and capping shall be coordinated with American States Utility Services (ASUS). Exterior electrical and lighting disconnections and demolition is the responsibility of Sandhills Utility Service (SUS). Natural gas disconnections and demolition is the responsibility of Piedmont Natural Gas. Where permitted, the contractor shall remove existing utilities, as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered but are not indicated on the drawings, notify the Contracting Officer prior to further work in that area. Remove meters and related equipment and deliver to a location on the station in accordance with instructions of the Contracting Officer.

3.1.3 Chain Link Fencing

Remove chain link fencing, gates and other related salvaged items scheduled for removal and transport to designated areas. Remove gates as whole units. Cut chain link fabric to 25 foot lengths and store in rolls off the ground.

3.1.4 Paving and Slabs

Remove sawcut concrete and asphaltic concrete paving and slabs including aggregate base as indicated. Provide neat sawcuts at limits of pavement removal as indicated. Pavement and slabs to be recycled and utilized in this project shall be moved, ground and stored as directed by the Contracting Officer. Pavement and slabs not to be used in this project shall be removed from the Installation at Contractor's expense. The contractor shall recycle as much pavement as practical.

3.1.5 Structural Steel

Dismantle structural steel at field connections and in a manner that will prevent bending or damage. Salvage for recycle structural steel, steel joists, girders, angles, plates, columns and shapes. Flame-cutting torches are permitted when other methods of dismantling are not practical. Transport steel joists and girders as whole units and not dismantled. Transport structural steel shapes to a designated recycling facility, stacked according to size, type of member and length, and stored off the ground, protected from the weather.

3.1.6 Miscellaneous Metal

Salvage shop-fabricated items such as access doors and frames, steel gratings, metal ladders, wire mesh partitions, metal railings, metal windows and similar items as whole units. Salvage light-gage and cold-formed metal framing, such as steel studs, steel trusses, metal gutters, roofing and siding, metal toilet partitions, toilet accessories and similar items. Scrap metal shall become the Contractor's property. Recycle scrap metal as part of demolition and deconstruction operations. Provide separate containers to collect scrap metal and transport to a scrap metal collection or recycling facility, in accordance with the Waste Management Plan.

3.1.7 Carpet

Remove existing carpet for reclamation in accordance with manufacturer recommendations and as follows. Remove used carpet in large pieces, roll tightly, and pack neatly in a container. Remove adhesive according to recommendations of the Carpet and Rug Institute (CRI). Adhesive removal solvents shall comply with CRI 104/CRI 105. Recycle removed carpet cushion.

3.1.8 Acoustic Ceiling Tile

Remove, neatly stack, and recycle acoustic ceiling tiles. Recycling may be available with manufacturer. Otherwise, priority shall be given to a local recycling organization. Recycling is not required if the tiles contain or may have been exposed to asbestos material.

3.1.9 Air Conditioning Equipment

Recover all refrigerants prior to removing air conditioning, refrigeration, and other equipment containing refrigerants and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)." Turn in salvaged Class I ODS refrigerants as specified in paragraph, "Salvaged Materials and Equipment." Coordinate with Fort Bragg DPW for salvaging of select HVAC equipment.

3.1.10 Cylinders and Canisters

Remove all fire suppression system cylinders and canisters and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)."

3.1.11 Locksets on Swinging Doors

Remove all locksets from all swinging doors indicated to be removed and disposed of. Deliver the locksets and related items to a designated location for receipt by the Contracting Officer after removal.

3.1.12 Mechanical Equipment and Fixtures

Disconnect mechanical equipment and fixtures at fittings. Do not offer low-efficiency equipment for reuse; provide to recycling service for disassembly and recycling of parts.

3.1.12.1 Piping

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. Classify piping not designated for salvage, or not reusable, as scrap metal.

3.1.12.2 Ducts

Classify removed duct work as scrap metal.

3.1.12.3 Fixtures, Motors and Machines

Remove fixtures, motors and machines associated with plumbing, heating, air conditioning, refrigeration, and other mechanical system installations. Salvage, box and store auxiliary units and accessories with the main motor and machines. Tag salvaged items for identification, storage, and protection from damage. Classify non-porcelain broken, damaged, or otherwise unserviceable units and not caused to be broken, damaged, or otherwise unserviceable as debris to be disposed of by the Contractor. Salvage and crush porcelain plumbing fixtures unsuitable for reuse.

3.1.13 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.

3.1.13.1 Fixtures

Remove and salvage electrical fixtures. Salvage unprotected glassware from the fixture and salvage separately. Salvage incandescent, mercury-vapor, and fluorescent lamps and fluorescent ballasts manufactured prior to 1978, boxed and tagged for identification, and protected from breakage.

3.1.13.2 Electrical Devices

Remove and salvage switches, switchgear, transformers, conductors including wire and nonmetallic sheathed and flexible armored cable, regulators, meters, instruments, plates, circuit breakers, panelboards, outlet boxes, and similar items. Box and tag these items for identification according to type and size.

3.1.13.3 Wiring Ducts or Troughs

Remove and salvage wiring ducts or troughs. Dismantle plug-in ducts and wiring troughs into unit lengths. Remove plug-in or disconnecting devices from the busway and store separately.

3.1.13.4 Conduit and Miscellaneous Items

Salvage conduit except where embedded in concrete or masonry. Consider corroded, bent, or damaged conduit as scrap metal. Sort straight and undamaged lengths of conduit according to size and type. Classify supports, knobs, tubes, cleats, and straps as debris to be removed and disposed.

3.1.14 Elevators and Hoists

Remove elevators, hoists, and similar conveying equipment and salvage as whole units, to the most practical extent. Remove and prepare items for salvage without damage to any of the various parts. Salvage and store rails for structural steel with the equipment as an integral part of the unit.

3.1.15 Items With Unique/Regulated Disposal Requirements

Remove and dispose of items with unique or regulated disposal requirements in the manner dictated by law or in the most environmentally responsible manner (such as batteries or electrical transformers).

3.2 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition or deconstruction work in areas occupied by structures to be demolished or deconstructed until all demolition and deconstruction in the area has been completed and debris removed. Fill holes, open basements and other hazardous openings.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor

and shall be removed from Government property. Title to materials resulting from demolition and deconstruction, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition, deconstruction, and removal procedures, and authorization by the Contracting Officer to begin demolition and deconstruction. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.3.2 Reuse of Materials and Equipment

Remove and store materials and equipment listed in the Demolition Plan to be reused or relocated to prevent damage, and reinstall as the work progresses. Coordinate the re-use of materials and equipment with the re-use requirements in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL. Capture re-use of materials in the diversion calculations for the project.

3.3.3 Salvaged Materials and Equipment

Remove materials and equipment that are listed in the Demolition Plan and specified to be removed by the Contractor and that are to remain the property of the Government, and deliver to a storage site, as directed within 5 miles of the work site and determined by the Contracting Officer.

- a. Store all materials salvaged for the Contractor as approved by the Contracting Officer and remove from Government property before completion of the contract. Coordinate the salvaged materials with tracking requirements in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL. Capture salvaged materials in the diversion calculations for the project.
- b. Remove salvaged items to remain the property of the Government in a manner to prevent damage, and packed or crated to protect the items from damage while in storage or during shipment. Items damaged during removal or storage must be repaired or replaced to match existing items. Properly identify the contents of containers. Deliver the items reserved as property of the Government to the areas designated.
- c. Remove historical items in a manner to prevent damage. Deliver the following historical items to the Government for disposition: Corner stones, contents of corner stones, and document boxes wherever located on the site.
- d. Remove and capture all Class I ODS refrigerants in accordance with the Clean Air Act Amendment of 1990. Removal and disposal must be coordinated with the Fort Bragg Environmental Division. No materials shall leave the site without prior Government approval.

3.3.4 Disposal of Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in Section, 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting AHRI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. Recovered ODS shall be removed from Government property and disposed of in accordance with 40 CFR 82. Products, equipment and appliances containing ODS in a sealed,

self-contained system (e.g. residential refrigerators and window air conditioners) shall be disposed of in accordance with 40 CFR 82. Submit Receipts or bills of lading, as specified. The contractor shall contact the Defense Depot in Richmond, Virginia to coordinate shipping of ODS. Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped to the Defense Depot, Richmond, Virginia.

3.3.4.1 Special Instructions

No more than one type of ODS is permitted in each container. A warning/hazardous label shall be applied to the containers in accordance with Department of Transportation regulations. All cylinders including but not limited to fire extinguishers, spheres, or canisters containing an ODS shall have a tag with the following information:

- a. Activity name and unit identification code
- b. Activity point of contact and phone number
- c. Type of ODS and pounds of ODS contained
- d. Date of shipment
- e. National stock number (for information, call (804) 279-4525).

3.3.4.2 Fire Suppression Containers

Deactivate fire suppression system cylinders and canisters with electrical charges or initiators prior to shipment. Also, safety caps must be used to cover exposed actuation mechanisms and discharge ports on these special cylinders.

3.3.5 Transportation Guidance

Ship all ODS containers in accordance with MIL-STD-129, DLA 4145.25 (also referenced one of the following: Army Regulation 700-68, Naval Supply Instruction 4440.128C, Marine Corps Order 10330.2C, and Air Force Regulation 67-12), 49 CFR 173.301, and DOD 4000.25-1-M.

3.3.6 Unsalvageable and Non-Recyclable Material

Dispose of unsalvageable and non-recyclable noncombustible material in an approved landfill capable of receiving the specific waste being generated.

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.

3.5.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property.

3.5.3 Removal from Government Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

-- End of Section --

Hazardous Materials Analysis Base Bid Buildings

D-1910, D-1911, D-2111, D-2113, D-2211 & D-2212

Fort Bragg, North Carolina

SOF Human Platform-Force Generation
(FORGE) Facility



Asbestos Survey for Demolition of

Building D-1910 Fort Bragg, North Carolina

Prepared by Bruce Billings Chenega Support Services for the Directorate of Public Works, Fort Bragg, North Carolina



XVIII AIRBORNE CORPS

Asbestos Inspection Report

Introduction

Scope of the Investigation

This report documents the focus asbestos inspection and survey of Building No. D-1910 at Ft. Bragg, North Carolina conducted on March 19th, 2010 by Jeffrey Frank and on December 27th, 2007 by Walter Moses.

An attempt was made by the inspector to reach all areas inside the scope of work for Building No. D-1910, however, if suspect materials are discovered during demolition in concealed spaces, demolition activities should stop and the materials sampled and analyzed. All suspect materials were given appropriate consideration, likewise, materials visibly and completely identifiable as non-asbestos (fiberglass, foam rubber, wood, etc.,) were not sampled.

Conclusions

ASBESTOS-CONTAINING MATERIAL WAS DETECTED.

Photos of Asbestos Containing Materials

The white square duct coating located on the metal ductwork in the mechanical room was found to contain asbestos.



Floor Tile with Mastic, 12" Black was found to contain asbestos



Transite Board/Storage Room Walls was found to contain asbestos



Floor Tile with Mastic, 12" Tan was found to contain asbestos



Asbestos Table Fort Bragg, Building D-1910

MATERIAL		CHARACTERISTICS			ASSESSMENT	
Type	Description/Location	Asbestos Yes/No/Presumed	Quantity/Type (If ACM)	Friable / Non- Friable	Condition	Disturbance Potential
Misc	Floor Tile With Mastic, 12" Black, Room 5	Yes	10% Chrysotile/Approx.120 Sq. Ft	Non- Friable	Damaged	High
Misc	Transite Board/ Room 2 Walls	Yes	30% Chrysotile/approx.100 Sq. Ft	Non- Friable	Damaged	High
Misc	Floor Tile With Mastic, 12" Tan, Room 5	Yes	10% Chrysotile /approx.100 Sq. Ft	Non- Friable	Damaged	High
TSI	White Duct Coating/ Mechanical Room	Yes	65% Chrysotile /approx. 20 Sq. Ft	Friable	Damaged	High

Sq. Ft.-Square Foot, Ln. Ft.-Linear Foot, C. Ft.-cubic Foot
Materials Containing Asbestos are in Bold Print.

Analytical Report



EMSL Analytical, Inc.

706 Gralin Street, Kernersville, NC 27284

Phone: (336) 992-1026 Fax: (336) 992-4176 Email: greensborolab@emsl.com

Attn: **Bruce Billings**
US Army Fort Bragg
DPW Environmental Compliance Branch
Building 3-1137 Reilly Road
Fort Bragg, North Carolina 23810

Customer ID: USAR85
 Customer PO:
 Received: 01/04/08 10:30 AM
 EMSL Order: 020800046

Fax: (910) 396-4188 Phone: (910) 432-3564
 Project: **Bldg D-1910**

EMSL Proj:
 Analysis Date: 1/5/2008
 Report Date: 1/7/2008

Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
D-1910-MISC-2-1-RY 020800046-0001	Transite Board/Storage Rm	Gray/White Fibrous Heterogeneous	1% Cellulose	69% Non-fibrous (other)	30% Chrysotile
D-1910-MISC-2-2-RY 020800046-0002	Transite Board/Storage Rm	Gray/White Fibrous Heterogeneous	1% Cellulose	69% Non-fibrous (other)	30% Chrysotile
D-1910-MISC-2-3-RY 020800046-0003	Transite Board/Storage Rm	Gray/White Fibrous Heterogeneous	1% Cellulose	69% Non-fibrous (other)	30% Chrysotile
D-1910-FT-2-1-AP 020800046-0004	Floor Tile with Mastic, 12" Tan	Mauve Non-Fibrous Heterogeneous Mauve Tile		100% Non-fibrous (other)	None Detected
D-1910-FT-2-1-APA 020800046-0004A	Floor Tile with Mastic, 12" Tan	Yellow/Orange Non-Fibrous Heterogeneous Mastic	<1% Cellulose	100% Non-fibrous (other)	None Detected
D-1910-FT-2-1-APB 020800046-0004B	Floor Tile with Mastic, 12" Tan	Black Fibrous Heterogeneous Black Tile		90% Non-fibrous (other)	10% Chrysotile
D-1910-FT-2-2-AP 020800046-0005	Floor Tile with Mastic, 12" Tan	Mauve Non-Fibrous Heterogeneous Mauve Tile		100% Non-fibrous (other)	None Detected

Analyst(s)

Scott Combs (27)

Stephen Bennett, Laboratory Manager
 or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. The limit of detection, as stated in the method is 1%. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government.

Analysis performed by EMSL Greensboro (NV/LAP lab code #102104-0, Virginia ID# is 3333-030228 West Virginia ID# is LT000297, Texas - Lab ID# 300301)

PLM-1

1



EMSL Analytical, Inc.

706 Gralin Street, Kernersville, NC 27284

Phone: (336) 992-1025 Fax: (336) 992-4175 Email: greensborolab@emsl.com

Attn: **Bruce Billings**
US Army Fort Bragg
DPW Environmental Compliance Branch
Building 3-1137 Reilly Road
Fort Bragg, North Carolina 23810

Customer ID: USAR85
Customer PO:
Received: 01/04/08 10:30 AM
EMSL Order: 020800046

Fax: (910) 396-4188 Phone: (910) 432-3564
Project: **Bldg D-1910**

EMSL Proj:
Analysis Date: 1/5/2008
Report Date: 1/7/2008

Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos % Type
			% Fibrous	% Non-Fibrous	
D-1910-FT-2-2-APA 020800046-00054	Floor Tile with Mastic, 12" Tan	Yellow/Orange Non-Fibrous Heterogeneous	<1% Cellulose	100% Non-fibrous (other)	None Detected
D-1910-FT-2-2-APB 020800046-00058	Floor Tile with Mastic, 12" Tan	Black Fibrous Heterogeneous		90% Non-fibrous (other)	10% Chrysotile
D-1910-FT-2-3-AP 020800046-0005	Floor Tile with Mastic, 12" Tan	Mauve Non-Fibrous Heterogeneous		100% Non-fibrous (other)	None Detected
D-1910-FT-2-3-APA 020800046-00054	Floor Tile with Mastic, 12" Tan	Yellow/Orange Non-Fibrous Heterogeneous	<1% Cellulose	100% Non-fibrous (other)	None Detected
D-1910-FT-2-3-APB 020800046-00058	Floor Tile with Mastic, 12" Tan	Black Fibrous Heterogeneous		90% Non-fibrous (other)	10% Chrysotile
D-1910-FT-5-1-FE 020800046-0007	Floor Tile with Mastic, 12" Black	Black Fibrous Heterogeneous		90% Non-fibrous (other)	10% Chrysotile
D-1910-FT-5-1-FEA 020800046-00074	Floor Tile with Mastic, 12" Black	Black Fibrous Heterogeneous	3% Cellulose	87% Non-fibrous (other)	10% Chrysotile

Analyst(s)

Scott Combs (2)

Stephen Bennett, Laboratory Manager
or other approved signatory

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Analysis performed by EMSL Greensboro (NVLAP lab code #1021040, Virginia ID# is 3333-00229 West Virginia ID# is L7000297, Texas - Lab ID# 300301)



EMSL Analytical, Inc.
706 Gralin Street, Kernersville, NC 27284

Phone: (336) 992-1025 Fax: (336) 992-4175 Email: greensborotab@emsl.com

Attn: **Bruce Billings**
US Army Fort Bragg
DPW Environmental Compliance Branch
Building 3-1137 Reilly Road
Fort Bragg, North Carolina 23810

Fax: (910) 396-4188 Phone: (910) 432-3564
Project: **Bldg D-1910**


Customer ID: USAR85
Customer PO:
Received: 01/04/08 10:30 AM
EMSL Order: 020800046

EMSL Proj:
Analysis Date: 1/5/2008
Report Date: 1/7/2008

Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
D-1910-FT-5-2-FE 020800046-0008	Floor Tile with Mastic, 12" Black	Black Fibrous Heterogeneous		90% Non-fibrous (other)	10% Chrysotile
D-1910-FT-5-2-FEA 020800046-00084	Floor Tile with Mastic, 12" Black	Black Fibrous Heterogeneous	3% Cellulose	87% Non-fibrous (other)	10% Chrysotile
D-1910-FT-5-3-FE 020800046-0009	Floor Tile with Mastic, 12" Black	Black Fibrous Heterogeneous		90% Non-fibrous (other)	10% Chrysotile
D-1910-FT-5-3-FEA 020800046-00094	Floor Tile with Mastic, 12" Black	Black Fibrous Heterogeneous	3% Cellulose	87% Non-fibrous (other)	10% Chrysotile
D-1910-MISC-B-1-FH 020800046-0010	Ceiling Tile, 2x4 White	Gray/White Fibrous Heterogeneous	45% Cellulose 15% Min. Wool	40% Non-fibrous (other)	None Detected
D-1910-MISC-B-2-FH 020800046-0011	Ceiling Tile, 2x4 White	Gray/White Fibrous Heterogeneous	45% Cellulose 15% Min. Wool	40% Non-fibrous (other)	None Detected
D-1910-MISC-B-3-FH 020800046-0012	Ceiling Tile, 2x4 White	Gray/White Fibrous Heterogeneous	45% Cellulose 15% Min. Wool	40% Non-fibrous (other)	None Detected

Analyst(s)
Scott Combs (27)


Stephen Bennett, Laboratory Manager
or other approved signatory

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Analysis performed by EMSL Greensboro (NVLAP lab code #102104-0, Virginia ID# is 3333-000228 West Virginia ID# is L7000297, Texas - Lab ID# 300301)



EMSL Analytical, Inc.
 706 Grain Street, Kernersville, NC 27284
 Phone: (336) 992-1025 Fax: (336) 992-4175 Email: greensborolab@emsl.com

Attn: **Bruce Billings**
US Army Fort Bragg
DPW Environmental Compliance Branch
Building 3-1137 Reilly Road
Fort Bragg, North Carolina 23810

Fax: (910) 396-4188 Phone: (910) 432-3564
 Project: Bldg D-1910

Customer ID: USAR85
 Customer PO:
 Received: 01/04/08 10:30 AM
 EMSL Order: 020800046

EMSL Proj:
 Analysis Date: 1/5/2008
 Report Date: 1/7/2008

Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Location	Appearance	Non-Asbestos			Asbestos
			%	Fibrous	% Non-Fibrous	% Type
D-1910-CPT-H-1-AH 020800046-0013	Carpet with Mastic	Tan/Brown/Black Fibrous Heterogeneous	98%	Synthetic	2% Non-fibrous (other)	None Detected
D-1910-CPT-H-1-AHA 020800046-0013A	Carpet with Mastic	Cream/Yellow Non-Fibrous Heterogeneous	<1% <1%	Cellulose Synthetic	100% Non-fibrous (other)	None Detected
D-1910-CPT-H-2-AH 020800046-0014	Carpet with Mastic	Tan/Brown/Black Fibrous Heterogeneous	98%	Synthetic	2% Non-fibrous (other)	None Detected
D-1910-CPT-H-2-AHA 020800046-0014A	Carpet with Mastic	Cream/Yellow Non-Fibrous Heterogeneous	<1% <1%	Cellulose Synthetic	100% Non-fibrous (other)	None Detected
D-1910-CPT-H-3-AH 020800046-0015	Carpet with Mastic	Tan/Brown/Black Fibrous Heterogeneous	98%	Synthetic	2% Non-fibrous (other)	None Detected
D-1910-CPT-H-3-AHA 020800046-0015A	Carpet with Mastic	Cream/Yellow Non-Fibrous Heterogeneous	<1% <1%	Cellulose Synthetic	100% Non-fibrous (other)	None Detected

Analyst(s)
 Scott Combs (27)

Stephen Bennett, Laboratory Manager
 or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. The limit of detection as stated in the method is 1%. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government.
 Analysis performed by EMSL Greensboro (NVLAP lab code #102104-0, Virginia ID# is 3333-000228 West Virginia ID# is LT000297, Texas - Lab ID# 300301)



EMSL Analytical, Inc.
 706 Gralin Street, Kernersville, NC 27284
 Phone: (336) 992-1025 Fax: (336) 992-4175 Email: greenabotmlab@emsl.com

Attn: Bruce Billings
 US Army Fort Bragg
 DPW Environmental Compliance Branch
 Building 3-1137 Reilly Road
 Fort Bragg, NC 23810

Customer ID: USAR85
 Customer PO:
 Received: 03/22/10 9:45 AM
 EMSL Order: 021001602

Fax: (910) 396-4188 Phone: (910) 432-3564
 Project: D-1910 MD-00040-OP

EMSL Proj:
 Analysis Date: 3/22/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
D-1910-TSI-1-TSID- DUCT 1 021001602-0001	Thermal systems Insulation Duct	Gray/Tan Non-Fibrous Heterogeneous	1% Cellulose	34% Non-fibrous (other)	65% Chrysotile

Analyst(s)

Scott Combs (1)

Stephen Bennett, Laboratory Manager
 or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. The limit of detection as stated in the method is 1%. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government.

Samples analyzed by EMSL Analytical, Inc. 706 Gralin Street, Kernersville NC NVLAP Lab Code 102104-0, CA ELAP 2589, Virginia 3333-000228, West Virginia LT000321

Chain of Custody

Name of Lab: EMSL Analytical, Inc.
Lab Address: 706 Grallin St.,
 Kernersville, NC 27284

CHAIN OF CUSTODY RECORD ASBESTOS ANALYSIS

020800046

Lab Tel: (336) 922-102
Lab Fax: (336) 992-4175

Client: US ARMY FORT BRAGG **Client ID:** _____
Address: DPW ENVIRONMENTAL COMPLIANCE BRANCH
 BLDG 3-1137 REILLY RD, FORT BRAGG, NC 23810
Building Number: D-1910 **Project Number:** _____

Project Manager: Bruce E. Billings
Phone: (910) 432-3564 **Fax:** (910) 396-4188
Email: bruce.billings1@us.army.mil
Turn Around Time: 3 Days

DESCRIPTION	SAMPLE NUMBER	ASBESTOS					
		PLM Bulk	PLM Count	PLM Gravimetric	PCM Air	TEM Bulk	TEM Air
TRANSITE BOARD / STORAGE ROOM	D-1910-MISC-2-1-RY	X					
TRANSITE BOARD / STORAGE ROOM	D-1910-MISC-2-2-RY	X					
TRANSITE BOARD / STORAGE ROOM	D-1910-MISC-2-3-RY	X					
FLOOR TILE WITH MASTIC, 12" TAN WITH ROCK PATTERN / STORAGE ROOM	D-1910-FT-2-1-AP	X					
FLOOR TILE WITH MASTIC, 12" TAN WITH ROCK PATTERN / STORAGE ROOM	D-1910-FT-2-2-AP	X					
FLOOR TILE WITH MASTIC, 12" TAN WITH ROCK PATTERN / STORAGE ROOM	D-1910-FT-2-3-AP	X					
FLOOR TILE WITH MASTIC, 12" BLACK / HALDDEEPSINK	D-1910-FT-5-1-FE	X					
FLOOR TILE WITH MASTIC, 12" BLACK / HALDDEEPSINK	D-1910-FT-5-2-FE	X					
FLOOR TILE WITH MASTIC, 12" BLACK / HALDDEEPSINK	D-1910-FT-5-3-FE	X					
CEILING TILE, 2' X 4' WHITE CELLULOSE / BUILDING	D-1910-MISC-B-1-FH	X					

Samples will be disposed of 30 days after analysis, unless otherwise requested.

REMARKS:

Relinquished By: Walter Moses Date/Time: _____ Received By: *[Signature]* Date/Time: 1/4/08 1030

Relinquished By: _____ Date/Time: _____ Received By: _____ Date/Time: _____

Time of Lab: EMSL Analytical, Inc.
 Lab Address: 706 Gralin St.,
 Kernersville, NC 27284

**CHAIN OF CUSTODY
 RECORD
 ASBESTOS ANALYSIS**

0208000416

Lab Tel: (336) 922-102
 Lab Fax: (336) 992-4175

Client: US ARMY FORT BRAGG Client ID
 Address: DPW ENVIRONMENTAL COMPLIANCE BRANCH
 BLDG 3-1137 REILLY RD, FORT BRAGG, NC 28810
 Building Number: D-1910 Project Number:
 Project Manager: Bruce E. Billings
 Phone: (910) 432-3564 Fax: (910) 396-4188
 Email: bruce.billings1@us.army.mil
 Turn Around Time: 3 Days

DESCRIPTION	SAMPLE NUMBER	ASBESTOS					
		PLM Bulk	PLM Count	PLM Gravimetric	PCM Air	TEM Bulk	TEM Air
CEILING TILE, 2' X 4' WHITE CELLULOSE / BUILDING	D-1910-MISC-B-2-FH	X					
CEILING TILE, 2' X 4' WHITE CELLULOSE / BUILDING	D-1910-MISC-B-3-FH	X					
CARPET WITH MASTIC, TAN COMMERCIAL PATTERN / HALLWAY	D-1910-CPT-H-1-AH	X					
CARPET WITH MASTIC, TAN COMMERCIAL PATTERN / HALLWAY	D-1910-CPT-H-2-AH	X					
CARPET WITH MASTIC, TAN COMMERCIAL PATTERN / HALLWAY	D-1910-CPT-H-3-AH	X					

REMARKS:

Samples will be disposed of 30 days after analysis, unless otherwise requested.

Relinquished By: Walker Moses Date/Time: Received By: Date/Time:
 Relinquished By: Date/Time: Received By: Date/Time:

1602

Name of Lab: EMSL Analytical, Inc.
 Lab Address: 706 Galin St.,
 Kenersville, NC 27284

Lab Tel: (336) 922-102
 Lab Fax: (336) 992-4175

**CHAIN OF CUSTODY
 RECORD
 ASBESTOS ANALYSIS**

Client US Army Fort Bragg **Client ID** _____
Address: DPW Environmental Compliance Branch
 Bldg 3-1137 Reilly RD, Fort Bragg, NC 23810
Building Number: D-1910 **Project Number:** MD-00040-0P

Project Manager: Bruce E. Billings
Phone: (910) 432-3564 **Fax:** (910) 396-4188
Email: bruce.billings1@us.army.mil
Turn Around Time: 24 Hours

DESCRIPTION	SAMPLE NUMBER	ASBESTOS					
		PLM Bulk	PLM Point Count	PLM Gravimetric	PCM Air	TEM Bulk	TEM Air
THERMAL SYSTEMS INSULATION DUCT, DUCT 1 / MECH RM	D-1910-TSI-1-TSID-DUCT 1	X					

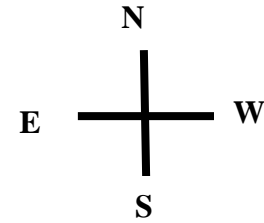
REMARKS:

Relinquished By: Jeffrey Frank Date/Time: 5/19/10 Received By: JPh Date/Time: 5/22/10 9:45
 Relinquished By: _____ Date/Time: _____ Received By: _____ Date/Time: _____

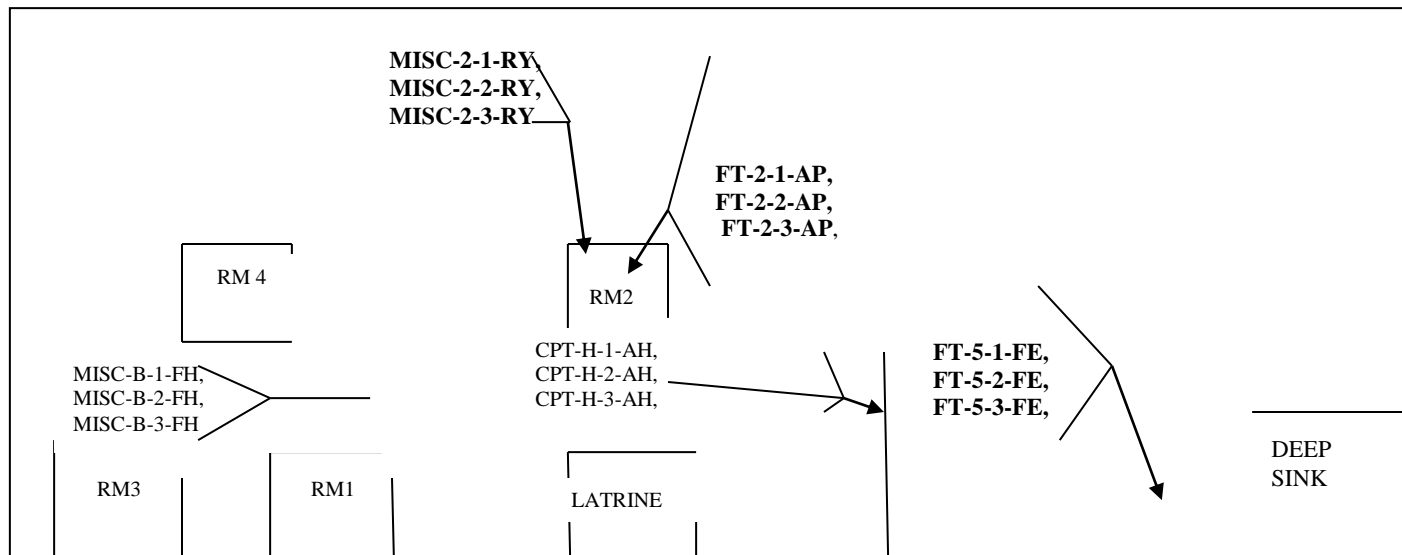
Samples will be disposed of 30 days after analysis, unless otherwise requested.
 Date/Time: 5/22/10 9:45
 Date/Time: _____

Sample Locations

Bldg D-1910
Date: 27 Dec 2007
Inspector: Walter Moses
Inspector Number: 12498
Type of Inspection: Focus Asbestos



ASBESTOS SAMPLE LOCATIONS



NOT TO SCALE

TSI-1-TSID is located in the ceiling area of the mechanical room



Focus Asbestos Survey for Renovation of

Building D-1911 Fort Bragg, North Carolina

Prepared by Jeffrey Frank, Chenega Global Services, LLC
for the Directorate of Public Works,
Ft. Bragg, North Carolina



XVIII AIRBORNE CORPS

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Asbestos Inspection Report

Introduction

Scope of the Investigation

This report documents the focus asbestos inspection and survey of Building D-1911 at Ft. Bragg, North Carolina conducted on October 9th, 2009 and October 25th, 2011 by Jeffrey Frank, inspector certification number: NC 12312.

Background

Building D-1911 is a single story brick structure with a flat roof. The building is currently used as office space. The floor is concrete covered by 12 x 12 inch vinyl tile, carpet, or linoleum. The walls are constructed of painted drywall, painted block, or painted transite. The building was constructed in 1967.

Description of study

Investigation

Building D-1911 was visually inspected for suspected asbestos containing materials (ACM) by a North Carolina accredited inspector. A copy of the inspector's accreditation certificate is included in Appendix A. Bulk samples of all suspect ACM's were collected. This report details ACM as identified at the time of inspection only. A focus inspection was conducted for the presence of asbestos containing building materials (ACBM). **Laboratory results indicated that ASBESTOS WAS DETECTED.**

EMSL located in Morrisville, NC analyzed the bulk samples. The laboratory is accredited by the National Voluntary Laboratory Accredited Program (NVLAP) Accreditation sponsored by the National Institute of Standards and Technology (NIST). A Copy of their accreditation certificate is included in Appendix A. The samples were analyzed by the accepted method of polarized light microscopy (PLM) using EPA's "Method For the Determination of Asbestos In Bulk Building Materials", EPA/600/R-93/116. The laboratory's analytical report is included in Table 2.

In compliance with the AHERA regulations, material is considered an Asbestos Containing Material (ACM) when it contains greater than one percent asbestos. Likewise, in this report, any material containing concentrations greater than one percent asbestos will be considered "positive". Occasionally, materials containing less than one percent asbestos, or not sampled, are assumed to be a "positive" asbestos containing material at the discretion of the inspectors. A narrative discussion of the AHERA ACM types (i.e., thermal systems insulation, miscellaneous and surfacing materials) found in Building No. D-1911 is included in this report where relevant. Bulk sample information appears, estimated quantities of individual asbestos containing materials, material characterization of asbestos containing materials appears on Table 1. The

approximate location where each bulk sample was obtained is shown on the building floor plans, which appear as Figure 1.

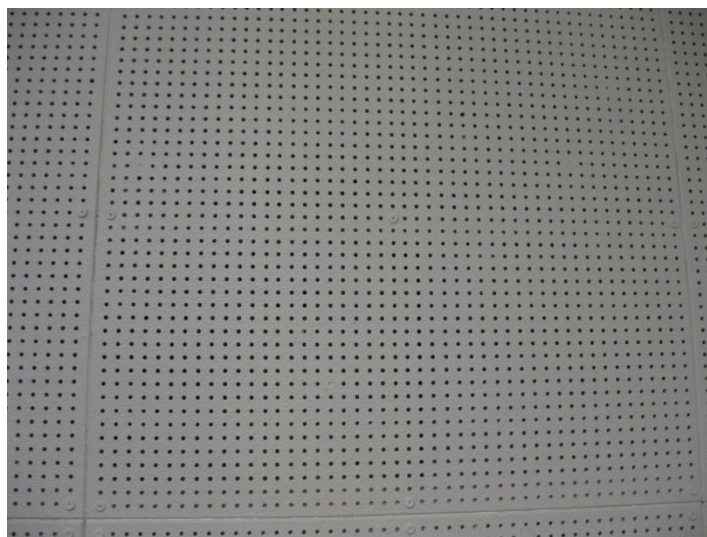
Conclusions

ASBESTOS-CONTAINING MATERIAL WAS DETECTED.

Miscellaneous Materials

Miscellaneous materials include building material on structural components, structural members or fixtures, such as floor and ceiling tiles, and do not include surfacing or TSI. The tile and black mastic located under the carpet in the comptroller's office (may be located throughout) was found to contain asbestos. (No Picture Available)

The pegboard style transite panels found on the walls in the comptroller's office were found to contain asbestos.



**TABLE 1
ASBESTOS TABLE
FORT BRAGG, BUILDING D-1911**

Date of Inspection: October 25th, 2011
 Inspector: Jeffrey Frank
 Inspector Certification Number: NC 12312

MATERIAL		CHARACTERISTICS			ASSESSMENT	
Type	Description/Location/Amount	% Asbestos Yes/No/Presumed	Percentage/Type (If ACM)	Friable / Non- Friable	Condition	Disturbance Potential
Misc	Floor Tile and Black Mastic under Carpet/ Comptroller's office/ 200 Sq. Ft.	ASBESTOS CONTAINING MATERIAL WAS DETECTED	3-5% Chrysotile	Non Friable	Good	Low
Misc	Transite Wall Panels/ Comptroller's office/ 200 Sq. Ft.	ASBESTOS CONTAINING MATERIAL WAS DETECTED	10% Chrysotile	Non Friable	Good	Low

Sq. Ft.-Square Foot, Ln. Ft.-Linear Foot, C. Ft.-cubic Foot
 Amounts are estimated, contractor is responsible for exact measurements.

Table 2

Analytical Report



EMSL Analytical, Inc.

2500 Gateway Centre Blvd., Suite 600, Morrisville, NC 27560

Phone: (919) 465-3300 Fax: (919) 465-3350 Email: ralph@emsl.com

Attn: Bruce Billings
US Army Fort Bragg
Building 3-1137 Reily Road
DPW Environmental Compliance Branch
Fort Bragg, NC 28310

Customer ID: USAR85
Customer PO:
Received: 10/27/11 10:16 AM
EMSL Order: 291108445

Fax: (910) 396-4188 Phone: (910) 432-3564
Project: Bldg D-1911, MD-00008-1P

EMSL Proj:
Analysis Date: 10/27/2011

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Table with 7 columns: Sample, Description, Appearance, % Fibrous, % Non-Fibrous, Asbestos % Type. Contains 4 rows of sample analysis data.

Initial report from 10/27/2011 14:53:29

Analyst(s)
Essie Spencer (4)

Essie Spencer, Laboratory Manager
or other approved signatory

EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-fragile organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Samples received in good condition unless otherwise noted. Estimated accuracy, precision and uncertainty data available upon request.
Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200671-D, VA 3333 000278, WVA LT000296



EMSL Analytical, Inc.
706 Galin Street, Kernersville, NC 27284

Phone: (336) 992-1025 Fax: (336) 992-4175 Email: greensborolab@emsl.com

Attn: **Bruce Billings**
US Army Fort Bragg
DPW Environmental Compliance Branch
Building 3-1137 Reilly Road
Fort Bragg, NC 23810

Customer ID: USAR85
Customer PO:
Received: 10/12/09 10:00 AM
EMSL Order: 020905980

Fax: (910) 396-4188 Phone: (910) 432-3564
Project: Bldg No. D-1911, Project # MD-00008-OP

EMSL Proj:
Analysis Date: 10/13/2009

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
D-1911-SR-2-SR 020905980-0001	Sheetrock	Brown/White Fibrous Heterogeneous	10% Cellulose	90% Non-fibrous (other)	None Detected
D-1911-SR-1-SR- Sheetrock 020905980-0002	Sheetrock	Brown/White Fibrous Heterogeneous	10% Cellulose 6% Glass	84% Non-fibrous (other)	None Detected
D-1911-SR-1-SR- Joint Compound 020905980-0002A	Sheetrock	White Non-Fibrous Heterogeneous	<1% Cellulose	100% Non-fibrous (other)	None Detected
D-1911-M-1-M 020905980-0003	Mastic or Glue	Green Fibrous Heterogeneous	40% Cellulose	60% Non-fibrous (other)	None Detected
D-1911-MISC-1-ES- Cove Base 020905980-0004	Covebase/mastic	Beige Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
D-1911-MISC-1-ES- Mastic 020905980-0004A	Covebase/mastic	White Non-Fibrous Homogeneous	<1% Cellulose	100% Non-fibrous (other)	None Detected

Analyst(s)

Stephen Bennett (10)

Stephen Bennett, Laboratory Manager
or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. The limit of detection as stated in the method is 1%. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government.

Samples analyzed by EMSL Analytical, Inc. Kernersville 706 Galin Street, Kernersville NC NVLAP Lab Code 102104-0, CA ELAP 2689, Virginia 3333-000228, West Virginia LT000321



EMSL Analytical, Inc.
706 Galin Street, Kernersville, NC 27284

Phone: (336) 992-1025 Fax: (336) 992-4175 Email: greensborolab@emsl.com

Attn: **Bruce Billings**
US Army Fort Bragg
DPW Environmental Compliance Branch
Building 3-1137 Reilly Road
Fort Bragg, NC 23810

Customer ID: USAR85
Customer PO:
Received: 10/12/09 10:00 AM
EMSL Order: 020905980

Fax: (910) 396-4188 Phone: (910) 432-3564
Project: Bldg No. D-1911, Project # MD-00008-OP

EMSL Proj:
Analysis Date: 10/13/2009

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
D-1911-MISC-1-T-Cove Base 020905980-0005	Covebase/mastic	Black Non-Fibrous Heterogeneous		100% Non-fibrous (other)	None Detected
D-1911-MISC-1-T-Mastic 020905980-0005A	Covebase/mastic	White Non-Fibrous Homogeneous	<1% Cellulose	100% Non-fibrous (other)	None Detected
D-1911-MISC-1-MN 020905980-0006	Ceiling tile	Gray/White Fibrous Heterogeneous	30% Cellulose 10% Glass	60% Non-fibrous (other)	None Detected
D-1911-MISC-2-MN 020905980-0007	Ceiling tile	Gray/White Fibrous Heterogeneous	30% Cellulose 10% Glass	60% Non-fibrous (other)	None Detected

Analyst(s)

Stephen Bennett (10)

Stephen Bennett, Laboratory Manager
or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. The limit of detection as stated in the method is 1%. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government.

Samples analyzed by EMSL Analytical, Inc. Kernersville 706 Galin Street, Kernersville NC NVLAP Lab Code 102104-0, CA ELAP 2689, Virginia 3333-000228, West Virginia LT000321

Table 3
Chain of Custody

Name of Lab: EMSL Lab

Lab Address: 1101 Aviation Parkway Suite A
Morrisville, NC 27560

**CHAIN OF CUSTODY
RECORD
ASBESTOS ANALYSIS**

Lab Tel: (919) 456-390
Lab Fax: (919) 456-3950

Client US Army Fort Bragg **Client ID**
Address: DPW Environment Compliance Branch
Bldg 3-1137 Reilly RD, Fort Bragg, NC 23810
Building Number: D-1911 **Project Number:** MD-00008-1P
Project Manager: Bruce E. Billings
Phone: (910) 432-3564 **Fax:** (910) 396-4188
Email: bruce.billings1@us.army.mil, jfrankjr@gmail.com
Turn Around Time: 24 Hours

DESCRIPTION	SAMPLE NUMBER	ASBESTOS					
		PLM Bulk	PLM Point Count	PLM Gravimetric	PCM Air	TEM Bulk	TEM Air
TRANSITE BOARD / RM 201 WALL PEGBOARD PANELS	D-1911-MISC-1-RY	X					
MISCELLANEOUS / RM 201 BEHIND PEGBOARD	D-1911-MISC-1-MISC	X					
FLOOR TILE WITH MASTIC, NO SPECIFIED COLOR / RM 201 BOTTOM LAYER FLOORING UNDER CARPET	D-1911-FT-1-TA	X					

US Army Fort Bragg
Bldg D-1911, MD-00008-1P
10/27/2011 10:1 PLM
TAT: 24 Hour Bulk
Order ID: 291106445
No Samples: 3
Due: 10/28 10:16 AM
Fax: 910-396-4188

REMARKS:

Relinquished By: Jeffrey Frank Date/Time: 10/25/11
Relinquished By: _____ Date/Time: _____
Samples will be disposed of 30 days after analysis, unless otherwise requested.

Received By: *ME* Date/Time: 10-27-11 A
Received By: *Ad* Date/Time: 10-27-11 A
REC'D

Name of Lab: EMSL Analytical, Inc.
 Lab Address: 706 Gralin St.,
 Kernersville, NC 27284

**CHAIN OF CUSTODY
 RECORD
 ASBESTOS ANALYSIS**

Lab Tel: (336) 922-102
 Lab Fax: (336) 992-4175

~~5980~~
5980

Client: US Army Fort Bragg **Client ID**
Address: DPW Environmental Compliance Branch
 Bldg 3-1137 Reilly RD, Fort Bragg, NC 23810
Building Number: D-1911 **Project Number:** MD-00008-0P

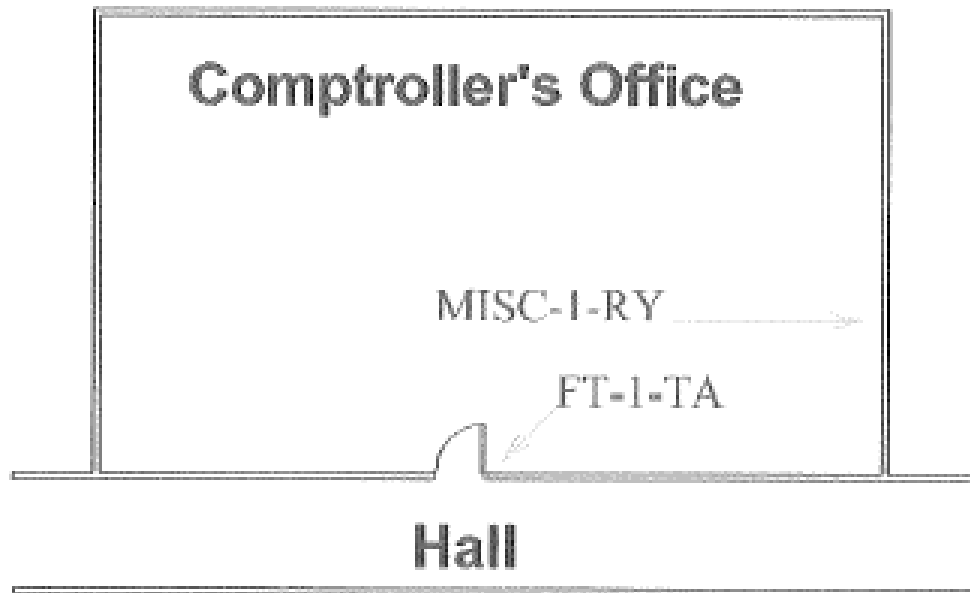
Project Manager: Bruce E. Billings
Phone: (910) 432-3564 **Fax:** (910) 396-4188
Email: bruce.billings1@us.army.mil
Turn Around Time: 24 Hours

DESCRIPTION	SAMPLE NUMBER	ASBESTOS					
		PLM Bulk	PLM Point Count	PLM Gravimetric	PCM Air	TEM Bulk	TEM Air
SHEETROCK (WALL OR CEILING) / WM RM	D-1911-SR-2-SR	X					
SHEETROCK (WALL OR CEILING) / HALL	D-1911-SR-1-SR	X					
MASTIC OR GLUE / MECH RM	D-1911-M-1-M	X					
COVE BASE WITH MASTIC, LIGHT TAN / WM RM	D-1911-MISC-1-ES	X					
COVE BASE WITH MASTIC, BLACK / HALL	D-1911-MISC-1-T	X					
CEILING TILE, 2' X 2' WITH HOLES / HALL	D-1911-MISC-1-MN	X					
CEILING TILE, 2' X 2' WITH HOLES / HALL	D-1911-MISC-2-MN	X					

REMARKS: Samples will be disposed of 30 days after analysis, unless otherwise requested.

Relinquished By: Jeffrey Frank Date/Time: 10/9/09 Received By: **JPL** Date/Time: 10/12 10:00
 Relinquished By: Date/Time: Received By: Date/Time:

Figure 1



**Building D-1911
Asbestos Sample Locations**

Appendix A



North Carolina Department of Health and Human Services
 Division of Public Health - Epidemiology Section
 Occupational and Environmental Epidemiology Branch
 1912 Mail Service Center - Raleigh, North Carolina 27699-1912
 Tel: 919-707-5950 - Fax: 919-870-4808

Beverly Hills Perdue, Governor
 Lamber M. Cantler, Secretary

Jeffrey P. Engle, M.D.
 State Health Director

April 29, 2011

Jeffrey R. Frank
 1104 Linden Ridge Dr
 Holy Springs, NC 27540

Dear Mr. Frank:

Based upon the review of your accreditation application, the Health Hazards Control Unit (HHCU) has determined that you have fulfilled the requirements and are eligible for asbestos accreditation as a(n) INSPECTOR. Your assigned North Carolina accreditation number is 12312, which is reflected on your enclosed North Carolina Accreditation card. Please be sure to take this card with you to any asbestos work site where you are employed. The State requires that all persons conducting asbestos abatement or asbestos management activities be accredited and have their identification card on site.

Your North Carolina Inspector accreditation will expire on MARCH 31, 2012. It is NOT the policy of the HHCU to issue renewal notices. If you wish to continue working as a(n) Inspector after this expiration date, you must successfully complete the required training and submit a completed application to this office prior to March 31, 2012. If you should continue to perform asbestos management activities as a(n) Inspector without a valid North Carolina accreditation, you will be in violation of State regulations and may be cited for noncompliance.

Sincerely,

Marita E. Cheek
 Accreditation/Certification Secretary
 Health Hazards Control Unit



Jeffrey R. Frank
 1104 Linden Ridge Dr
 Holy Springs, NC 27540

92252

North Carolina Asbestos Accreditation				
EXPIRATION				
03-31-2012				
DOB	SEX	HT	WT	
05-08-1976	M	6'0"	180	
CLASS		#	EXP	
INSPECTOR		12312	03-12	



North Carolina Public Health
 Working for a healthier and safer North Carolina
 Everywhere. Everyday. Everybody.



Location: 5101 Six Forks Road, 2nd Floor, Room D-7 - Raleigh, N.C. 27609

United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200671-0

EMSL Analytical, Inc.
Morrisville, NC

is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:

BULK ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2011-04-01 through 2012-03-31

Effective dates



Jolly S. Buses
For the National Institute of Standards and Technology

FACILITIES ENGINEERING WORK REQUEST - XFA, XFB, XFC

For use of this form, see AR 420-17 and DA Pam 420-6; the proponent agency is the Office of the Chief of Engineers.

DOCUMENT NUMBER		BUILDING/FACILITY		DATE		SHORT JOB DESCRIPTION		BUILDING/FACILITY		
TRANS AN GE	REQ SERIAL NUMBER	NUMBER	SUFFIX	YR	MO	DA	OTHER FUND CITATION	NUMBER	SUFFIX	
CODE HC	ID NUMBER	1	2	3	4	5	6	7	8	
		13	14	15	16	17	18	19	20	
		21	22	23	24	25	26	27	28	
		29	30	31	32	33	34	35	36	
		37	38	39	40	41	42	43	44	
		45	46	47	48	49	50	51	52	
		53	54	55	56	57	58	59	60	
		61	62	63	64	65	66	67	68	
		69	70	71	72	73	74	75	76	
		77	78	79	80					
X F A	MD00008-1P	D1911		10	08	30		D1911 repair Comptroller's office		
TRANS AN GE	REQ SERIAL NUMBER	BUILDING/FACILITY	BUILDING/FACILITY	BUILDING/FACILITY	BUILDING/FACILITY	BUILDING/FACILITY	BUILDING/FACILITY	BUILDING/FACILITY	BUILDING/FACILITY	
CODE HC	ID NUMBER	NUMBER	SUFFIX	NUMBER	SUFFIX	NUMBER	SUFFIX	NUMBER	SUFFIX	
		1	2	3	4	5	6	7	8	
		9	10	11	12	13	14	15	16	
		17	18	19	20	21	22	23	24	
		25	26	27	28	29	30	31	32	
		33	34	35	36	37	38	39	40	
		41	42	43	44	45	46	47	48	
		49	50	51	52	53	54	55	56	
		57	58	59	60	61	62	63	64	
		65	66	67	68	69	70	71	72	
		73	74	75	76	77	78	79	80	
X F B C										

DESCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED
HHC 4th POG requests that the comptrollers office will be fired out sheet rocked and painted over the top of the old sound proofing which contains asbestos. We also want the drop ceiling fixed to the new maal as well as the carpet cut so the wall is not on the carpet and base put up. We would like the work accomplished ASAP. Unit will fund this critical project

DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED
We need this work done so no one disturbs the asbestos causing an airborne health issue.

NAME	ORGANIZATION	TELEPHONE NO.	SIGNATURE	NAME	ORGANIZATION	TELEPHONE NO.
John O'Donnell	HHC 4th POG	432-5165	odonnell@soc.mil	MAJ Nichols, Patrice	HHC 4th POG (RMO Comp)	910-432-6494

TO	RECOMMENDED ACTION	ENVIRONMENTAL IMPACT	ESTIMATED COST	WORK TO BE PERFORMED	FROM
	<input checked="" type="checkbox"/> APPROVAL <input type="checkbox"/> DISAPPROVAL	NO <input type="checkbox"/> YES <input type="checkbox"/> ENVIRONMENTAL CONSIDERATIONS	FUNDED \$ _____ WC K \$ _____ WC L \$ _____ WC M \$ _____ WC J \$ _____ UNFUNDING \$ _____ TOTAL \$ _____	<input type="checkbox"/> IN-HOUSE <input type="checkbox"/> SELF-HELP <input type="checkbox"/> CONTRACT <input type="checkbox"/> TROOP	FACILITIES ENGINEER _____ DATE _____
APPROVING AUTHORITY					

APPROVED FOR DESIGN	SOURCE OF FUNDS
_____ SIGNATURE _____ DATE _____	<input type="checkbox"/> DIRECT <input type="checkbox"/> AUTOMATIC REIMB. <input type="checkbox"/> FUNDED REIMB.
REMARKS	

FORWARDED TO	DATE
DESIGN ESTIMATOR	
MO DA MO DA	
19 20 21 22 23 24 25 26	
SIGNATURE OF APPROVAL AUTHORITY	
A - APPROVED D - DISAPPROVED	



Asbestos Survey for Demolition of

Building D-2111 Fort Bragg, North Carolina

Prepared by David L Clark Chenega Support Services for the Directorate of Public Works, Fort Bragg, North Carolina



XVIII AIRBORNE CORPS

Asbestos Inspection Report

Introduction

Scope of the Investigation

This report documents the limited asbestos inspection and survey of Building D-2111 at Ft. Bragg, North Carolina conducted on November 7, 2012 David L Clark, inspector certification number: NC 11788.

Background

Building No. D-2111 is a one story brick structure with a flat roof. The interior walls are constructed of painted sheetrock and cinder block. The interior of the building has gone through renovations in the past. The floor system inside the building proper is concrete. The concrete is covered with 9"x 9", 12"x12" floor tile and carpet. The building's primary use is office space.

Description of study

Investigation

Building D-2111 was visually inspected for suspected asbestos containing materials (ACM) by a North Carolina accredited inspector. A copy of the inspector's accreditation certificate is included. Bulk samples of all suspect ACM's were collected. This report details ACM as identified at the time of inspection only. A focused inspection was conducted for the presence of asbestos containing building materials (ACBM). This is a secure facility and no interior pictures were taken.

Conclusions

ASBESTOS-CONTAINING MATERIAL WAS DETECTED.

The Tan 9"X 9" Floor Tile And Black Mastic Under The Carpet Throughout The Building Was Found To Contain Asbestos.

Asbestos Table Fort Bragg, Building D-2111

Date of Inspection: November 11, 2012

Inspector: David L Clark

Inspector Certification Number: NC 11788

MATERIAL		CHARACTERISTICS			ASSESSMENT	
Type	Description/Location/Amount	Asbestos Yes/No/Presumed	Percentage/Type (If ACM)	Friable / Non- Friable	Condition	Disturbance Potential
Misc	9"x 9" Tan Floor Tile and Mastic Throughout/Quantity Unknown	Yes	5-10% Chrysotile	Non Friable	Damaged	Moderate
Misc	White Transite/Behind Sheetrock Walls In PBO Office Quantity Unknown	Yes	35 % Chrysotile	Non Friable	Good	Low
Misc	Roofing Material	Presumed	Unknown	Non Friable	Damaged	Moderate

Sq. Ft.-Square Foot, LN. Ft.-Linear Foot, C. Ft.-cubic Foot

Amounts are estimated, contractor is responsible for exact measurements.

Analytical Report



EMSL Analytical, Inc.

2500 Gateway Centre Blvd., Suite 600, Morrisville, NC 27560
Phone/Fax: (919) 465-3900 / (919) 465-3950
<http://www.emsl.com> raleighlab@emsl.com

EMSL Order: 291205707
CustomerID: CHEG25
CustomerPO:
ProjectID:

Attn: **Bruce Billings**
Chenega Global
3-1137 Butner Rd
Fort Bragg, NC 28310

Phone: (910) 584-1062
Fax:
Received: 11/08/12 9:30 AM
Analysis Date: 11/8/2012
Collected:

Project: **Bldg D-2111, MD-00051-2P**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 and/or EPA 600/M4-82-020 Method(s) using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
D-2111-MISC-2-GV 291205707-0001	PBO Office - Transite Board	White Fibrous Heterogeneous		70% Non-fibrous (other)	30% Chrysotile
D-2111-MISC-3-GV 291205707-0002	PBO Office - Transite Board	White Fibrous Heterogeneous		70% Non-fibrous (other)	30% Chrysotile
D-2111-MISC-1-GV 291205707-0003	PBO Office - Transite Board	White Fibrous Heterogeneous		65% Non-fibrous (other)	35% Chrysotile
D-2111-SR-2-SR- Sheetrock 291205707-0004	Hallway - Sheetrock, Wall/Ceiling	White Fibrous Heterogeneous	10% Cellulose 5% Glass	85% Non-fibrous (other)	None Detected
D-2111-SR-2-SR- Joint Compound 291205707-0004A	Hallway - Sheetrock, Wall/Ceiling	White Non-Fibrous Heterogeneous		100% Non-fibrous (other)	None Detected
D-2111-SR-1-SR- Sheetrock 291205707-0005	Foyer - Sheetrock, Wall/Ceiling	White Fibrous Heterogeneous	10% Cellulose 5% Glass	85% Non-fibrous (other)	None Detected
D-2111-SR-1-SR- Joint Compound 291205707-0005A	Foyer - Sheetrock, Wall/Ceiling	White Non-Fibrous Heterogeneous		100% Non-fibrous (other)	None Detected

Analyst(s)

Billy Barnes (20)
Essie Spencer (11)

Essie Spencer, Laboratory Manager
or other approved signatory

EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Samples received in good condition unless otherwise noted. Estimated accuracy, precision and uncertainty data available upon request. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Reporting limit is 1%
Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200671-0, VA 3333 000278, WVA LT000296

Initial report from 11/08/2012 12:13:58

Test Report PLM-7.16.0 Printed: 11/8/2012 4:18:12 PM



EMSL Analytical, Inc.
 2500 Gateway Centre Blvd., Suite 600, Morrisville, NC 27560
 Phone/Fax: (919) 465-3900 / (919) 465-3950
<http://www.emsl.com> raleighlab@emsl.com

EMSL Order: 291205707
 CustomerID: CHEG25
 CustomerPO:
 ProjectID:

Attn: **Bruce Billings**
Chenega Global
3-1137 Butner Rd
Fort Bragg, NC 28310


Phone: (910) 584-1062
 Fax:
 Received: 11/08/12 9:30 AM
 Analysis Date: 11/8/2012
 Collected:

Project: Bldg D-2111, MD-00051-2P

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 and/or EPA 600/M4-82-020 Method(s) using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos	
			% Fibrous	% Non-Fibrous	% Type	
D-2111-SR-3-SR-Sheetrock 291205707-0006	Chief's Office - Sheetrock, Wall/Ceiling	White Fibrous Heterogeneous	12% Cellulose 5% Glass	83% Non-fibrous (other)		None Detected
D-2111-SR-3-SR-Joint Compound 291205707-0006A	Chief's Office - Sheetrock, Wall/Ceiling	White Fibrous Heterogeneous	2% Wollastonite	98% Non-fibrous (other)		None Detected
D-2111-I-1-I 291205707-0007	PBO Office - Insulation Building	Yellow Fibrous Heterogeneous	75% Min. Wool	25% Non-fibrous (other)		None Detected
D-2111-I-2-I 291205707-0008	PBO Office - Insulation Building	Yellow Fibrous Heterogeneous	85% Min. Wool	15% Non-fibrous (other)		None Detected
D-2111-I-3-I 291205707-0009	PBO Office - Insulation Building	Yellow Fibrous Heterogeneous	85% Min. Wool	15% Non-fibrous (other)		None Detected
D-2111-FT-3-FTMB-Floor Tile 291205707-0010	Hallway - Floor Tile Mastic, Black	Gray Fibrous Heterogeneous		95% Non-fibrous (other)	5% Chrysotile	
D-2111-FT-3-FTMB-Mastic 291205707-0010A	Hallway - Floor Tile Mastic, Black	Black Fibrous Heterogeneous	3% Cellulose	87% Non-fibrous (other)	10% Chrysotile	

Analyst(s)
 Billy Barnes (20)
 Essie Spencer (11)


 Essie Spencer, Laboratory Manager
 or other approved signatory

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 Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200671-0, VA 3333 000278, WVA LT000296

Initial report from 11/08/2012 12:13:58

**EMSL Analytical, Inc.**

2500 Gateway Centre Blvd., Suite 600, Morrisville, NC 27560
 Phone/Fax: (919) 465-3900 / (919) 465-3950
<http://www.emsl.com> raleighlab@emsl.com

EMSL Order: 291205707
 CustomerID: CHEG25
 CustomerPO:
 ProjectID:

Attn: **Bruce Billings**
Chenega Global
3-1137 Butner Rd
Fort Bragg, NC 28310

Phone: (910) 584-1062
 Fax:
 Received: 11/08/12 9:30 AM
 Analysis Date: 11/8/2012
 Collected:


Project: Bldg D-2111, MD-00051-2P

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 and/or EPA 600/M4-82-020 Method(s) using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
D-2111-FT-2-FTMB- Floor Tile 291205707-0011	Foyer - Floor Tile Mastic, Black	White Non-Fibrous Heterogeneous		100% Non-fibrous (other)	None Detected
D-2111-FT-2-FTMB- Mastic 291205707-0011A	Foyer - Floor Tile Mastic, Black	Tan/Black Fibrous Heterogeneous	3% Cellulose	97% Non-fibrous (other)	<1% Chrysotile
D-2111-FT-1-FTMB- Floor Tile 291205707-0012	Closet - Floor Tile Mastic, Black	Gray Fibrous Heterogeneous		95% Non-fibrous (other)	5% Chrysotile
D-2111-FT-1-FTMB- Mastic 291205707-0012A	Closet - Floor Tile Mastic, Black	Black Fibrous Heterogeneous	3% Cellulose	89% Non-fibrous (other)	8% Chrysotile
D-2111-MISC-2-ES- Cove Base 291205707-0013	Foyer - Cove Base w/ Mastic, Light Tan	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
D-2111-MISC-2-ES- Mastic 291205707-0013A	Foyer - Cove Base w/ Mastic, Light Tan	White/Beige Fibrous Heterogeneous	<1% Cellulose	100% Non-fibrous (other)	None Detected
D-2111-MISC-1-ES- Cove Base 291205707-0014	Closet - Cove Base w/ Mastic, Light Tan	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected

Analyst(s)

Billy Barnes (20)
 Essie Spencer (11)


 Essie Spencer, Laboratory Manager
 or other approved signatory

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 Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200671-0, VA 3333 000278, WVA LT000296

Initial report from 11/08/2012 12:13:58

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<http://www.emsl.com> raleighlab@emsl.com

EMSL Order: 291205707
 CustomerID: CHEG25
 CustomerPO:
 ProjectID:

Attn: **Bruce Billings**
Chenega Global
3-1137 Butner Rd
Fort Bragg, NC 28310

Phone: (910) 584-1062
 Fax:
 Received: 11/08/12 9:30 AM
 Analysis Date: 11/8/2012
 Collected:


Project: Bldg D-2111, MD-00051-2P

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 and/or EPA 600/M4-82-020 Method(s) using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
D-2111-MISC-1-ES-Mastic 291205707-0014A	Closet - Cove Base w/ Mastic, Light Tan	Beige Fibrous Heterogeneous	<1%	Cellulose	100% Non-fibrous (other) None Detected
D-2111-MISC-3-MN 291205707-0015	Room 106 - Ceiling Tile, 2'x2' w/ Holes	White Fibrous Heterogeneous	40% 25%	Cellulose Min. Wool	20% Perlite 15% Non-fibrous (other) None Detected
D-2111-MISC-2-MN 291205707-0016	John's Office - Ceiling Tile, 2'x2' w/ Holes	White Fibrous Heterogeneous	40% 25%	Cellulose Min. Wool	20% Perlite 15% Non-fibrous (other) None Detected
D-2111-MISC-1-MN 291205707-0017	Hallway - Ceiling Tile, 2'x2' w/ Holes	White Fibrous Heterogeneous	45% 20%	Cellulose Min. Wool	15% Perlite 20% Non-fibrous (other) None Detected
D-2111-CPT-3-BG-Carpet 291205707-0018	PBO Office - Carpet w/ Mastic, Blue Commercial	Various Fibrous Heterogeneous	85%	Synthetic	15% Non-fibrous (other) None Detected
D-2111-CPT-3-BG-Mastic 291205707-0018A	PBO Office - Carpet w/ Mastic, Blue Commercial	Yellow Fibrous Heterogeneous	5%	Cellulose	95% Non-fibrous (other) None Detected
D-2111-CPT-2-BG-Carpet 291205707-0019	Foyer - Carpet w/ Mastic, Blue Commercial	Various Fibrous Heterogeneous	85%	Synthetic	15% Non-fibrous (other) None Detected

Analyst(s)

Billy Barnes (20)
 Essie Spencer (11)


 Essie Spencer, Laboratory Manager
 or other approved signatory

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 Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200671-0, VA 3333 000278, WVA LT000296

Initial report from 11/08/2012 12:13:58

**EMSL Analytical, Inc.**

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Fort Bragg, NC 28310


Phone: (910) 584-1062
 Fax:
 Received: 11/08/12 9:30 AM
 Analysis Date: 11/8/2012
 Collected:

Project: Bldg D-2111, MD-00051-2P

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 and/or EPA 600/M4-82-020 Method(s) using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
D-2111-CPT-2-BG-Mastic 291205707-0019A	Foyer - Carpet w/ Mastic, Blue Commerical	Yellow Fibrous Heterogeneous	3%	Cellulose	97% Non-fibrous (other) None Detected
D-2111-CPT-1-BG-Carpet 291205707-0020	Closet - Carpet w/ Mastic, Blue Commerical	Various Fibrous Heterogeneous	90%	Synthetic	10% Non-fibrous (other) None Detected
D-2111-CPT-1-BG-Mastic 291205707-0020A	Closet - Carpet w/ Mastic, Blue Commerical	Yellow Fibrous Heterogeneous	3%	Cellulose	97% Non-fibrous (other) None Detected

Analyst(s)
 Billy Barnes (20)
 Essie Spencer (11)


 Essie Spencer, Laboratory Manager
 or other approved signatory

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 Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200671-0, VA 3333 000278, WVA LT000296

Initial report from 11/08/2012 12:13:58

Name of Lab: EMSL Lab
 Lab Address: 1101 Aviation Parkway Suite A
 Morrisville, NC 27560

**CHAIN OF CUSTODY
 RECORD
 ASBESTOS ANALYSIS**

Lab Tel: (919) 456-3900
 Lab Fax: (919) 456-3950

Client: US Army Fort Bragg Client ID CHEG25 Project Manager: Bruce E. Billings
 Address: DPV/ Environment Compliance Branch Bldg 3-1137 Rellly RD, Fort Bragg, NC 23810 Phone: (910) 432-3564 Fax: (910) 396-4188
 Building Number: D-2111 Project Number: MD-00051-2P Email: bruce.billings1@us.army.mil
 Turn Around Time: 24 Hours

DESCRIPTION	SAMPLE NUMBER	ASBESTOS					
		PLM Bulk	PLM Point Count	PLM Gravimetric	PCM Air	TEM Bulk	TEM Air
TRANSITE BOARD / PBO Office	D-2111-MISC-2-GV	X					
TRANSITE BOARD / PBO Office	D-2111-MISC-3-GV	X					
TRANSITE BOARD / PBO Office	D-2111-MISC-1-GV	X					
SHEETROCK (WALL OR CEILING) / Hallway	D-2111-SR-2-SR	X					
SHEETROCK (WALL OR CEILING) / Foyer	D-2111-SR-1-SR	X					
SHEETROCK (WALL OR CEILING) / Chief's Office	D-2111-SR-3-SR	X					
INSULATION (BUILDING) / PBO Office	D-2111-I-1-I	X					
INSULATION (BUILDING) / PBO Office	D-2111-I-2-I	X					
INSULATION (BUILDING) / PBO Office	D-2111-I-3-I	X					

Chemega Global Order ID: 291205707
 Bldg D-2111, MD-00051-2P No Samples: 20
 11/8/2012 9:30 TAT: 24 Hour Due: 11/09 9:30 AM
 PLM Bulk Bulk Bulk
 Fax:
 Relinquished By: Dave Clark Date/Time: 11/7/12 Received By: [Signature] Date/Time: 11/8/12 9:30
 Relinquished By: Date/Time: Received By: Date/Time:

Sample will be disposed of 30 days after analysis, unless otherwise requested.

Chain of Custody

291205707

Name of Lab: EMSL Lab
 Lab Address: 1101 Aviation Parkway Suite A
 Morrisville, NC 27560

**CHAIN OF CUSTODY
 RECORD
 ASBESTOS ANALYSIS**

Lab Tel: (919) 456-3900
 Lab Fax: (919) 456-3950

Client: US Army Fort Bragg Client ID CHEG25 Project Manager: Bruce E. Billings
 Address: DPW Environment Compliance Branch Bldg 3-1137 Reilly RD, Fort Bragg, NC 23810 Phone: (910) 432-3564 Fax: (910) 396-4188
 Building Number: D-2111 Project Number: MD-00051-2P Email: bruce.billings1@us.army.mil Turn Around Time: 24 Hours

DESCRIPTION	SAMPLE NUMBER	ASBESTOS					
		PLM Bulk	PLM Point Count	PLM Gravimetric	PCM Air	TEM Bulk	TEM Air
FLOOR TILE MASTIC, BLACK/ Hallway	D-2111-FT-3-FTMB	X					
FLOOR TILE MASTIC, BLACK/ Foyer	D-2111-FT-2-FTMB	X					
FLOOR TILE MASTIC, BLACK/ Closet	D-2111-FT-1-FTMB	X					
COVE BASE WITH MASTIC, LIGHT TAN / Foyer	D-2111-MISC-2-ES	X					
COVE BASE WITH MASTIC, LIGHT TAN / Closet	D-2111-MISC-1-ES	X					
CEILING TILE, 2' X 2' WITH HOLES / Room 106	D-2111-MISC-3-MN	X					
CEILING TILE, 2' X 2' WITH HOLES / John's office	D-2111-MISC-2-MN	X					
CEILING TILE, 2' X 2' WITH HOLES / Hallway	D-2111-MISC-1-MN	X					
CARPET WITH MASTIC, BLUE COMMERCIAL / PBO Office	D-2111-CPT-3-BG	X					

Chenega Global
 Bldg D-2111, MD-00051-2P
 11/8/2012 9:30 PLM
 TAT: 24 Hour Bulk

Order ID: 291205707
 No Samples: 20
 Due: 11/09 9:30 AM
 Fax:

Sample will be disposed of 30 days after analysis, unless otherwise requested.

Relinquished By: Dave Clark Date/Time: 4/14 Received By: [Signature] Date/Time: 11/9/12 9:30
 Relinquished By: Date/Time: Received By: Date/Time:

291205707





Drawing

Name of Lab: EMSL Lab

Lab Address: 1101 Aviation Parkway Suite A
Morrisville, NC 27560

**CHAIN OF CUSTODY
RECORD
ASBESTOS ANALYSIS**

Lab Tel: (919) 456-3900
Lab Fax: (919) 456-3950

Client: US Army Fort Bragg

Client ID CHEG25

Project Manager: Bruce E. Billings

Address: DPW/ Environment Compliance Branch
Bldg 3-1137 Reilly RD, Fort Bragg, NC 23810

Phone: (910) 432-3564

Fax: (910) 396-4188

Building Number: D-2111

Project Number: MD-00051-2P

Email: bruce.billings1@us.army.mil

Turn Around Time: 24 Hours

DESCRIPTION	SAMPLE NUMBER	ASBESTOS					
		PLM Bulk	PLM Point Count	PLM Gravimetric	PCM Air	TEM Bulk	TEM Air
CARPET WITH MASTIC, BLUE COMMERCIAL / Foyer	D-2111-CPT-2-BG	X					
CARPET WITH MASTIC, BLUE COMMERCIAL / Closet	D-2111-CPT-1-BG	X					

Chemega Global
Bldg D-2111, MD-00051-2P
11/8/2012 9:30
PLM

TAT: 24 Hour
Bulk

Order ID: 291205707
No Samples: 20
Due: 11/09 9:30 AM
Fax:

REMARKS: Samples will be disposed of 30 days after analysis, unless otherwise requested.

Relinquished By: Dave Clark	Date/Time:	4/11	Received By:	Date/Time:
Relinquished By:	Date/Time:		Received By:	Date/Time:

Inspector Accreditation

North Carolina
Asbestos Accreditation



David L. Clark
1425 Milton St
Spring Lake, NC 28390
94770

EXPIRATION			
DOB	SEX	HT	WT
05-25-1961	M	6'0"	200
CLASS		#	EXP
INSPECTOR	11788	11412	
SUPERVISOR	34129	11412	

The EI Group, Inc.
This certifies that
David Louis Clark

Student Address: 1425 Milton Street, Spring Lake, NC 28390

Has completed the requisite training for asbestos accreditation under TSCA Title II and has met the requirements of and passed the examination of an EPA approved
**Asbestos Inspector Refresher (4-Hour)
Training Course**



7011110051
Certificate Number

5662
Social Security Number

November 16, 2011
Course Dates

November 16, 2011
Exam Date

November 16, 2012
Expiration Date

2101 Gateway Centre
Morrisville, NC 27560
(919) 657-1500

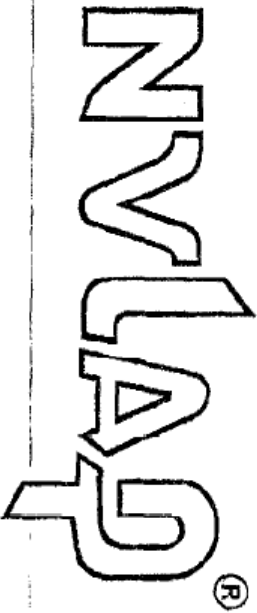
Morrisville, NC
Location


Barry Maxwell, Training Manager


Frank Robinson, Principal Instructor


Frank Robinson, Exam Administrator

United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200671-0

EMSL Analytical, Inc.
Morrisville, NC

is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:

BULK ASBESTOS FIBER ANALYSIS

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-LAC-IAF Communiqué dated January 2009).*

2012-04-01 through 2013-03-31

Effective dates



David E. Alderman
For the National Institute of Standards and Technology



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EMSL Analytical, Inc.
2500 Gateway Centre, Ste. 600
Morrisville, NC 27560
Ms. Essie Spencer
Phone: 919-465-3900 Fax: 919-465-3950
E-Mail: espencer@emsl.com
URL: <http://www.emsl.com>

BULK ASBESTOS FIBER ANALYSIS (PLM)

NVLAP LAB CODE 200671-0

NVLAP Code *Designation / Description*

18/A01 EPA-600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples

2012-04-01 through 2013-03-31

Effective dates

David F. Alderman
For the National Institute of Standards and Technology

FB Form 4283



Asbestos Survey for the Carpeted Area of the Staff Section

Building D-2113 Fort Bragg, North Carolina

Prepared David L Clark Chenega Support Services for the Directorate of Public Works, Fort Bragg, North Carolina



XVIII AIRBORNE CORPS

This asbestos inspection was conducted on July 20, 2017 by David L Clark, inspector certification number: NC 11788, for Project number TA00034-17.

Asbestos Inspection Report

Introduction

Scope of the Investigation

This report documents the asbestos inspection and survey of Building D-2113 at Ft. Bragg, North Carolina conducted on July 20, 2017 by David L Clark, inspector certification number: NC 11788.

Background

Building No. D-2113 is a one story brick structure with a pitched roof. The interior walls are constructed of cinder block and painted sheetrock. The interior of the building has gone through renovations in the past. The floor system inside the building is concrete and covered with 12 x 12 inch floor tile, 9 x 9 inch floor tile, carpet and vinyl flooring. The building's primary use is office space.

Description of study

The staff section of D-2113 was visually inspected for suspected asbestos containing materias (ACM) by a North Carolina accredited inspector. Bulk samples of all suspect ACM's were collected. This report details ACM as identified at the time of inspection only.

Conclusions

Upon visual inspection, replacing the carpet in the Staff Section only of Building D-2113 would not impact any suspect asbestos containing material. Samples collected indicate Tan 9 x 9 asbestos containing floor tile is present under the carpet in areas of the building. A copy of the Asbestos Report must be provided to the Contractor performing this work. If suspect materials are discovered during demolition in concealed spaces, demolition and renovation activities work should stop. A North Carolina accredited asbestos inspector shall sampled the suspect material. The project manager will provide a copy of the asbestos removal applications, permits, any revisions and receipt of disposal documents to the Fort Bragg ECB Asbestos Program Manager.



**9 x 9 Floor Tile/Black Mastic under Carpet
in Rooms 3, 4, 5, 6, 8, 9/Unknown Quantity**

Asbestos Table Fort Bragg, Building D-2113

MATERIAL		CHARACTERISTICS			ASSESSMENT	
Type	Description/Location/Amount	Asbestos Yes/No/Presumed	Percentage/Type (If ACM)	Friable / Non- Friable	Condition	Disturbance Potential
Misc	Vinyl Flooring Staff Duty & Staff Section Office Under Carpet Unknown Quantity	No	NA	Non Friable	Damaged	Moderate
Misc	Black 9 x 9 Floor Tile Staff Duty Office Under Carpet Approx. 115 Sq. Ft.	No	NA	Non Friable	Damaged	Moderate
Misc	Vinyl Flooring Staff Duty & Staff Section Office Under Carpet Unknown Quantity	No	NA	Non Friable	Damaged	Moderate
Misc	Sheetrock Throughout Unknown	No	NA	Non Friable	Damaged	Moderate
Misc	Tan 9 x 9 Tan Floor Tile & Black Mastic Rooms 3, 4, 5, 6, 8, 9 Under Carpet Unknown Quantity	Yes	12% Chrysotile/5% Chrysotile	Non Friable	Damaged	Moderate

Sq. Ft.-Square Foot, LN. Ft.-Linear Foot, C. Ft.-cubic Foot

Amounts are estimated, contractor is responsible for exact measurements.

Analytical Report



EMSL Analytical, Inc.

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<http://www.EMSL.com> / raleighlab@emsl.com

EMSL Order: 291706004
 Customer ID: CHEG25
 Customer PO:
 Project ID:

Attention: Bruce Billings
 Chenega Support Services, LLC
 IMBG-PWE-C/Bruce Billings
 2175 Reilly Road, Stop A
 Fort Bragg, NC 28310-5000
 Project: Bldg D-2113, TA00034-17

Phone: (910) 584-1062
 Fax:
 Received Date: 07/21/2017 10:00 AM
 Analysis Date: 07/21/2017
 Collected Date:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos % Type
			% Fibrous	% Non-Fibrous	
D-2113-MISC-1-NP-Flooring <small>291708004-0001</small>	Staff Duty Office Under Carpet - Vinyl w/ Mastic, Gray	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2113-MISC-1-NP-Mastic <small>291708004-0001A</small>	Staff Duty Office Under Carpet - Vinyl w/ Mastic, Gray	Tan Fibrous Homogeneous	2% Cellulose 5% Synthetic	93% Non-fibrous (Other)	None Detected
D-2113-MISC-2-NP-Flooring <small>291708004-0002</small>	Staff Duty Office Under Carpet - Vinyl w/ Mastic, Gray	White Non-Fibrous Homogeneous	<1% Cellulose	100% Non-fibrous (Other)	None Detected
D-2113-MISC-2-NP-Mastic <small>291708004-0002A</small>	Staff Duty Office Under Carpet - Vinyl w/ Mastic, Gray	Brown/Tan Fibrous Homogeneous	2% Cellulose 5% Synthetic	93% Non-fibrous (Other)	None Detected
D-2113-MISC-3-NP-Flooring <small>291708004-0003 7</small>	Staff Duty Office Under Carpet - Vinyl w/ Mastic, Gray	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2113-MISC-3-NP-Mastic <small>291708004-0003A 7</small>	Staff Duty Office Under Carpet - Vinyl w/ Mastic, Gray	Tan Fibrous Homogeneous	2% Cellulose 5% Synthetic	93% Non-fibrous (Other)	None Detected
D-2113-SR-1-SR-Sheetrock <small>291708004-0004</small>	Hallway - Sheetrock (Wall/Ceiling)	White Fibrous Homogeneous	15% Cellulose	85% Non-fibrous (Other)	None Detected
D-2113-SR-1-SR-Joint Compound <small>291708004-0004A</small>	Hallway - Sheetrock (Wall/Ceiling)	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2113-SR-2-SR-Sheetrock <small>291708004-0005</small>	Cipr Room - Sheetrock (Wall/Ceiling)	Gray Fibrous Homogeneous	12% Cellulose	88% Non-fibrous (Other)	None Detected
D-2113-SR-2-SR-Joint Compound <small>291708004-0005A</small>	Cipr Room - Sheetrock (Wall/Ceiling)	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2113-FT-1-WH <small>291708004-0006</small>	Staff Duty Office Under Carpet - FT/M, 9" White w/ Black Specks	Brown Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2113-FT-2-WH <small>291708004-0007</small>	Staff Duty Office Under Carpet - FT/M, 9" White w/ Black Specks	Brown Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Initial report from: 07/21/2017 17:32:14



EMSL Analytical, Inc.

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Tel/Fax: (919) 465-3900 / (919) 465-3950
<http://www.EMSL.com> / raleighlab@emsl.com

EMSL Order: 291706004
Customer ID: CHEG25
Customer PO:
Project ID:

Analyst(s)

Billy Barnes (7)
Joshua Moorman (5)

Billy Barnes, Asbestos Lab Manager
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Samples received in good condition unless otherwise noted. Estimated accuracy, precision and uncertainty data available upon request. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Reporting limit is 1%
Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200871-0, VA 3333 000278, WVA LT000296

Initial report from: 07/21/2017 17:32:14

CAROLINA ENVIRONMENTAL, INC.
 107 New Edition Court, Cary, NC 27511
 Phone: (919) 481-1413 Fax: (919) 481-1442

LABORATORY REPORT ASBESTOS BULK ANALYSIS

Client: **Department of the Army**

 Public Works Business Center
 Fort Bragg, NC 28310

CEI Lab Code: A06-4899
 Received: 07-12-06
 Analyzed: 07-13-06
 Reported: 07-13-06
 Analyst: Virginia Wilson

Project: D2113

CLIENT ID	CEI LAB ID	HOMOGENEITY DESCRIPTION	% ASBESTOS			
D2113-S-2-1-WI	A494397	<u>SEALANT</u> Homogeneous, White, Non-fibrous, Bound	ND			
		BIND 98 %				
		PAINT 2 %				
D2113-S-2-2-WI	A494398	<u>SEALANT</u> Homogeneous, White, Non-fibrous, Bound	ND			
		BIND 98 %				
		PAINT 2 %				
D2113-S-2-3-WI	A494399	<u>SEALANT</u> Homogeneous, White, Non-fibrous, Bound	ND			
		BIND 98 %				
		PAINT 2 %				
D2113-SR-2-1-PL	A494400	<u>SHEETROCK</u> Homogeneous, Pink, Fibrous, Bound	ND			
		GYPSUM 90 %	FBGL	10 %		
D2113-SR-2-2-PL	A494401	<u>SHEETROCK</u> Homogeneous, Pink, Brown, Fibrous, Bound	ND			
		GYPSUM 75 %	CELL	15 %		
			FBGL	10 %		
D2113-SR-2-3-PL	A494402	<u>SHEETROCK</u> Homogeneous, Pink, Brown, Fibrous, Bound	ND			
		GYPSUM 75 %	CELL	15 %		
			FBGL	10 %		

CAROLINA ENVIRONMENTAL, INC.
 107 New Edition Court, Cary, NC 27511
 Phone: 919-481-1413 Fax: 919-481-1442

Project: D2113

Lab Code: A06-4899

CLIENT ID	CEI LAB ID	HOMOGENEITY DESCRIPTION	% ASBESTOS
D2113-MISC- 1-1-BC	A494403A Homogeneous,	<u>COVEBASE</u> Black, Non-fibrous, Bound RUBR 100 %	ND
	A494403B Homogeneous,	<u>MASTIC ONLY</u> Off-white, Non-fibrous, Bound MAST 100 %	ND
D2113-MISC- 2-2-BC	A494404A Homogeneous,	<u>COVEBASE</u> Black, Non-fibrous, Bound RUBR 100 %	ND
	A494404B Homogeneous,	<u>MASTIC ONLY</u> Off-white, Non-fibrous, Bound MAST 100 %	ND
D2113-MISC- 2-3-BC	A494405 Homogeneous,	<u>COVEBASE</u> Black, Non-fibrous, Bound RUBR 100 %	ND
D2113-MISC- 5-1-CB	A494406 Heterogeneous,	<u>CINDERBLOCK/MORTAR</u> Grey, Non-fibrous, Tightly Bound BIND 95 % PAINT 5 %	ND
D2113-MISC- 5-2-CB	A494407 Heterogeneous,	<u>CINDERBLOCK/MORTAR</u> Grey, Non-fibrous, Tightly Bound BIND 95 % PAINT 5 %	ND

CAROLINA ENVIRONMENTAL, INC.
 107 New Edition Court, Cary, NC 27511
 Phone: 919-481-1413 Fax: 919-481-1442

Project: D2113

Lab Code: A06-4899

CLIENT ID	CEI LAB ID	HOMOGENEITY DESCRIPTION	% ASBESTOS
D2113-MISC- 5-3-CB	A494408 Heterogeneous,	<u>CINDERBLOCK/MORTAR</u> Grey, Non-fibrous, Tightly Bound BIND 95 % PAINT 5 %	ND
D2113-MISC- 1-1-SK	A494409 Homogeneous,	<u>CONCRETE</u> Grey, Non-fibrous, Tightly Bound BIND 85 % SILI 10 % PAINT 5 %	ND
D2113-MISC- 1-2-SK	A494410 Homogeneous,	<u>CONCRETE</u> Grey, Non-fibrous, Tightly Bound BIND 85 % SILI 10 % PAINT 5 %	ND
D2113-MISC- 1-3-SK	A494411 Homogeneous,	<u>CONCRETE</u> Grey, Non-fibrous, Tightly Bound BIND 85 % SILI 10 % PAINT 5 %	ND
D2113-FT- 4-1-TA	A494412A Homogeneous,	<u>MASTIC (SURFACE)</u> Yellow, Non-fibrous, Bound MAST 100 %	ND
	A494412B Homogeneous,	<u>FLOOR TILE</u> Tan, Fibrous, Tightly Bound CHRY 12% VINYL 88 %	CHRY 12%
	A494412C Homogeneous,	<u>MASTIC</u> Black, Fibrous, Bound CHRY 5% MAST 95 %	CHRY 5%

CAROLINA ENVIRONMENTAL, INC.
 107 New Edition Court, Cary, NC 27511
 Phone: 919-481-1413 Fax: 919-481-1442

Project: D2113

Lab Code: A06-4899

CLIENT ID	CEI LAB ID	HOMOGENEITY DESCRIPTION	% ASBESTOS
D2113-FT- 4-2-TA	A494413A Homogeneous,	<u>MASTIC (SURFACE)</u> Yellow, Non-fibrous, Bound MAST 100 %	ND
	A494413B Homogeneous,	<u>FLOOR TILE</u> Tan, Fibrous, Tightly Bound CHRY 12% VINYL 88 %	CHRY 12%
	A494413C Homogeneous,	<u>MASTIC</u> Black, Fibrous, Bound CHRY 8% MAST 92 %	CHRY 8%
D2113-FT- 5-3-TA	A494414A Homogeneous,	<u>MASTIC (SURFACE)</u> Yellow, Non-fibrous, Bound MAST 100 %	ND
	A494414B Homogeneous,	<u>FLOOR TILE</u> Tan, Fibrous, Tightly Bound CHRY 12% VINYL 88 %	CHRY 12%
	A494414C Homogeneous,	<u>MASTIC</u> Black, Fibrous, Bound CHRY 8% MAST 92 %	CHRY 8%
D2113-CPT- 4-1-TB	A494415 Heterogeneous,	<u>CARPET & MASTIC</u> Tan/Blk Streak Fibrous, Bound BIND 5% SYNT 85 % MAST 10 %	ND

CAROLINA ENVIRONMENTAL, INC.
107 New Edition Court, Cary, NC 27511
Phone: 919-481-1413 Fax: 919-481-1442

Project: D2113

Lab Code: A06-4899

CLIENT ID	CEI LAB ID	HOMOGENEITY DESCRIPTION	% ASBESTOS
D2113-CPT- 4-2-TB	A494416 Heterogeneous,	<u>CARPET & MASTIC</u> Tan/Blk Streak Fibrous, Bound BIND 5 % SYNT 85 % MAST 10 %	ND
D2113-CPT- 5-3-TB	A494417 Heterogeneous,	<u>CARPET & MASTIC</u> Tan/Blk Streak Fibrous, Bound BIND 5 % SYNT 85 % MAST 10 %	ND

The following definitions apply to the abbreviations used in the ASBESTOS BULK ANALYSIS REPORT:

CHRY = Chrysotile	CELL = Cellulose	DEBR = Debris
AMOS = Amosite	FBGL = Fibrous Glass	BIND = Binder
CROC = Crocidolite	ORGN = Organics	SILI = Silicates
TREM = Tremolite	SYNT = Synthetics	GRAV = Gravel
ANTH = Anthophyllite	WOLL = Wollastonite	MAST = Mastic
ACTN = Actinolite	CERWL = Ceramic Wool	PLAS = Plaster
ND = None Detected	NTREM = Non-Asbestiform Tremolite	PERL = Perlite
NANTH = Non-Asbestiform Anthophyllite	FBGY = Fibrous Gypsum	RUBR = Rubber

CLIENT: Department of the Army

PROJECT: D2113
CEI LAB CODE: A06-4899

Stereoscopic microscopy and polarized light microscopy coupled with dispersion staining is the analytical technique used for sample identification. The percentage of each component is visually estimated by volume. These results pertain only to the samples analyzed. The samples were analyzed as submitted by the client and may not be representative of the larger material in question. Unless notified in writing to return samples, Carolina Environmental, Inc. will discard all bulk samples after 30 days.

Many vinyl floor tiles have been manufactured using greater than 1% asbestos. Often the asbestos was milled to a fiber size below the detection limit of polarized light microscopy. Therefore, a "None Detected" (ND) reading on vinyl floor tile does not necessarily exclude the presence of asbestos. Transmission electron microscopy provides a more conclusive form of analysis for vinyl floor tiles.

It is certified by the signature below that Carolina Environmental, Inc. is accredited by the National Voluntary Accreditation Program (NVLAP) for the analysis of asbestos in bulk materials. The accredited test method is EPA / 600 / M4-82 / 020 for the analysis of asbestos in building materials. Procedures described in EPA / 600 / R-93 / 116 have been incorporated where applicable. The detection limit for the method is 0.1% (trace amount). Carolina Environmental, Inc.'s NVLAP accreditation number is #101768-0. This report is not to be used to claim product endorsement by NVLAP or any agency of the U. S. Government. This report and its contents are only valid when reproduced in full. Dust and soil analyses for asbestos using PLM are not covered under NVLAP accreditation.

ANALYST



REVIEWED BY



Tianbao Bai, Ph.D.
Laboratory Director

End of Report

Chain of Custody

Name of Lab: **EMSL Analytical, Inc**
 Lab Address: 706 Grafin Street
 Kernersville, NC 27284

CHAIN OF CUSTODY RECORD ASBESTOS ANALYSIS

Lab Tel: (336) 992-1020
 Lab Fax: (336) 992-4175

Client: Chenega Support Services	Client ID CHEG25
Project Manager: Bruce E. Billings	
Address: Directorate of Public Works (IMBG-PWE) 2175 Reilly Rd Stop A, Fort Bragg, NC 23810-5000	Phone: (910) 432-3564
	Fax: (910) 396-4188
Building Number: D-2113	Project Number: TA00034-17
	Email: bruce.e.billings.ctr@mail.mil
	Turn Around Time: 24 Hours

DESCRIPTION	SAMPLE NUMBER	ASBESTOS					
		PLM Bulk	PLM Point Count	PLM Gravimetric	PCM Air	TEM Bulk	TEM Air
VINYL WITH MASTIC, GRAY / Staff duty Office Under Carpet	D-2113-MISC-1-NP	X					
VINYL WITH MASTIC, GRAY / Office Area Under Carpet	D-2113-MISC-2-NP	X					
VINYL WITH MASTIC, GRAY / Office Area Under Carpet	D-2113-MISC-3-NP	X					
SHEETROCK (WALL OR CEILING) / Hallway	D-2113-SR-1-SR	X					
SHEETROCK (WALL OR CEILING) / Cjpr Room	D-2113-SR-2-SR	X					
FLOOR TILE WITH MASTIC, 9" WHITE W/ BLACK SPECKS / Staff Duty Office Under Carpet	D-2113-FT-1-WH	X					
FLOOR TILE WITH MASTIC, 9" WHITE W/ BLACK SPECKS / Staff Duty Office Under Carpet	D-2113-FT-2-WH	X					

Chenega Support Services, LLC
 Bldg D-2113, TA00034-17
 7/21/2017 10:00
 PLM Bulk
 Order ID: 291706004
 No Samples: 7
 Due: 07/24 10:00 AM
 Fax:

REMARKS: Samples will be disposed of 30 days after analysis, unless otherwise requested.

Relinquished By: David Clark	Date/Time: 7/20/17	Received By: [Signature]	Date/Time: 7/24/17
	Date/Time:	Received By:	Date/Time:

74522423 8780

AD6-4699 (ED)
 A494397, A494417
 CHAIN OF CUSTODY RECORD
 ASBESTOS/LEAD ANALYSIS

Name of Lab: CAROLINA ENVIRONMENTAL, INC.
 Lab Address: 107 New Edition Court, Cary, NC 27511
 Tel: 866-481-1412 Fax: 919-481-1442

Client: US ARMY FORT BRAGG
 Address: DPW ENVIRONMENTAL COMPLIANCE BRANCH
 BLDG 3-1137 REILLY RD FORT BRAGG NC 23810
 Email: bruce.billings1@us.army.mil
 Project Manager: Bruce E. Billings
 Phone: (910) 432-8467
 Fax: (910) 396-4188

PO#:	DESCRIPTION	SAMPLE NUMBER	ASBESTOS					LEAD PAINT				TURN - AROUND TIME	
			PLM Bulk	PLM Point Count	PLM Gravimetric	PCM Air	TEM Bulk	TEM Air	Lead Paint	Lead Wipe	Lead Soil		Lead Air
A494397	WHITE SEALANT	D2113-S-2-1-WI	X										5 DAYS
98	WHITE SEALANT	D2113-S-2-2-WI	X										3 DAYS
99	WHITE SEALANT	D2113-S-2-3-WI	X										48 HOURS
400	PAINTED SHEETROCK	D2113-SR-2-1-PL	X										X 24 HOURS
01	PAINTED SHEETROCK	D2113-SR-2-2-PL	X										4 HOURS
02	PAINTED SHEETROCK	D2113-SR-2-3-PL	X										
03	BLACK COVE BASE/MASTIC	D2113-MISC-1-1-BC	X										
04	BLACK COVE BASE/MASTIC	D2113-MISC-2-2-BC	X										
05	BLACK COVE BASE/MASTIC	D2113-MISC-2-3-BC	X										
06	CINDER BLOCK/MORTAR	D2113-MISC-5-1-CB	X										
REMARKS: Relinquished By: Bruce Billings Date / Time: 30 JUNE 2006 12:00PM Received By: <i>Vicky Ruedel</i> Relinquished By: Date / Time: Received By: Date / Time: 7/12/06 9:05am													

Samples will be disposed of 30 days after analysis, unless otherwise requested.

Ad. 4899

CHAIN OF CUSTODY RECORD
ASBESTOS/LEAD ANALYSIS

Name of Lab: CAROLINA ENVIRONMENTAL, INC.
Lab Address: 107 New Edition Court, Cary, NC 27511
Tel: 866-481-1412 Fax: 919-481-1442

Client: US ARMY FORT BRAGG
Address: DPW ENVIRONMENTAL COMPLIANCE BRANCH
BLDG 3-1137 REILLY RD FORT BRAGG NC 23810
Project Manager: Bruce E. Billings
Phone: (910) 432-8467
Fax: (910) 396-4188

Email: bruce.billings1@us.army.mil

PO#:	DESCRIPTION	SAMPLE NUMBER	ASBESTOS						LEAD PAINT				TURN . AROUND TIME	
			PLM Bulk	PLM Point Count	PLM Gravimetric	PCM Air	TEM Bulk	TEM Air	Lead Paint	Lead Wipe	Lead Soil	Lead Air		Other Analysis
07	CINDER BLOCK/MORTAR	D2113-MISC-5-2-CB	X											5 DAYS
08	CINDER BLOCK/MORTAR	D2113-MISC-5-3-CB	X											3 DAYS
09	CONCRETE	D2113-MISC-1-1-SK	X											X 24 HOURS
10	CONCRETE	D2113-MISC-1-2-SK	X											4 HOURS
11	CONCRETE	D2113-MISC-1-3-SK	X											
12	FLOOR TILE AND MASTIC	D2113-FT-4-1-TA	X											
13	FLOOR TILE AND MASTIC	D2113-FT-4-2-TA	X											
14	FLOOR TILE AND MASTIC	D2113-FT-5-3-TA	X											
15	TAN/BLACK STREAK CARPET/MASTIC	D2113-CPT-4-1-TB	X											
16	TAN/BLACK STREAK CARPET/MASTIC	D2113-CPT-4-2-TB	X											

REMARKS:

Relinquished By: Bruce Billings Date / Time: 30 JUNE 2006 12:00PM Received By: *Y. H. Paul* Date / Time: 7/12/06 9:01AM

Samples will be disposed of 30 days after analysis, unless otherwise requested.

Acc 4e99

CHAIN OF CUSTODY RECORD
ASBESTOS/LEAD ANALYSIS

Name of Lab: CAROLINA ENVIRONMENTAL, INC.
Lab Address: 107 New Edition Court, Cary, NC 27511
Tel: 866-481-1412 Fax: 919-481-1442

Client: US ARMY FORT BRAGG
Address: DPW ENVIRONMENTAL COMPLIANCE BRANCH
BLDG 3-1137 REILLY RD FORT BRAGG NC 23810
Project Manager: Bruce E. Billings
Phone: (910) 432-8467
Fax: (910) 396-4188

Email: bruce.billings1@us.army.mil

PO#:

DESCRIPTION

SAMPLE NUMBER

ASBESTOS

LEAD PAINT

TURN • AROUND
TIME

17

TAN/BLACK STREAK CARPET/MASTIC D2113-CPT-5-3-TB

X

PLM Bulk
PLM Point Count
PLM Gravimetric
PCM Air
TEM Bulk
TEM Air
Lead Paint
Lead Wipe
Lead Soil
Lead Air
Other Analysis

5 DAYS
3 DAYS

X 24 HOURS
48 HOURS
4 HOURS

CLIENT ID#

REMARKS:

Samples will be disposed of 30 days after analysis, unless otherwise requested

Relinquished By: Bruce Billings Date / Time: 30 JUNE 2006 12:00PM Received By:

Date / Time:

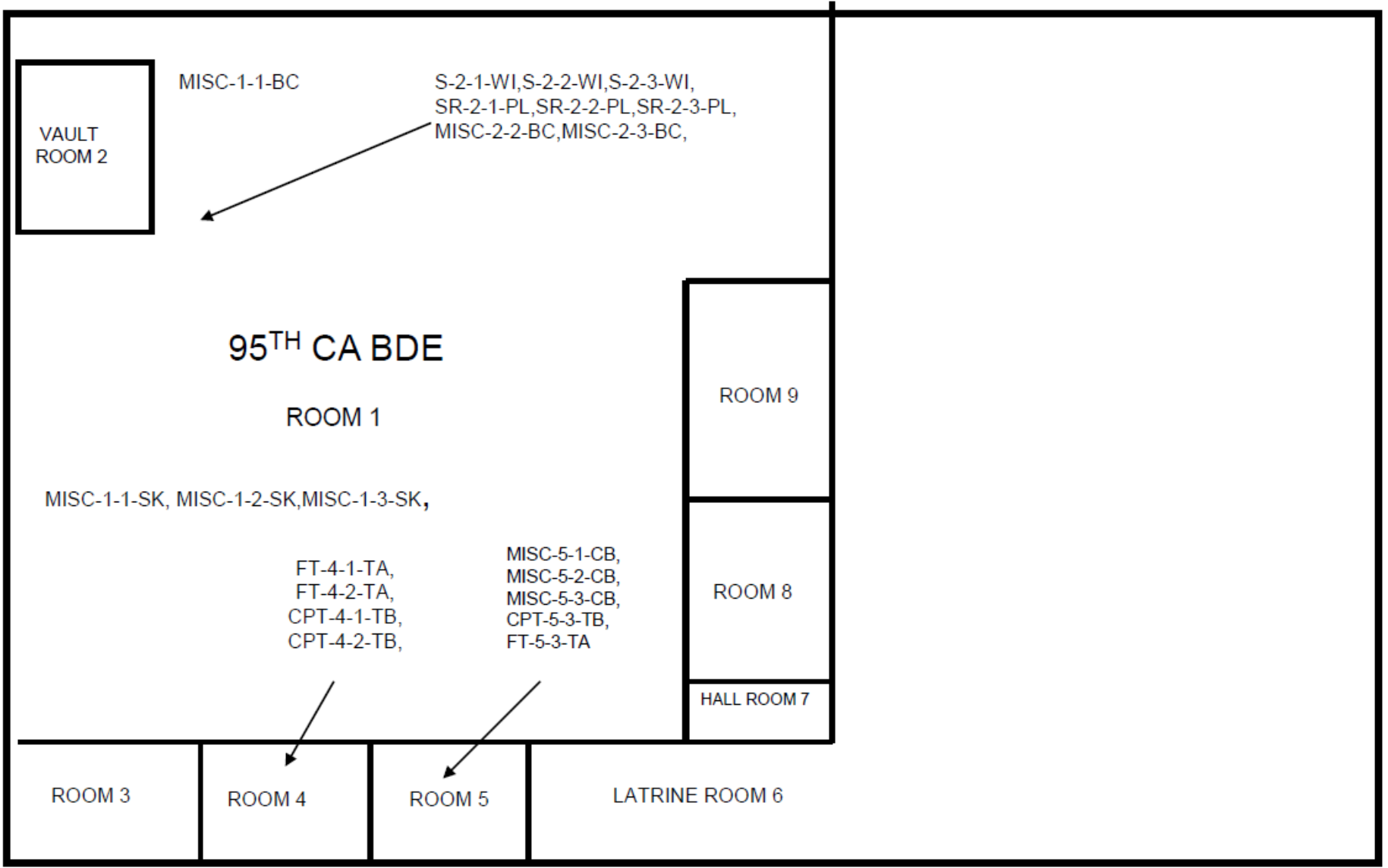
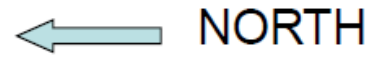
Relinquished By: Date / Time: Received By:

Date / Time:

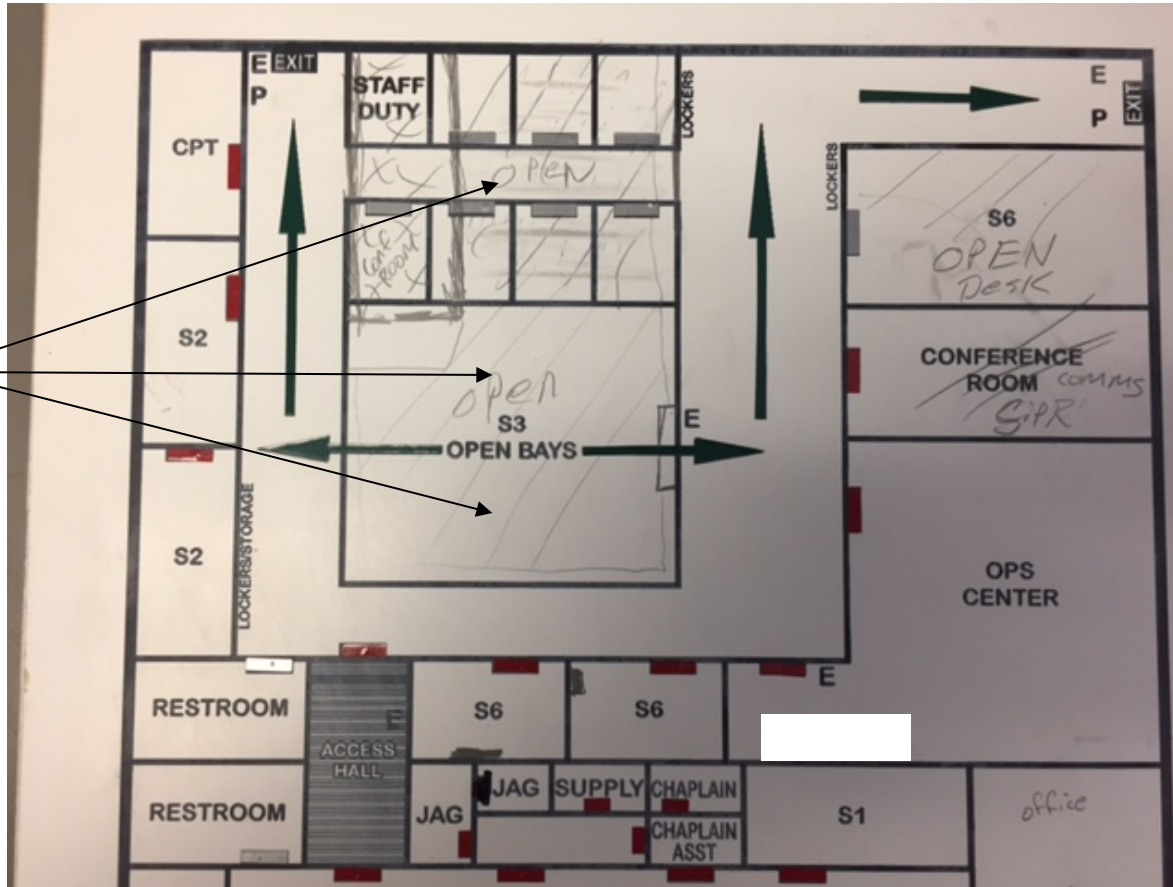
1 3 PAGES OF 3

BLDG:D2113
DATE:29 JUNE 2006
TYPE OF INSPECTION: ASBESTOS
INSPECTOR:BRUCE BILLINGS

ASBESTOS SAMPLE LOCATION



Staff Section



Prepared By: David L Clark
NC Accreditation #11788
August 4, 2017

Not to Scale

Accreditations



North Carolina Department of Health and Human Services Division of Public Health

Roy Cooper
Governor

Mandy Cohen, MD, MPH
Secretary
Daniel Stanley
Director

February 28, 2017

David L Clark
1425 Milton St
Spring Lake, NC 28390

Dear Mr. Clark:

Based upon the review of your accreditation application, the Health Hazards Control Unit (HHCU) has determined that you have fulfilled the requirements and are eligible for asbestos accreditation as a(n) INSPECTOR. Your assigned North Carolina accreditation number is 11788, which is reflected on your enclosed North Carolina Accreditation card. Please be sure to take this card with you to any asbestos work site where you are employed. The State requires that all persons conducting asbestos abatement or asbestos management activities be accredited and have their identification card on site.

Your North Carolina Inspector accreditation will expire on FEBRUARY 28, 2018. It is NOT the policy of the HHCU to issue renewal notices. If you wish to continue working as a(n) Inspector after this expiration date, you must successfully complete the required training and submit a completed application to this office prior to February 28, 2018. If you should continue to perform asbestos management activities as a(n) Inspector without a valid North Carolina accreditation, you will be in violation of State regulations and may be cited for noncompliance.



David L. Clark
1425 Milton St
Spring Lake, NC 28390

114808

North Carolina Asbestos Accreditation

EXPIRATION			
02-28-2018			
DOB	SEX	HT	WT
05-25-1951	M	6'0"	220
CLASS		#	EXP
INSPECTOR		11788	02-18
SUPERVISOR		34129	02-18

Sincerely,

Ed Norman
Program Manager
Health Hazards Control Unit

Enclosure

Location: 5505 Six Forks Road, Raleigh, NC 27609 | Mailing Address: 1912 Mail Service Center, Raleigh, NC 27699-1912
919-707-5980 T | 919-870-4808 F

An Equal Opportunity / Affirmative Action Employer



United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200671-0

EMSL Analytical, Inc.
Morrisville, NC

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:*

Asbestos Fiber Analysis

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communiqué dated January 2009).*

2017-04-01 through 2018-03-31

Effective Dates



For the National Voluntary Laboratory Accreditation Program

FB Form 4283

FACILITIES ENGINEERING WORK REQUEST

For use of this form, see DA Pam 420-6; the proponent agency is OACSIM

PART A (See Requestor Instructions)		CUSTOMER ID	DOCUMENT SERIAL NUMBER	FY	TYPE	SUMMARY OF WORK FOR TITLE			DATE		
		TA	00034	17		Perform Asbestos Assessments/ test on carpeted floor areas Bldg D-2113			DA	MON	YR
						12	7	17			
INSTALLATION ABBREVIATION OF FACILITIES											
1	Fort Bragg	1	2	3	4	5	6	7	8	9	
2	Key West	D-2113									
3	Camp Dawson										
REMARKS: All funding information will be sent to Mrs Tina Porter, portert@soc.mil or Ms. Dezala Peele, peeled@soc.mil at 910-432-6920. This project will comply with Title 10, USC, Section 2461, for maintenance, repair and construction contracts for real property using Operations & Maintenance funds.											
ORGANIZATION BENEFITTING FROM WORK		USAJFKSWCS		SENOR ENGINEERING REP. NAME		LTC Michael H. Carr		SENOR ENGINEERING REP. EMAIL ADDRESS		michael.h.carr@soc.mil	
WORK DESCRIPTION (Description and Justification of work requested)		Request DPW perform an asbestos test in the carpeted area of the stair section in bldg. D-2113. Unit is looking at replacing the carpet in the stair section of the facility and before the old carpet is removed, the unit wants to confirm if asbestos exists under the current carpeted area prior to removal.		SENOR ENGINEERING REP. PHONE #		910-396-6764		SENOR ENG REP PHONE #			
WORK REQUEST ALTERNATE POINT OF CONTACT (NAME, PHONE, EMAIL)		Mr. Stanley Shark, 910-396-9324, stanley.shark@socom.mil		Mr. Ron Dye, 910-396-9374, dye@socom.mil		Dean Rudisill, 910-432-1841, harold.rudisill@socom.mil		CPT Grealish, 910-396-9324, austin.grealish@socom.mil			
PART B (APPROVING OFFICIAL ONLY)		CHAMPION PROGRAM:		FUNDING SOURCE:		DPW/IMCOM/Cust.		FUNDING PLAN DOCUMENT:		SRM AWP	
NEPA DOCUMENTATION REQ'D		YES		NO		WBS ELEMENT (for main work effort):		MODEP:		DATE	
<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>							
RECORD OF ENV CONSIDERATION		<input type="checkbox"/>		<input type="checkbox"/>							
EA INITIATED		<input type="checkbox"/>		<input type="checkbox"/>							
EA COMPLETED		<input type="checkbox"/>		<input type="checkbox"/>							
WORK TO BE PERFORMED		IN-HOUSE DESIGN		SELF-HELP		CONTRACT		TRPOOP		RECURSABLE SOURCE OF FUNDS	
<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		GFBS	
<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		MIPR	
<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		CHECK w/ SERVICE AGREEMENT	
<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		WORK BREAKDOWN STRUCTURE DESIGN:	
<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		PREAWARD:	
DESIGN APPROVAL (Please type or print name)		DATE		APPROVAL AUTHORITY (Please type or print name)		APPROVAL ACTION		APPROVED		DATE	
DESIGN APPROVAL SIGNATURE		DA		MON		YR		DISAPPROVED		DA	

FB FORM 4283, SEP 2014

DA FORM 4283, AUG 1978, IS OBSOLETE

APR V 100



Asbestos Survey for Demolition

Building D-2211 Fort Bragg, North Carolina

Prepared by David L Clark, SpecPro Professional Service, LLC for the Directorate of Public Works, Ft Bragg, North Carolina



XVIII AIRBORNE CORPS

This asbestos inspection was conducted on October 23, 2017 by David L Clark, inspector certification number: NC 11788, for Project PN63850

Asbestos Inspection Report

Introduction

Scope of the Investigation

This report documents the full asbestos inspection and survey of Building D-2211 at Ft. Bragg, North Carolina conducted on October 23, 2017 by David L Clark, inspector certification number: NC 11788.

Background

Building D-2211 is a single story mobile structure with a metal roof. The building is currently used for administrative and training purposes. The floor is wood throughout covered with 12x12 inch vinyl tile and/or carpet.

Description of study

Investigation

Building D-2211 was visually inspected for suspected asbestos containing materials (ACM) by a North Carolina accredited inspector. A copy of the inspector's accreditation certificate is included in the report. Bulk samples of all suspect ACM's were collected. This report details ACM as identified at the time of inspection only. The inspection was conducted for the presence of asbestos containing building materials (ACBM).

Conclusions

ASBESTOS-CONTAINING MATERIAL WAS NOT DETECTED.

Analytical Report



EMSL Analytical, Inc.
 2500 Gateway Centre Blvd., Suite 600 Morrisville, NC 27560
 Tel/Fax: (919) 465-3900 / (919) 465-3950
<http://www.EMSL.com/raleighlab@emsl.com>

EMSL Order: 291708996
 Customer ID: SPEC29
 Customer PO:
 Project ID:

Attention: Bruce Billings
 SpecPro Professional Services, LLC
 3-1137 Bunter Road
 Fort Bragg, NC 28310
 Project: Bldg D-2211, PN63850

Phone: (910) 322-6338
 Fax:
 Received Date: 10/24/2017 10:00 AM
 Analysis Date: 10/24/2017
 Collected Date:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos % Type
			% Fibrous	% Non-Fibrous	
D-2211-MISC-1-A-Vinyl 291708996-0001	Room 5 - Vinyl w/ Mastic, Tan and Gray	Gray/Tan Fibrous Homogeneous	30% Cellulose 10% Glass	60% Non-fibrous (Other)	None Detected
D-2211-MISC-1-A-Mastic 291708996-0001A	Room 5 - Vinyl w/ Mastic, Tan and Gray	Tan Fibrous Homogeneous	3% Cellulose	97% Non-fibrous (Other)	None Detected
D-2211-MISC-1-BN-Cove Base 291708996-0002	Room 5 - Cove Base w/ Mastic, Tan	Brown Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2211-MISC-1-BN-Mastic 291708996-0002A	Room 5 - Cove Base w/ Mastic, Tan	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2211-FT-1-X-Floor Tile 291708996-0003	FT/M, 12" Tan w/ White & Bro	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2211-FT-1-X-Mastic 291708996-0003A	FT/M, 12" Tan w/ White & Bro	Black Fibrous Homogeneous	3% Cellulose	97% Non-fibrous (Other)	None Detected
D-2211-CPT-1-CPT-Carpet 291708996-0004	Room 5 - Carpet and Mastic (If Applicable)	Various Fibrous Homogeneous	90% Synthetic	10% Non-fibrous (Other)	None Detected
D-2211-CPT-1-CPT-Mastic 291708996-0004A	Room 5 - Carpet and Mastic (If Applicable)	Tan Fibrous Homogeneous	5% Cellulose 2% Synthetic	93% Non-fibrous (Other)	None Detected
D-2211-S-1-XH 291708996-0005	HVAC Unit #2 - Sealant, Clear Exterior	Clear Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2211-S-1-J 291708996-0006	Window-Wall #1 - Sealant, Gray Exterior Window	Gray/White Fibrous Homogeneous	8% Cellulose	92% Non-fibrous (Other)	None Detected
D-2211-MISC-2-A-Vinyl 291708996-0007	Room 9 - Vinyl w/ Mastic, Tan and Gray	Gray/Tan Fibrous Homogeneous	30% Cellulose 10% Glass	60% Non-fibrous (Other)	None Detected
D-2211-MISC-2-A-Mastic 291708996-0007A	Room 9 - Vinyl w/ Mastic, Tan and Gray	Tan Fibrous Homogeneous	3% Cellulose	97% Non-fibrous (Other)	None Detected
D-2211-MISC-2-BN-Cove Base 291708996-0008	Room 9 - Cove Base w/ Mastic, Tan	Brown Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Initial report from: 10/24/2017 17:57:04

**EMSL Analytical, Inc.**

2500 Gateway Centre Blvd., Suite 600 Morrisville, NC 27560
 Tel/Fax: (919) 465-3900 / (919) 465-3950
<http://www.EMSL.com> / raleighlab@emsl.com

EMSL Order: 291708996
 Customer ID: SPEC29
 Customer PO:
 Project ID:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
D-2211-MISC-2-BN-Mastic	Room 9 - Cove Base w/ Mastic, Tan	Tan Fibrous Homogeneous	5% Cellulose	95% Non-fibrous (Other)	None Detected
291708995-0008A					
D-2211-FT-2-X-Floor Tile	FT/M, 12" Tan w/ White & Bro	Tan/White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
291708995-0009					
D-2211-FT-2-X-Mastic	FT/M, 12" Tan w/ White & Bro	Black Fibrous Homogeneous	2% Cellulose	98% Non-fibrous (Other)	None Detected
291708995-0009A					
D-2211-CPT-2-CPT-Carpet	Room 12 - Carpet and Mastic (If Applicable)	Various Fibrous Homogeneous	90% Synthetic	10% Non-fibrous (Other)	None Detected
291708995-0010					
D-2211-CPT-2-CPT-Mastic	Room 12 - Carpet and Mastic (If Applicable)	Tan Fibrous Homogeneous	2% Cellulose 3% Synthetic	95% Non-fibrous (Other)	None Detected
291708995-0010A					
D-2211-S-2-XH	HVAC Unit #3 - Sealant, Clear Exterior	Clear Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
291708995-0011					
D-2211-S-2-J	Window-Wall #1 - Sealant, Gray Exterior Window	Gray Fibrous Homogeneous	5% Cellulose	95% Non-fibrous (Other)	None Detected
291708995-0012					
D-2211-MISC-3-A-Vinyl	Room 10 - Vinyl w/ Mastic, Tan and Gray	Gray/Tan Fibrous Homogeneous	25% Cellulose 10% Glass	65% Non-fibrous (Other)	None Detected
291708995-0013					
D-2211-MISC-3-A-Mastic	Room 10 - Vinyl w/ Mastic, Tan and Gray	Yellow Fibrous Homogeneous	2% Cellulose	98% Non-fibrous (Other)	None Detected
291708995-0013A					
D-2211-MISC-3-BN-Cove Base	Room 12 - Cove Base w/ Mastic, Tan	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
291708995-0014					
D-2211-MISC-3-BN-Mastic	Room 12 - Cove Base w/ Mastic, Tan	White Fibrous Homogeneous	3% Cellulose	97% Non-fibrous (Other)	None Detected
291708995-0014A					
D-2211-FT-3-X-Floor Tile	FT/M, 12" Tan w/ White & Bro	Brown/Tan/White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
291708995-0015					
D-2211-FT-3-X-Mastic	FT/M, 12" Tan w/ White & Bro	Gray/Yellow Fibrous Homogeneous	5% Cellulose	95% Non-fibrous (Other)	None Detected
291708995-0015A					
D-2211-CPT-3-CPT-Carpet	Room 9 - Carpet and Mastic (If Applicable)	Various Fibrous Homogeneous	85% Synthetic	15% Non-fibrous (Other)	None Detected
291708995-0016					
D-2211-CPT-3-CPT-Mastic	Room 9 - Carpet and Mastic (If Applicable)	Yellow Fibrous Homogeneous	2% Cellulose 2% Synthetic	96% Non-fibrous (Other)	None Detected
291708995-0016A					
D-2211-S-3-XH	HVAC Unit #4 - Sealant, Clear Exterior	White/Clear Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
291708995-0017					

Initial report from: 10/24/2017 17:57:04



EMSL Analytical, Inc.

2500 Gateway Centre Blvd., Suite 600 Morrisville, NC 27560
Tel/Fax: (919) 465-3900 / (919) 465-3950
<http://www.EMSL.com / raleighlab@emsl.com>

EMSL Order: 291708996
Customer ID: SPEC29
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
D-2211-S-3-J	Window-Wall #3 - Sealant, Gray Exterior	Gray Fibrous	2% Wollastonite	98% Non-fibrous (Other)	None Detected
291708996-0018	Window	Homogeneous			

Analyst(s)

Joshua Moorman (10)
Olivia Bradley (20)

Billy Barnes, Asbestos Lab Manager
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Samples received in good condition unless otherwise noted. Estimated accuracy, precision and uncertainty data available upon request. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Reporting limit is 1%
Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200671-0, VA 3333 000278, WVA LT000296

Initial report from: 10/24/2017 17:57:04



EMSL Analytical, Inc.

706 Gralin Street, Kernersville, NC 27284

Phone: (336) 992-1025 Fax: (336) 992-4175 Email: greensborolab@emsl.com

Attn: Bruce Billings
US Army Fort Bragg
DPW Environmental Compliance Branch
Building 3-1137 Reilly Road
Fort Bragg, NC 28310

Customer ID: USAR85
Customer PO:
Received: 04/14/10 10:30 AM
EMSL Order: 021002194

Fax: (910) 398-4188 Phone: (910) 432-3564
Project: TA-00055-OP D-2211

EMSL Proj:
Analysis Date: 4/15/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Table with 7 columns: Sample, Description, Appearance, % Fibrous, % Non-Fibrous, Asbestos % Type. Contains 4 rows of sample analysis data.

Analyst(s)

Kristie Elliott (2)
Scott Combs (2)

Handwritten signature of Stephen Bennett

Stephen Bennett, Laboratory Manager
or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. The limit of detection as stated in the method is 1%. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government.

Samples analyzed by EMSL Analytical, Inc. 706 Gralin Street, Kernersville NC NVLAP Lab Code 102104-0, CA ELAP 2689, Virginia 3333-000228, West Virginia LT000321

Chain of Custody

Name of Lab: EMSL Lab
Lab Address: 2500 Gatew:
 Morrisville,

SpecPro Professional Services, LLC
 Bldg D-2211, PN63850
 10/24/2017 100
 PLM

Order ID: 291706996
No Samples: 18
Due: 10/25 10:00 AM
TAT: 24 Hour
Bulk

Lab Tel: (919) 456-3900
Lab Fax: (919) 456-3950

ASBESTOS/LEAD

Client: Chenega Support Services, LLC	Client ID: CHEG25
Address: DPW Environment Compliance Branch Bldg 3-1137 Reilly RD, Fort Bragg, NC 23810	Point of Contact: Bruce E. Billings
Building Number: D-2211	Project Number: PN63850
Turn Around Time: 24 Hours	
Phone: (910) 322-6338 Fax: (910) 396-4188	
Email: bruce.e.billings.ct@mail.mil	

DESCRIPTION	SAMPLE NUMBER	ASBESTOS						LEAD PAINT	
		PLM Bulk	PLM Point Count	PLM Gravimetric	PCm Air	TEM Bulk	TEM Air	Lead Paint	Lead Wipe
VINYL WITH MASTIC, TAN AND GRAY / Room #5	D-2211-MISC-1-A	X							
COVE BASE WITH MASTIC, TAN / Room #5	D-2211-MISC-1-BN	X							
FLOOR TILE WITH MASTIC, 12" TAN WITH WHITE & BRO	D-2211-FT-1-X	X							
CARPET AND MASTIC (IF APPLICABLE) / Room #5	D-2211-CPT-1-CPT	X							
SEALANT, CLEAR EXTERIOR / HVAC Unit # 2	D-2211-S-1-XH	X							
SEALANT, GRAY EXTERIOR WINDOW / Window-Wall #1	D-2211-S-1-J	X							
VINYL WITH MASTIC, TAN AND GRAY / Room #9	D-2211-MISC-2-A	X							
COVE BASE WITH MASTIC, TAN / Room #9	D-2211-MISC-2-BN	X							
FLOOR TILE WITH MASTIC, 12" TAN WITH WHITE & BRO	D-2211-FT-2-X	X							
CARPET AND MASTIC (IF APPLICABLE) / Room #12	D-2211-CPT-2-CPT	X							
SEALANT, CLEAR EXTERIOR / HVAC Unit # 3	D-2211-S-2-XH	X							
SEALANT, GRAY EXTERIOR WINDOW / Window-Wall #1	D-2211-S-2-J	X							
VINYL WITH MASTIC, TAN AND GRAY / Room #10	D-2211-MISC-3-A	X							

REMARKS: Samples will be disposed of 30 days after analysis, unless otherwise requested.

Relinquished By: <i>Dave Clark</i>	Date/Time: <i>10/23/17</i>	Received By: <i>Rd Steen</i>	Date/Time: <i>10.24.17 10am</i>
Relinquished By:	Date/Time:	Received By:	Date/Time:

EF-dEx 7953 0353 1639 Page 1 of 2

Order ID: 291708996
 No Samples: 18
 Due: 10/25 10:00 AM
 Fax:

Lab Tel: (919) 456-3900
 Lab Fax: (919) 456-3950

Name of Lab: **EMSL Lab**
 Lab Address: 2500 Gatew
 Morrisville, PLM

SpecPro Professional Services, LLC
 Bldg D-2211, PN63850
 10/24/2017 10:00
 TAT: 24 Hour Bulk

ASBESTOS/LEAD

Client: Chenega Support Services, LLC Client ID: CHEG25
 Address: DPW Environment Compliance Branch
 Bldg 3-1137 Reilly RD, Fort Bragg, NC 23810
 Building Number D-2211 Project Number: PN63850
 Point of Contact: Bruce E. Billings
 Phone: (910) 322-6338 Fax: (910) 396-4188
 Email: bruce.e.billings.ctr@mail.mil
 Turn Around Time 24 Hours

DESCRIPTION	SAMPLE NUMBER	ASBESTOS						LEAD PAINT	
		PLM Bulk	PLM Point Count	PLM Gravimetric	PCm Air	TEM Bulk	TEM Air	Lead Paint	Lead Wipe
VINYL WITH MASTIC, TAN AND GRAY / Room #5	D-2211-MISC-1-A	X							
COVE BASE WITH MASTIC, TAN / Room #5	D-2211-MISC-1-BN	X							
FLOOR TILE WITH MASTIC, 12" TAN WITH WHITE & BRO	D-2211-FT-1-X	X							
CARPET AND MASTIC (IF APPLICABLE) / Room #5	D-2211-CPT-1-CPT	X							
SEALANT, CLEAR EXTERIOR / HVAC Unit # 2	D-2211-S-1-XH	X							
SEALANT, GRAY EXTERIOR WINDOW / Window-Wall #1	D-2211-S-1-J	X							
VINYL WITH MASTIC, TAN AND GRAY / Room #9	D-2211-MISC-2-A	X							
COVE BASE WITH MASTIC, TAN / Room #9	D-2211-MISC-2-BN	X							
FLOOR TILE WITH MASTIC, 12" TAN WITH WHITE & BRO	D-2211-FT-2-X	X							
CARPET AND MASTIC (IF APPLICABLE) / Room #12	D-2211-CPT-2-CPT	X							
SEALANT, CLEAR EXTERIOR / HVAC Unit # 3	D-2211-S-2-XH	X							
SEALANT, GRAY EXTERIOR WINDOW / Window-Wall #1	D-2211-S-2-J	X							
VINYL WITH MASTIC, TAN AND GRAY / Room #10	D-2211-MISC-3-A	X							

REMARKS: Samples will be disposed of 30 days after analysis, unless otherwise requested.

Relinquished By: *Dave Clark* Date/Time: 10/23/17
 Relinquished By: *RJ Steen* Date/Time: 10-24-17 10am

EF-dEX 7953 0353 1639 Page 1 of 2

2194

Lab Tel: (336) 922-102
Lab Fax: (336) 992-4175

**CHAIN OF CUSTODY
RECORD
ASBESTOS ANALYSIS**

Name of Lab: EMSL Analytical, Inc.
Lab Address: 706 Gralin St.,
Kernersville, NC 27284

Client: US Army Fort Bragg
Address: DPW Environmental Compliance Branch
Bldg 3-1137 Reilly RD, Fort Bragg, NC 23810
Building Number: D-2211

Client ID
Project Manager: Bruce E. Billings
Phone: (910) 432-3564
Email: bruce.billings1@us.army.mil
Turn Around Time: 24 Hours

DESCRIPTION	SAMPLE NUMBER	ASBESTOS					
		PLM Bulk	PLM Point Count	PLM Gravimetric	PCM Air	TEM Bulk	TEM Air
SHEETROCK (WALL OR CEILING) / KINESTHETIC RM WALL	D-2211-SR-2-SR	X					
SHEETROCK (WALL OR CEILING) / KINESTHETIC RM CEIL	D-2211-SR-1-SR	X					

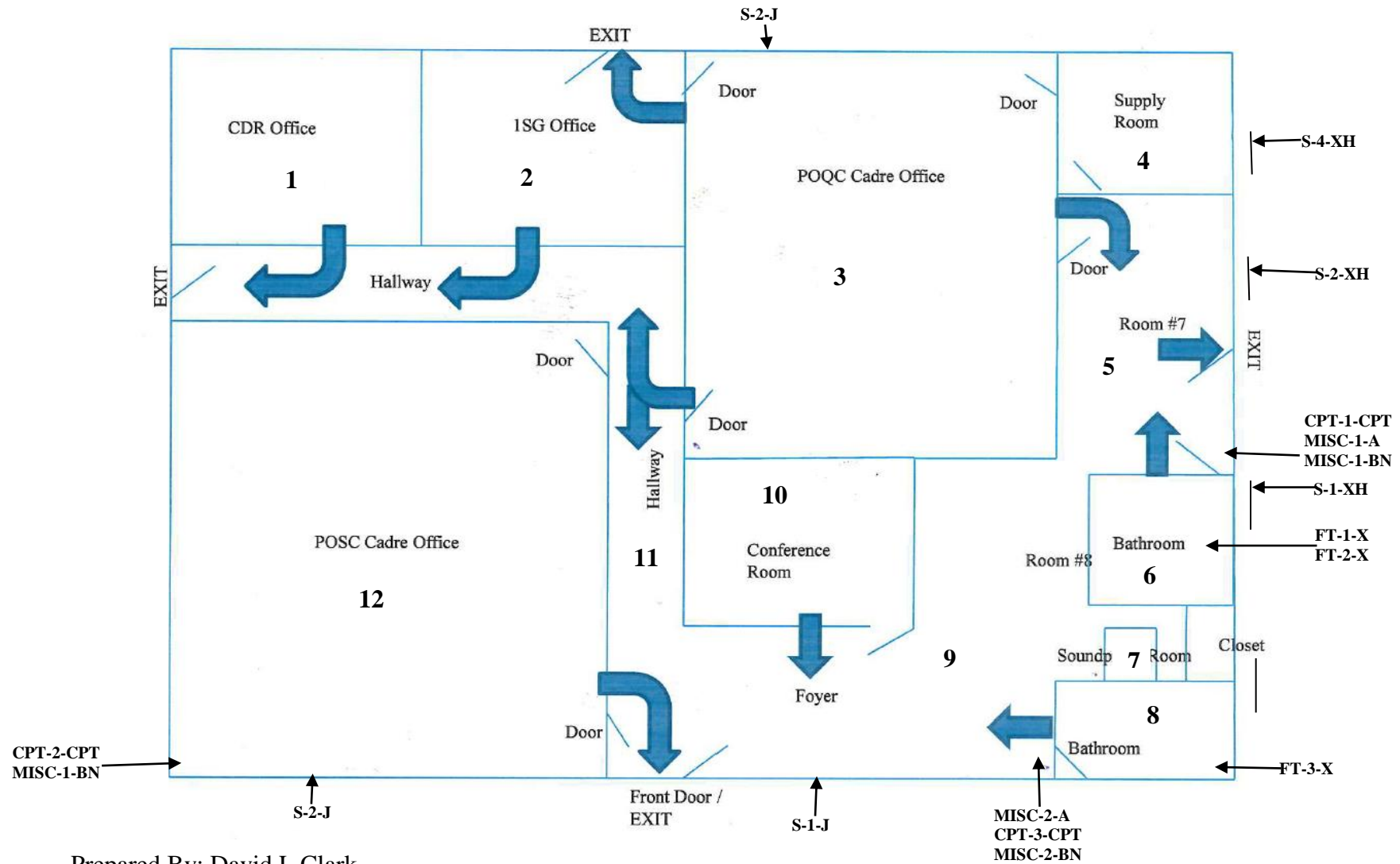
REMARKS:
Samples will be disposed of 30 days after analysis, unless otherwise requested.

Relinquished By: Jeffrey Frank
Relinquished By: *JFK*

Date/Time: 4/13/10
Date/Time: 4/14 10:42

Date/Time: *4/14*
Date/Time: *10:42*

Sample Locations Building D-2111



Prepared By: David L Clark
Accreditation # NC11788

Not to Scale

Inspector Accreditation



North Carolina Department of Health and Human Services

Division of Public Health

Roy Cooper
Governor

Mandy Cohen, MD, MPH
Secretary

Daniel Stanley
Director

February 28, 2017

David L Clark
1425 Milton St
Spring Lake, NC 28390

Dear Mr. Clark:

Based upon the review of your accreditation application, the Health Hazards Control Unit (HHCU) has determined that you have fulfilled the requirements and are eligible for asbestos accreditation as a(n) INSPECTOR. Your assigned North Carolina accreditation number is 11788, which is reflected on your enclosed North Carolina Accreditation card. Please be sure to take this card with you to any asbestos work site where you are employed. The State requires that all persons conducting asbestos abatement or asbestos management activities be accredited and have their identification card on site.

Your North Carolina Inspector accreditation will expire on FEBRUARY 28, 2018. It is NOT the policy of the HHCU to issue renewal notices. If you wish to continue working as a(n) Inspector after this expiration date, you must successfully complete the required training and submit a completed application to this office prior to February 28, 2018. If you should continue to perform asbestos management activities as a(n) Inspector without a valid North Carolina accreditation, you will be in violation of State regulations and may be cited for noncompliance.



David L. Clark
1425 Milton St
Spring Lake, NC 28390

114808

North Carolina
Asbestos Accreditation

EXPIRATION			
02-28-2018			
DOB	SEX	HT	WT
05-26-1951	M	6'0"	220
CLASS	#	EXP	
INSPECTOR	11788	02-18	
SUPERVISOR	34129	02-18	

Sincerely,

Ed Norman
Program Manager
Health Hazards Control Unit

Enclosure

Location: 5505 Six Forks Road, Raleigh, NC 27609 | Mailing Address: 1912 Mail Service Center, Raleigh, NC 27699-1912
919-707-5950 T | 919-870-4808 F

An Equal Opportunity / Affirmative Action Employer





Asbestos Survey for Demolition of

Building D-2212 Fort Bragg, North Carolina

Prepared by Damita Reed of RETRAC Environmental & Consulting Services, LLC
For the Directorate of Public Works,
Fort Bragg, North Carolina



XVIII AIRBORNE CORPS

Building D-2212 was inspected for asbestos by Damita Reed
on February 1, 2018 for project number PN81165.

Introduction

Scope of the Investigation

This report documents the asbestos inspection and survey of Building D-2212 at Ft. Bragg, North Carolina conducted by Damita Reed, inspector certification number: NC 11844 on February 1, 2018.

Building D-2212 was visually inspected. Roof approximate 1,679 square foot, is made of black rubber membrane. Samples of materials to be disturbed during work to be performed were taken and sent to a NVLAP certified laboratory for analysis. The approximate location where each bulk sample was obtained is shown on the building floor plan included in this report.

Conclusions

ASBESTOS-CONTAINING MATERIAL WAS NOT DETECTED.

Asbestos Table D-2212 Fort Bragg, Building

MATERIAL		CHARACTERISTICS			ASSESSMENT	
Type	Description/Location/Amount	Asbestos Yes/No/Presumed/ND	Percentage/Type (If ACM)	Friable / Non- Friable	Condition	Disturbance Potential
Misc.	Black Cove Base with Mastic throughout building lower walls/ Approx. 488 Ln. Ft. Total	ND	ND	Non Friable	Damaged	Potential Moderate
Misc.	Blue Commercial Carpet with Mastic throughout building except in the Latrine and Room 5/Approx. 1,000 Sq. Ft.	ND	ND	Non Friable	Damaged	Potential Moderate
Misc.	White Sheetrock Walls throughout building/ Approx. 5,106 Sq. Ft.	ND	ND	Non Friable	Good	Potential Moderate
Misc.	Clear Exterior Sealant around Exterior of Window Frames/ Approx. 84 Ln. Ft.	ND	ND	Non Friable	Damaged	Potential Moderate

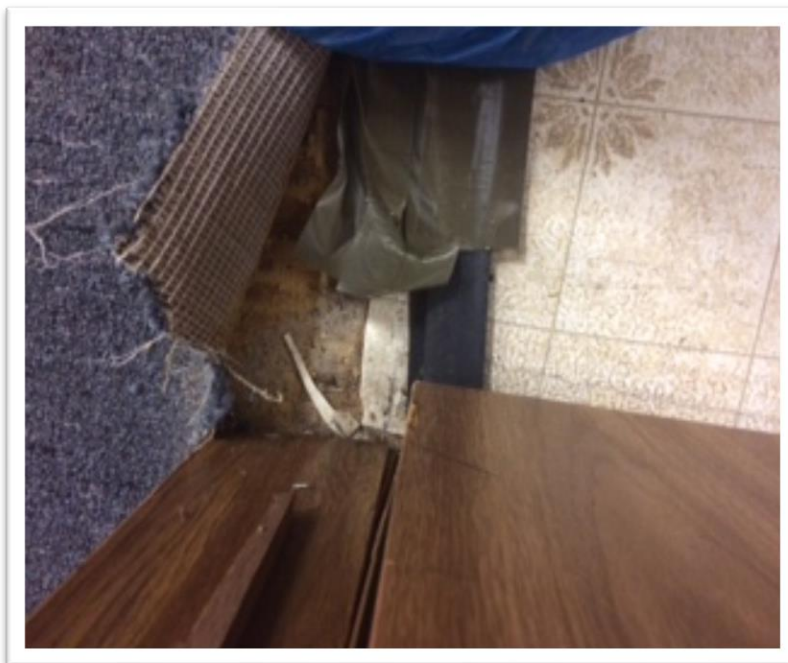
Misc.	White Textured Material on Sheetrock Ceilings, throughout building/ Approx. 1,702 Sq. Ft.	ND	ND	Non Friable	Damaged	Potential Moderate
Misc.	White and Beige Vinyl Flooring with Mastic in Latrine and Room 5/ Approx. 160 Sq. Ft.	ND	ND	Non Friable	Good	Potential Moderate

**Sq. Ft.-Square Foot, Ln. Ft.-Linear Foot, C. Ft.-cubic Foot
Amounts are estimated, contractor is responsible for exact measurements.**

Photos of Sampled Materials



Black Cove Base with Mastic throughout the building lower walls

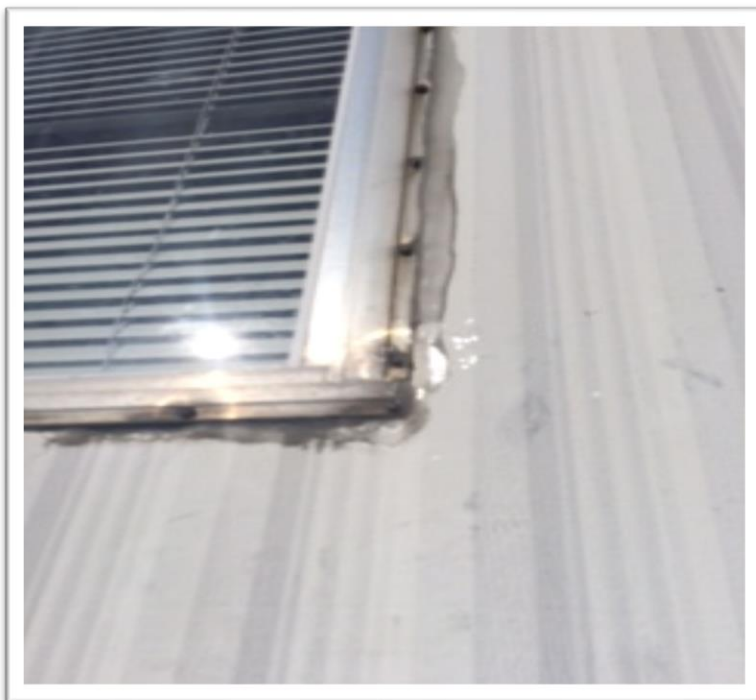


Blue Commercial Carpet with Mastic throughout building except in the Latrine and Room 5

Photos of Sampled Materials

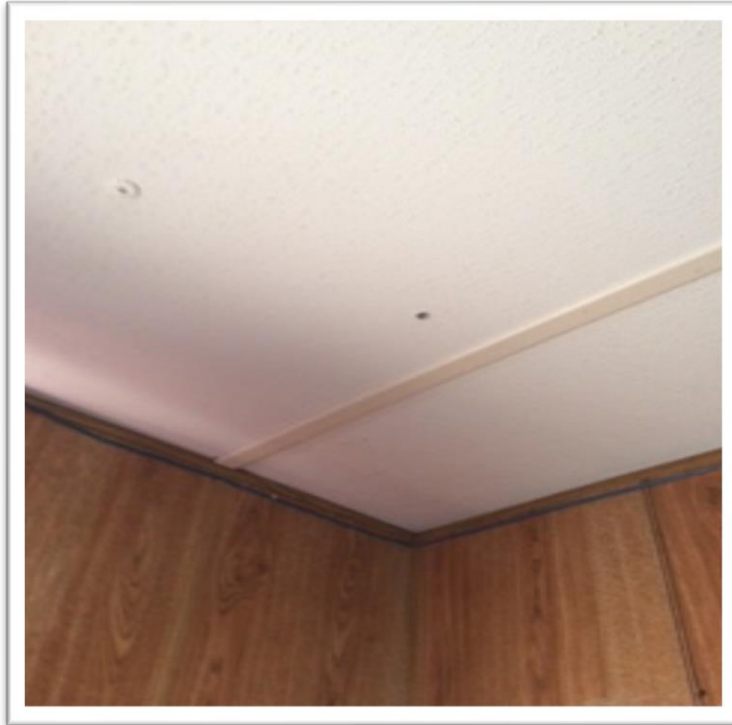


White and Beige Vinyl Flooring with Mastic in Latrine and Room 5

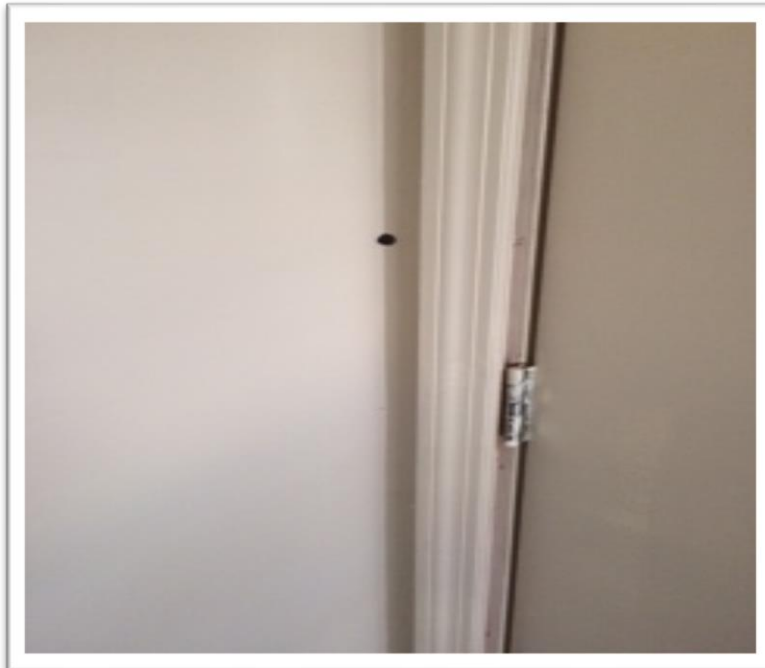


Exterior Sealant, Clear on Exterior Windows

Photos of Sampled Materials



**White Textured Material on Sheetrock Ceilings
throughout building**



White Sheetrock Walls throughout building

Analytical Report



EMSL Analytical, Inc.

2500 Gateway Centre Blvd., Suite 600 Morrisville, NC 27560
 Tel/Fax: (919) 465-3900 / (919) 465-3950
<http://www.EMSL.com> / raleighlab@emsl.com

EMSL Order: 291801055
 Customer ID: RETR29
 Customer PO:
 Project ID:

Attention: Damita Reed
 RETRAC Environmental & Consulting Svcs
 1966 Fairforest Drive
 Fayetteville, NC 28304

Phone: (910) 797-8701
Fax:
Received Date: 02/08/2018 11:00 AM
Analysis Date: 02/08/2018 - 02/09/2018
Collected Date:

Project: Bldg D-2212, PN81165

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos % Type
			% Fibrous	% Non-Fibrous	
D-2212-SR-1-SR <small>291801055-0001</small>	Room 1 Wall - Sheetrock, Wall/Ceiling	Brown/Gray Fibrous Homogeneous	20% Cellulose 5% Glass	75% Non-fibrous (Other)	None Detected
D-2212-CPT-1-BG-Carp et <small>291801055-0002</small>	Room 6 Floor - Carpet w/ Mastic, Blue Commercial	Gray/Blue Fibrous Homogeneous	65% Synthetic	35% Non-fibrous (Other)	None Detected
D-2212-CPT-1-BG-Mast ic <small>291801055-0002A</small>	Room 6 Floor - Carpet w/ Mastic, Blue Commercial	Yellow Fibrous Homogeneous	2% Cellulose 3% Synthetic	95% Non-fibrous (Other)	None Detected
D-2212-S-1-BJ <small>291801055-0003</small>	Room 1 Exterior Wall - Sealant, Clear Exterior Window <i>Result includes a small amount of inseparable attached material</i>	Clear Non-Fibrous Homogeneous		100% Non-fibrous (Other)	<1% Chrysotile
D-2212-MISC-1-T-Cove Base <small>291801055-0004</small>	Room 1 - Cove Base w/ Mastic, Black	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2212-MISC-1-T-Masti c <small>291801055-0004A</small>	Room 1 - Cove Base w/ Mastic, Black	Yellow Fibrous Homogeneous	2% Cellulose 2% Synthetic	96% Non-fibrous (Other)	None Detected
D-2212-AC-A-EH <small>291801055-0005</small>	Room 1 Ceiling - Acoustical Coating, White	White Fibrous Homogeneous	20% Glass	80% Non-fibrous (Other)	None Detected
D-2212-MISC-1-FY <small>291801055-0006</small>	Vinyl Flooring, w/ Mastic, White w/ Beige Specks	White/Beige Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2212-SR-2-SR <small>291801055-0007</small>	Conference Room Wall - Sheetrock Wall/Ceiling	Brown/Gray Fibrous Homogeneous	20% Cellulose 5% Glass	75% Non-fibrous (Other)	None Detected
D-2212-CPT-2-BG-Carp et <small>291801055-0008</small>	Conference Rm - Carpet w/ Mastic, Blue Commercial	Gray/Blue Fibrous Homogeneous	65% Synthetic	35% Non-fibrous (Other)	None Detected
D-2212-CPT-2-BG-Mast ic <small>291801055-0008A</small>	Conference Rm - Carpet w/ Mastic, Blue Commercial	Blue/Yellow Fibrous Homogeneous	2% Cellulose 3% Synthetic	95% Non-fibrous (Other)	None Detected
D-2212-S-2-BJ <small>291801055-0009</small>	Room 6 Exterior - Sealant, Clear Exterior Window	Clear Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2212-MISC-2-T-Cove Base <small>291801055-0010</small>	Room 6 - Cove Base w/ Mastic, Black	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Initial report from: 02/09/2018 09:58:26



EMSL Analytical, Inc.
 2500 Gateway Centre Blvd., Suite 600 Morrisville, NC 27560
 Tel/Fax: (919) 465-3900 / (919) 465-3950
<http://www.EMSL.com> / raleighlab@emsl.com

EMSL Order: 291801055
Customer ID: RETR29
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
D-2212-MISC-2-T-Mastic	Room 6 - Cove Base w/ Mastic, Black	Yellow Fibrous Homogeneous	2% Cellulose 2% Synthetic	96% Non-fibrous (Other)	None Detected
<i>291801055-0010A</i>					
D-2212-AC-2-EH	Conference Room Ceiling - Acoustical Coating, White	White Fibrous Homogeneous	3% Cellulose	97% Non-fibrous (Other)	None Detected
<i>291801055-0011</i>					
D-2212-MISC-2-FY	Vinyl Flooring w/ Mastic, White w/ Beige Specks	White/Beige Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
<i>291801055-0012</i>					
D-2212-SR-3-SR	Room 4 Wall - Sheetrock, Wall/Ceiling	White Fibrous Homogeneous	20% Cellulose 3% Glass	77% Non-fibrous (Other)	None Detected
<i>291801055-0013</i>					
D-2212-CPT-3-BG-Carp	Room 1 Floor - Carpet w/ Mastic, Blue Commercial	Gray/Blue Fibrous Homogeneous	85% Synthetic	15% Non-fibrous (Other)	None Detected
<i>291801055-0014</i>					
D-2212-CPT-3-BG-Mastic	Room 1 Floor - Carpet w/ Mastic, Blue Commercial	Yellow Fibrous Homogeneous	<1% Cellulose 2% Synthetic	98% Non-fibrous (Other)	None Detected
<i>291801055-0014A</i>					
D-2212-S-3-BJ	Room 6 Exterior - Sealant, Clear Exterior Window	Clear Non-Fibrous Homogeneous		100% Non-fibrous (Other)	<1% Chrysotile
<i>291801055-0015</i> <i>Result includes a small amount of inseparable attached material</i>					
D-2212-MISC-3-T-Cove Base	Conference Room - Cove Base w/ Mastic, Black	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
<i>291801055-0016</i>					
D-2212-MISC-3-T-Mastic	Conference Room - Cove Base w/ Mastic, Black	Brown/Tan Fibrous Homogeneous	3% Cellulose	97% Non-fibrous (Other)	None Detected
<i>291801055-0016A</i>					
D-2212-AC-3-EH	Latrine Ceiling - Acoustical Coating, White	Brown/Gray Fibrous Homogeneous	20% Cellulose 2% Glass	78% Non-fibrous (Other)	None Detected
<i>291801055-0017</i>					
D-2212-MISC-3-FY	Vinyl Flooring w/ Mastic, White w/ Beige Specks	Tan/White Non-Fibrous Homogeneous	<1% Cellulose	100% Non-fibrous (Other)	None Detected
<i>291801055-0018</i>					
D-2212-AC-4-EH	Room 5 Ceiling - Acoustical Coating, White	Brown/Gray Fibrous Homogeneous	20% Cellulose <1% Glass	80% Non-fibrous (Other)	None Detected
<i>291801055-0019</i>					
D-2212-AC-5-EH	Room 6 Ceiling - Acoustical Coating, White	Brown/Gray Fibrous Homogeneous	20% Cellulose	80% Non-fibrous (Other)	None Detected
<i>291801055-0020</i>					

Initial report from: 02/09/2018 09:58:26



EMSL Analytical, Inc.

2500 Gateway Centre Blvd., Suite 600 Morrisville, NC 27560

Tel/Fax: (919) 465-3900 / (919) 465-3950

<http://www.EMSL.com> / raleighlab@emsl.com

EMSL Order: 291801055

Customer ID: RETR29

Customer PO:

Project ID:

Analyst(s)

Joshua Moorman (11)

Kelly Gallisdorfer (15)

Billy Barnes, Asbestos Lab Manager
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Samples received in good condition unless otherwise noted. Estimated accuracy, precision and uncertainty data available upon request. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Reporting limit is 1%

Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200671-0, VA 3333 000278, WVA LT000296

Initial report from: 02/09/2018 09:58:26



EMSL Analytical, Inc.
 2500 Gateway Centre Blvd., Suite 600, Morrisville, NC 27560
 Phone/Fax: (919) 465-3900 / (919) 465-3950
<http://www.EMSL.com> raleighlab@emsl.com

EMSL Order: 291801055
 CustomerID: RETR29
 CustomerPO:
 ProjectID:

Attn: **Damita Reed**
RETRAC Environmental & Consulting Svcs
1966 Fairforest Drive
Fayetteville, NC 28304

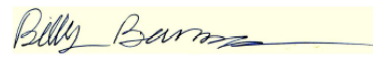
Phone: (910) 797-8701
 Fax:
 Received: 02/08/18 11:00 AM
 Analysis Date: 2/13/2018
 Collected:

Project: **Bldg D-2212, PN81165**

Test Report: Polarized Light Microscopy (PLM) - Point Count Performed by EPA 600/R-93/116 Method with Gravimetric Reduction and 400 Point Count

SAMPLE ID	DESCRIPTION	APPEARANCE	(% Matrix		NON- ASBESTOS % Fibrous	NON- ASBESTOS % NON-FIBROUS	ASBESTOS % TYPES
			Organic	Acid			
D-2212-S-1-BJ 291801055-0003	Room 1 Exterior Wall - Sealant, Clear Exterior Window	Clear Fibrous Homogeneous	66.5	13.2		20.3 Non-fibrous (other)	None Detected
D-2212-S-3-BJ 291801055-0015	Room 6 Exterior - Sealant, Clear Exterior Window	Clear Fibrous Homogeneous	65.3	13.9		20.7 Non-fibrous (other)	None Detected

Analyst(s)
 Joshua Moorman (1)
 Roxsee Stover (1)


 Billy Barnes, Asbestos Lab Manager
 or other approved signatory

Disclaimers: Some samples may contain asbestos fibers present in dimensions below PLM resolution limits. The limit of detection as stated in the method is 0.25%. EMSL Analytical Inc. suggests that samples reported as <0.25% or none detected undergo additional analysis via TEM. The above test report relates only to the items tested. This report may not be reproduced, except in full, without written approval by EMSL Analytical Inc. This report must not be used to claim product endorsement by NVLAP or any agency of the United States Government. EMSL Analytical Inc. bears no responsibility for sample collection activities, analytical method limitations, or the accuracy of results when requested to separate layer samples. EMSL Analytical Inc. liability is limited to the cost of sample analysis. The test results contained within this report meet the requirements of NELAC unless otherwise noted. Samples received in good condition unless otherwise noted. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample.
 Samples analyzed by EMSL Analytical, Inc. Morrisville, NC NVLAP Lab Code 200671-0, VA 3333 000278, WVA LT000296

Initial report from 02/09/2018 09:53:44

Chain of Custody

Order ID: 291801055

Name of Lab: **EMSL Lab**
 Lab Address: 2500 Gateway Centre Blvd, Sui
 Morrisville, NC 27560

CHAIN OF CUSTODY RECORD ASBESTOS/LEAD

Lab Tel: (919) 456-3900
 Lab Fax: (919) 456-3950

Client: RETRAC Environmental & Consulting S Address: 1966 Fair Forest Drive Fayetteville, NC 28304 Building Number: D-2212 Project Number: PN81165		Client ID: RETR29 Point of Contact: Danita Reed Phone: (910) 797-8701 Fax: Email: dreedretrac@gmail.com Turn Around Time: 24 Hours		RETRAC Environmental & Consulting Svcs Bldg D-2212, PN81165 PLM TAT: 24 Hour Bulk Order ID: 291801055 No Samples: 20 Due: 02/09 11:00 AM Fax:			
DESCRIPTION	SAMPLE NUMBER	ASBESTOS			LEAD		
		PLM Bulk	PLM Point Count	PLM Gravimetric	PCm Air	TEM Bulk	TEM Air
SHEETROCK (WALL OR CEILING) / Room 1 wall	D-2212-SR-1-SR	X					Lead Paint
CARPET WITH MASTIC, BLUE COMMERCIAL / Rm 6 floor	D-2212-CPT-1-BG	X					
SEALANT, CLEAR EXTERIOR WINDOW / Room 1 Exterior Wj	D-2212-S-1-BJ	X					
COVE BASE WITH MASTIC, BLACK / Room 1	D-2212-MISC-1-T	X					
ACOUSTICAL COATING, WHITE / Rm 1 ceiling	D-2212-AC-1-EH	X					
VINYL FLOORING WITH MASTIC, WHITE WITH BEIGE SPE	D-2212-MISC-1-FY	X					
SHEETROCK (WALL OR CEILING) / Conference Room wall	D-2212-SR-2-SR	X					
CARPET WITH MASTIC, BLUE COMMERCIAL / Conference R	D-2212-CPT-2-BG	X					
SEALANT, CLEAR EXTERIOR WINDOW / Room 6 Exterior Wj	D-2212-S-2-BJ	X					
COVE BASE WITH MASTIC, BLACK / Room 6	D-2212-MISC-2-T	X					
ACOUSTICAL COATING, WHITE / conference Room ceiling	D-2212-AC-2-EH	X					
VINYL FLOORING WITH MASTIC, WHITE WITH BEIGE SPE	D-2212-MISC-2-FY	X					
SHEETROCK (WALL OR CEILING) / Room 4 wall	D-2212-SR-3-SR	X					
REMARKS:							
Relinquished By: <i>Danita Reed</i>		Date/Time: 2-7-18		Received By: <i>[Signature]</i>		Date/Time: 2/8/18	
Relinquished By:		Date/Time:		Received By:		Date/Time:	

Samples will be disposed of 30 days after analysis, unless otherwise requested.

7954 z 380 H/12

Environmental & Consulting Svcs
 Bldg D-2212, PN81165
 2/8/2018 11:0
 PLM

TAT: 24 Hour
 Bulk

OrderID: 291801055
 No Samples: 20
 Due: 02/09 11:00 AM
 Fax:

Lab Tel: (919) 456-3900
 Lab Fax: (919) 456-3950

**CHAIN OF CUSTODY
 RECORD
 ASBESTOS/LEAD**

Name of Lab: **EIMSL Lab**
 Lab Address: 2500 Gateway Centre Blvd, Sui
 Morrisville, NC 27560

Client: RETRAC Environmental & Consulting S Client ID: RETR29
 Address: 1986 Fair Forest Drive
 Fayetteville, NC 28304
 Building Number: D-2212 Project Number: PN81165
 Point of Contact: Damita Reed
 Phone: (910) 797-8701 Fax:
 Email: dreedretrac@gmail.com
 Turn Around Time 24 Hours

DESCRIPTION	SAMPLE NUMBER	ASBESTOS						LEAD PAINT		
		PLM Bulk	PLM Point Count	PLM Gravimetric	PCm Air	TEM Bulk	TEM Air	Lead Paint	Lead Wipe	
CARPET WITH MASTIC, BLUE COMMERCIAL / Rm 1 Floor	D-2212-CPT-3-BG	X								
SEALANT, CLEAR EXTERIOR WINDOW / Room 6 Exterior Wi	D-2212-S-3-BJ	X								
COVE BASE WITH MASTIC, BLACK / Conference Room	D-2212-MISC-3-T	X								
ACOUSTICAL COATING, WHITE / Latrine Ceiling	D-2212-AC-3-EH	X								
VINYL FLOORING WITH MASTIC, WHITE WITH BEIGE SPE	D-2212-MISC-3-FY	X								
ACOUSTICAL COATING, WHITE / Rm 5 Ceiling	D-2212-AC-4-EH	X								
ACOUSTICAL COATING, WHITE / Rm 6 Ceiling	D-2212-AC-5-EH	X								

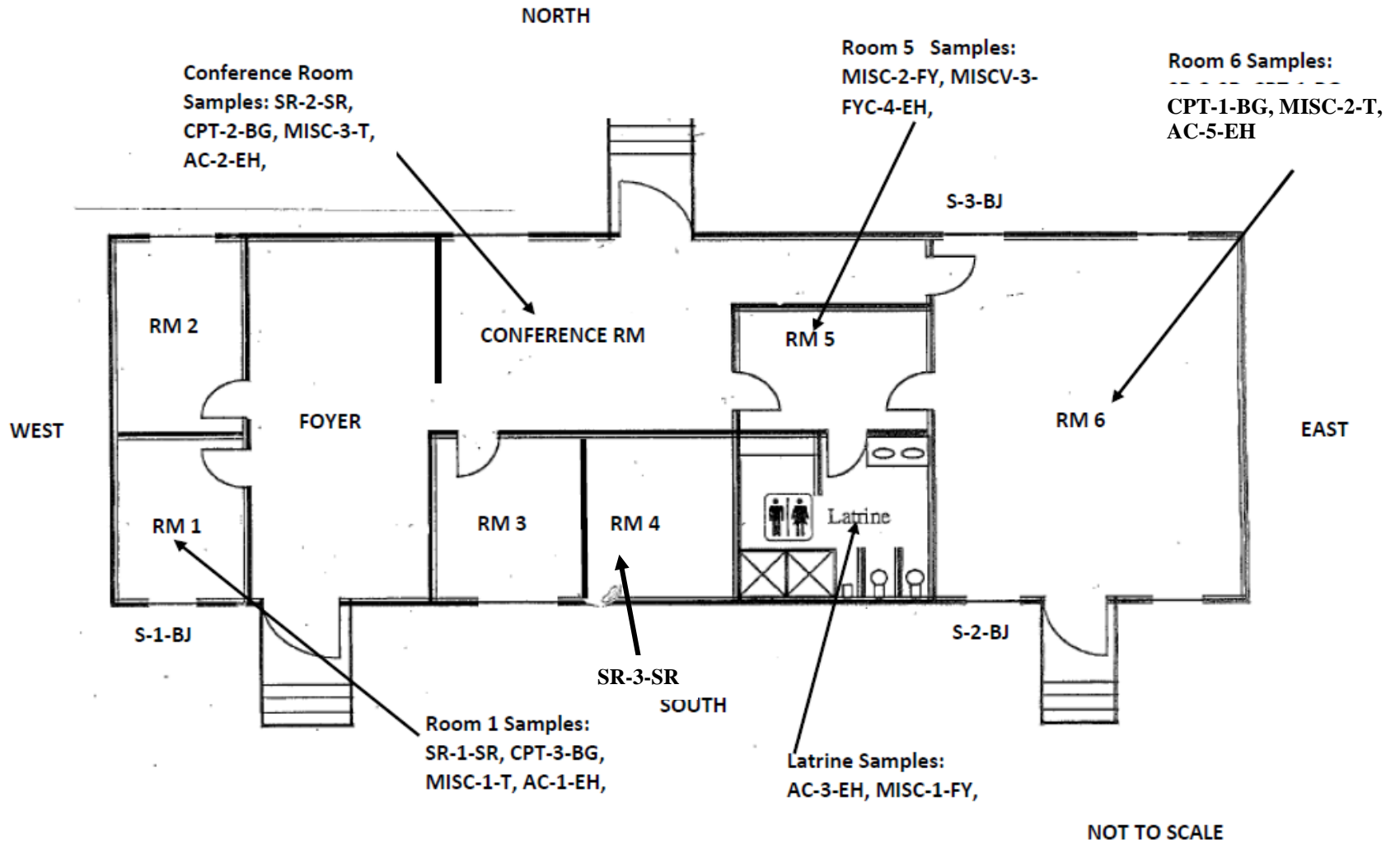
REMARKS:
 Samples will be disposed of 30 days after analysis, unless otherwise requested.

Relinquished By: *David Kent* Date/Time: *2-7-18 9:17 pm* Received By: _____ Date/Time: _____
 Relinquished By: _____ Date/Time: _____ Received By: _____ Date/Time: _____

Sample Locations

BLDG D-2212
DATE FEB 2, 2018

SAMPLE LOCATIONS



Accreditations



North Carolina Department of Health and Human Services

Division of Public Health

Roy Cooper
Governor

Mandy Cohen, MD, MPH
Secretary
Daniel Stanley
Director

April 4, 2017

Damita Y Reed
1966 Fair Forest Dr
Fayetteville, NC 28304

Dear Ms. Reed:

Based upon the review of your accreditation application, the Health Hazards Control Unit (HHCU) has determined that you have fulfilled the requirements and are eligible for asbestos accreditation as a(n) INSPECTOR. Your assigned North Carolina accreditation number is 11844, which is reflected on your enclosed North Carolina Accreditation card. Please be sure to take this card with you to any asbestos work site where you are employed. The State requires that all persons conducting asbestos abatement or asbestos management activities be accredited and have their identification card on site.

Your North Carolina Inspector accreditation will expire on FEBRUARY 28, 2018. It is NOT the policy of the HHCU to issue renewal notices. If you wish to continue working as a(n) Inspector after this expiration date, you must successfully complete the required training and submit a completed application to this office prior to February 28, 2018. If you should continue to perform asbestos management activities as a(n) Inspector without a valid North Carolina accreditation, you will be in violation of State regulations and may be cited for noncompliance.

**North Carolina
Asbestos Accreditation**

EXPIRATION			
02-28-2018			
DOB	SEX	HT	WT
04-06-1954	F	5'4"	185
CLASS	#	EXP	
INSPECTOR	11844	02-18	

Damita Y Reed
1966 Fair Forest Dr
Fayetteville, NC 28304
115318

Sincerely,

Ed Norman
Program Manager
Health Hazards Control Unit

Enclosure

Location: 5505 Six Forks Road, Raleigh, NC 27609 | Mailing Address: 1912 Mail Service Center, Raleigh, NC 27699-1912

919-707-5950 T | 919-870-4808 F

An Equal Opportunity / Affirmative Action Employer



United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200671-0

EMSL Analytical, Inc.
Morrisville, NC

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:*

Asbestos Fiber Analysis

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2017-04-01 through 2018-03-31
Effective Dates



Dana S. Laman
For the National Voluntary Laboratory Accreditation Program



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EMSL Analytical, Inc.
2500 Gateway Centre, Ste. 600
Morrisville, NC 27560
Ms. Essie Spencer
Phone: 919-465-3900 Fax: 919-465-3950
Email: espencer@emsl.com
<http://www.emsl.com>

ASBESTOS FIBER ANALYSIS

NVLAP LAB CODE 200671-0

Bulk Asbestos Analysis

<u>Code</u>	<u>Description</u>
18/A01	EPA 600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples
18/A03	EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials

Airborne Asbestos Analysis

<u>Code</u>	<u>Description</u>
18/A02	U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.

For the National Voluntary Laboratory Accreditation Program

MEMORANDUM FOR RECORD

SUBJECT: Record of Environmental Consideration, PN-81165, Construct Special Operations Forces Human Performance Training Center

1. Brief Description: The proposed project will construct a multi-story human performance training center to include: administrative areas; cardio/strength/nutrition training areas; physical/hydro therapy; cognitive performance areas; adaptability training areas; and shower/locker space. The proposed facility will also include: fire detection and suppression; unclassified and classified communications networks; intrusion detection, surveillance, and electronic access control. Supporting facilities include all related site-work and utilities; parking; curb, gutter, and sidewalks; an emergency generator; storm drainage; and landscaping. This project will also include the demolition of Buildings D-2212, D-2211, D-2113, D-2111, D-1911, D-1910, D-1713, D-1611, D-1610, D-1511, D-1412, and D-1209. The proposed project is located on Gruber Road, Fort Bragg, North Carolina. See Enclosure 1.

2. Anticipated date and/or duration of proposed action: FY20

3. Reason for using a Record of Environmental Consideration (choose one):

a. (X) Is adequately covered in programmatic environmental assessment (PEA) entitled *United States Army John F. Kennedy Special Warfare Center and School Campus Master Plan*, final finding of no significant impact dated May 30, 2014 (Enclosure 2). The proposed project is mentioned on Pages 2 and 5, and approximate footprint is shown on Figure 1-1 of the PEA (Enclosure 3).

b. (X) Is categorically excluded under 32 CFR § 651, Appendix B, Section II, Categorical Exclusion (c)(2), as described in 32 CFR 651.29(a). The demolition of Buildings D-2212, D-2211, D-2113, D-2111, and D-1910 were mentioned as future actions in the 2014 PEA, however the list of buildings to be demolished as part of PN-81165 has changed since the final FNSI was signed. This REC covers the demolition of all 12 buildings.

4. Based on the inspection, sampling, and laboratory results, asbestos is present in Buildings D-2113, D-2111, D-1911, D-1910, D-1713, and D-1412. Buildings D-2212, D-2211, D-1611, D-1610, D-1511 and D-1209 did not contain asbestos. All of the surveys are attached as Enclosure 4. A North Carolina (NC) certified asbestos abatement contractor will perform abatement prior to any work occurring on any asbestos-containing materials (ACM), per NC Administrative Code Chapter 10-A Subchapter 41C - Occupational Health Section 0600 - Asbestos Hazard Management Program. All abated ACM will be handled and disposed of per 40 CFR, Chapter 61, Subpart M National Emission Standard for Asbestos.

IMBG-PWE

SUBJECT: Record of Environmental Consideration, PN-81165, Construct Special Operations Forces Human Performance Training Center

5. Facility renovation, maintenance, demolition, and/or painting have the potential for lead based paint (LBP) disturbance. All work will be done in accordance with Occupational Safety and Health Administration standards (29 CFR 1926.62). A toxicity characteristic leaching procedure (TCLP) will be performed to determine proper disposal methods if LBP is removed from any painted surface prior to disposal. The TCLP results will be provided to the Hazardous Waste Program Manager. The Hazardous Waste Program Manager will sign all manifests for LBP waste prior to disposal by the contractor.

6. The proposed project is located adjacent to the USAJFKSWCS Historic District. Fort Bragg consulted with the State Historic Preservation Office on the USAJFKSWCS campus master plan (which included PN-81165) in 2012, and concurrence was received on May 22, 2012 (Enclosure 5). Based on the designs, the proposed construction, demolition, and landscaping plans for PN-81165 will not result in adverse effects to the USAJFKSWCS Historic District. The project is clear for cultural resources.

7. Potential impacts to environmentally sensitive resources have been resolved. There are no extraordinary circumstances as described in 32 CFR 651.29(b)(1-14) that preclude the use of a categorical exclusion.

Prepared by:



LISA GUNDLACH
NEPA Analyst

Reviewed by

JONES.ROBERT.A
LAN.1542350756

Digitally signed by
JONES.ROBERT.ALAN.15423507
56
Date: 2020.01.10 05:34:22
-05'00'

ROBERT A. JONES
Captain, JA
Environmental Law Attorney

Reviewed by:



DAVID A. HEINS
Chief, Environmental Division

Proponent:

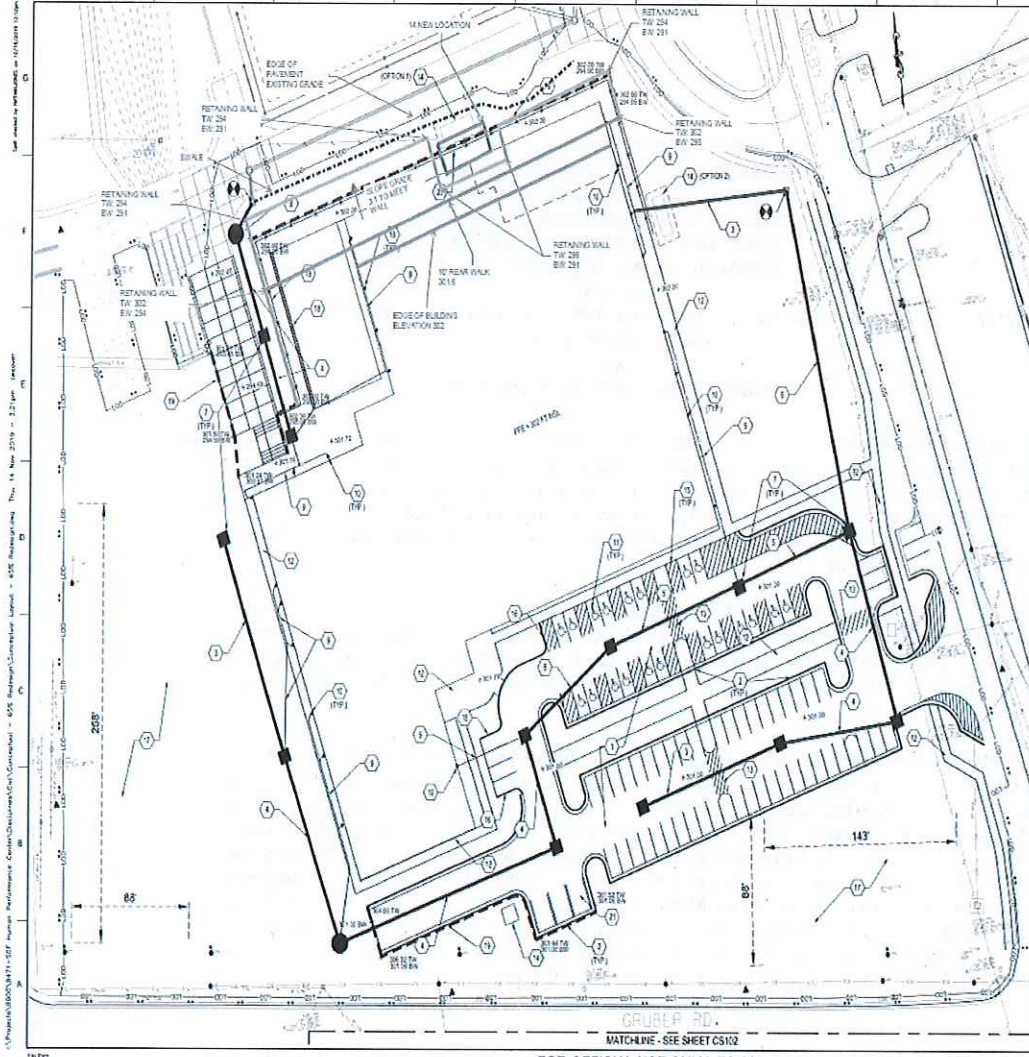

for MONICA A. STEPHENSON

Director of Public Works

Date: 13 January 2020

5 Encls

Enclosure 1



GENERAL NOTES

- 1 ALL DIMENSIONS ARE TO THE EDGE OF PAVEMENT OR EDGE OF CURB AS INDICATED
- 2 BACKGROUND FEATURES SHOWN OUTSIDE OF THE PROJECT LIMITS ARE FROM THE UNDERPLANS PROVIDED BY USACE SAVANNAH DISTRICT

SHEET KEYNOTES

- 1 ASPHALT PAVEMENT
- 2 CURB AND GUTTER
- 3 18" STORM SEWER
- 4 18" STORM SEWER
- 5 24" STORM SEWER
- 6 24" STORM SEWER
- 7 DISPLAY
- 8 STORM SEWER MANHOLE
- 9 ROOF DRAIN
- 10 CURB/OUT-ROCK DRAIN
- 11 ADA PARKING SPACE AND SIGN
- 12 CONCRETE SIDEWALK
- 13 SIDEWALK
- 14 CONCRETE EQUIPMENT PAD
- 15 VEH ACCESSIBLE SPACE
- 16 CURB TROUSERTON
- 17 TURF FELD SIGN OPTION
- 18 FRENCH DRAIN
- 19 RETAINING WALL
- 20 HANDBALL
- 21 CLAMPER PAD

ASSUME CUT QUANTITY OF 10,000 CY

PARKING SUMMARY

STANDARD	50
MOTORCYCLE	0
ADA	20
TOTAL	70

GRAPHIC SCALE(S)



US Army Corps of Engineers

FOR OFFICIAL USE ONLY (FOUO)

CS101

FOR OFFICIAL USE ONLY (FOUO)

65% SUBMITTAL - OCTOBER 18, 2019

Enclosure 2

DEPARTMENT OF THE ARMY
DIRECTORATE OF PUBLIC WORKS
FORT BRAGG GARRISON COMMAND
INSTALLATION MANAGEMENT COMMAND
FORT BRAGG, NORTH CAROLINA
FINAL FINDING OF NO SIGNIFICANT IMPACT

for the
UNITED STATES ARMY JOHN F. KENNEDY SPECIAL WARFARE CENTER AND SCHOOL
CAMPUS MASTER PLAN
at
FORT BRAGG, NORTH CAROLINA

1. **Proposed Action.** Fort Bragg proposes to modernize and upgrade the United States Army John F. Kennedy Special Warfare Center and School Campus in support of the Special Operations Forces training mission. The proposed master plan overhauls existing training and administrative facilities to better suit both current and future mission requirements.

2. **Anticipated Environmental Impacts.** For the two alternatives assessed fully in this Programmatic Environmental Assessment (PEA), the analyses found only non-significant impacts on cultural resources, water resources (including stormwater management), and cumulative effects.

3. **Public Review and Interagency Coordination.** The PEA and draft Finding of No Significant Impact (FNSI) were made available to the public for a 30-day review period from April 5, 2014, to May 5, 2014. Written comments and questions about the PEA and its analyses were directed to: Ms. Leslie Stewart, National Environmental Policy Act (NEPA) Analyst, United States Army Installation Management Command, Headquarters, United States Army Garrison, Fort Bragg, 2175 Reilly Road, Stop A, Fort Bragg, North Carolina (NC) 28310. Ms. Stewart was also available for questions regarding the PEA by phone at (910) 643-6741 and by email at leslie.l.stewart4.ctr@mail.mil.

Copies of the PEA were provided for review at <http://www.bragg.army.mil/directorates/dpw/envdiv/emb/Pages/NEPA.aspx> and at the following locations:


Cumberland County Library, 300 Maiden Lane, Fayetteville, NC 28301.

John L. Throckmorton Library, Building 1-3346, Randolph Street, Fort Bragg, NC 28310.

Fort Bragg did not receive any comments from the general public. Standard comments were received from the state and federal agencies (See Enclosure).

4. **Conclusion.** The PEA was prepared in accordance with the National Environmental Policy Act (NEPA); (40 Code of Federal Regulations (CFR)

1500 et seq.); the Council on Environmental Quality regulations; and Environmental Analysis of Army Actions (32 CFR Part 651). Based on a review of the information contained in the PEA, I have determined that the proposed action to modernize and upgrade the USAJFKSWCS campus will not have a significant impact on the quality of the human or natural environment on the Installation or in nearby communities; the action will not constitute a major federal action or generate a significant controversy. Therefore, the preparation of an environmental impact statement is not required and this FNSI is appropriate. This decision complies with legal requirements and has been made after taking into account all submitted information and considering a full range of reasonable alternatives.


JEFFREY M. SANBORN

COL, FA
Commanding

Date: 30 Aug 14

Enclosure



North Carolina
Department of Administration

Pat McCrory, Governor

Bill Daughtridge, Jr., Secretary

May 7, 2014

Ms. Leslie Stewart
Department of the Army
Fort Bragg - Directorate of Public Works
ATTN: IMBG-PWE-M
1137 Reilly Road, Bldg 3
Fort Bragg, North Carolina 28310

Re: SCH File # 14-E-0000-0413; EA/FONSI; Proposed project is for the US Army John F. Kennedy Special Warfare Center and School Campus Master Plan at Fort Bragg. Project will overhaul existing training and administrative facilities.

Dear Ms. Stewart:

The above referenced environmental impact information has been submitted to the State Clearinghouse under the provisions of the National Environmental Policy Act. According to G.S. 113A-10, when a state agency is required to prepare an environmental document under the provisions of federal law, the environmental document meets the provisions of the State Environmental Policy Act. Attached to this letter for your consideration are the comments made by agencies in the course of this review.

If any further environmental review documents are prepared for this project, they should be forwarded to this office for intergovernmental review.

Should you have any questions, please do not hesitate to call.

Sincerely,

Crystal Best
Crystal Best
State Environmental Review Clearinghouse

Attachments

cc: Region M

Mailing Address:
1301 Mail Service Center
Raleigh, NC 27609-1301

Telephone: 919/807-2423
Fax: 919/733-9531
State Courier: 919-01-50
e-mail: state_clearinghouse@desa.nc.gov

Location Address:
116 West Jones Street
Raleigh, North Carolina

In Equal Opportunity: Affirmative Action Employer

FNSI-3



North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

John E. Skvarla, III
Secretary

MEMORANDUM

TO: Crystal Best
State Clearinghouse

FROM: Lyn Hardison *Lyn Hardison*
Division of Environmental Assistance and Customer Service
Permit Assistance & Project Review Coordinator

RE: 14-0413
Environmental Assessment/Finding of No Significant Impact
Proposed project is for the US Army John F. Kennedy Special Warfare Center and School
Campus Master Plan at Fort Bragg to include an overhaul of existing training and
administrative facilities
Cumberland County

Date: May 1, 2014

The Department of Environment and Natural Resources has completed its review of the proposal for the referenced project. Based on the information provided, our agencies have identified permits that may be required and offered some suggestions. The comments are attached for the applicant's consideration.

The Department agencies will continue to be available to assist the applicant through the environmental review and permitting processes.

Thank you for the opportunity to respond.

Attachments:



North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

John E. Skwarla, III
Secretary

April 28, 2014

To: Dexter Matthews, Director
Division of Waste Management

Through: Mike Williford, Head, Compliance Branch *MW*
Hazardous Waste Section

From: Jenny Patterson, Eastern Region Supervisor, Compliance Branch *Jenny Patterson*
Hazardous Waste Section

Subject: Hazardous Waste Section Comments on renovation of US Army John F. Kennedy Special Warfare Center and School Campus Master Plan at Fort Bragg - Cumberland County
SEPA Review: Project 14-0413

The Hazardous Waste Section (HWS) has reviewed the subject Environmental Assessment and Finding of No Significant Impact for the proposed project to modernize and upgrade the United States Army John F. Kennedy Special Warfare Center and School Campus in support of the Special Operations Forces training mission. The proposed master plan overhauls existing training and administrative facilities located at Fort Bragg in Cumberland County.

Any hazardous waste generated from the construction, demolition, maintenance, operation and/or remediation created by the project must be managed in accordance with the North Carolina Hazardous Waste Rules. If construction, demolition, maintenance, operation and/or remediation occur, the waste that is generated will most likely be a solid waste, and the facility must determine if the waste is a hazardous waste.

Fort Bragg has notified the Hazardous Waste Section as a large quantity generator of hazardous waste operating under the EPA identification number NC8210020121. The proposed project is located within the boundaries of the property and may operate under the same EPA identification number.

The HWS has no objection to this proposed project. However, this opinion does not, in any way, preclude the possibility of historical waste management activities at this site that may have contributed to contamination unknown to this office.

Should any questions arise, please contact me at 336-767-0031.

1346 Vail Avenue, Raleigh, North Carolina 27699-1143
Phone: 919-737-1200; TDD: 919-737-1200
Fax: 919-737-1200; Email: ncdemr@ncdenr.gov



North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

John E. Skvarla, III
Secretary

Date: April 28, 2014

To: Dexter Matthews, Director
Division of Waste Management

From: Pete Doorn, Special Remediation Branch Head *Pete Doorn*

Subj: SEPA Project #14-0413 Proposed Upgrades to the JFK Special Warfare Center & School Campus, Fort Bragg, Cumberland County, NC

A review of the proximity of the Proposed Upgrades to the JFK Special Warfare Center & School Campus Project to CERCLIS and other sites under the jurisdiction of the Superfund Section has been completed. The proposed projects identified within the campus master plan include demolition of 19 structures and subsequent construction of (i) a 4-story language & cultural center and supporting facilities; (ii) construction of a multi-story training command group headquarters and supporting facilities; and (iii) future construction of a rehabilitation center, intelligence training facility, and two parking structures (see attached Figures 1-1 and 1-2).

Four on-base contaminant sources/sites were identified within a 1-mile radius of the Proposed Upgrades to the JFKSWCS Campus Project as listed below and shown on the attached Map 1. While it is not expected that the identified sites will affect the proposed project (or vice versa), it is recommended that site files be reviewed to ensure that any potential health and safety risks are appropriately addressed. Records pertaining to on-base contaminant sources/sites are available through the Directorate of Public Works at Fort Bragg, NC. Please contact me at 919.707.8369 if you have any questions.

Site Name	ID #	Program	Estimated Distance	Dir. from SEPA Proj.	Status
On-Base Sites					
SWMU 1	Fort Bragg	FRB/DoD	0.1 mi	SW	Site is a former unlined solid waste landfill; long-term monitoring is ongoing
SWMU 9	Fort Bragg	FRB/DoD	0.8 mi	NE	Site is a former unlined landfill; long-term monitoring is ongoing
SWMU 8B	Fort Bragg	FRB/DoD	0.9 mi	NE	Site is a former unlined landfill; long-term monitoring is ongoing
SWMU 8C	Fort Bragg	FRB/DoD	1.0 mi	ENE	Site is a former unlined landfill; long-term monitoring is ongoing

Cc: Jim Bateson

1166 Mail Service Center, Raleigh, North Carolina 27609-1616
Phone: 919.707.8200 Internet: <http://portal.ncdenr.org/ncdenr>
For Field Operations: fieldops@ncdenr.gov - All other questions go to ncdenr@ncdenr.gov

Figure 1-1: Proposed USAJFKSWCS Campus Master Plan

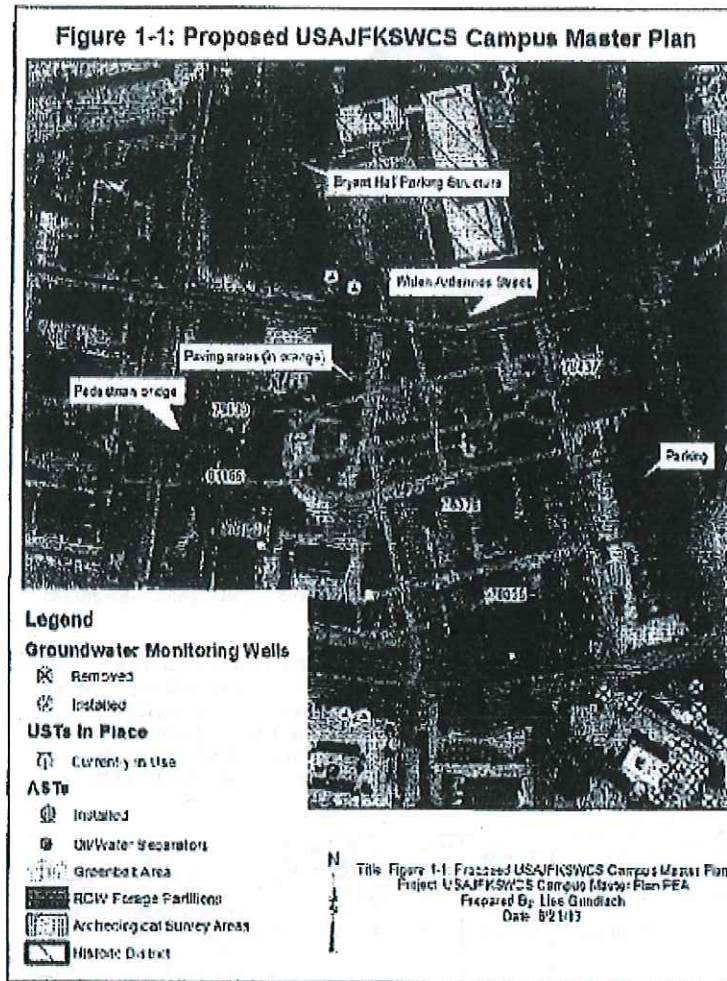
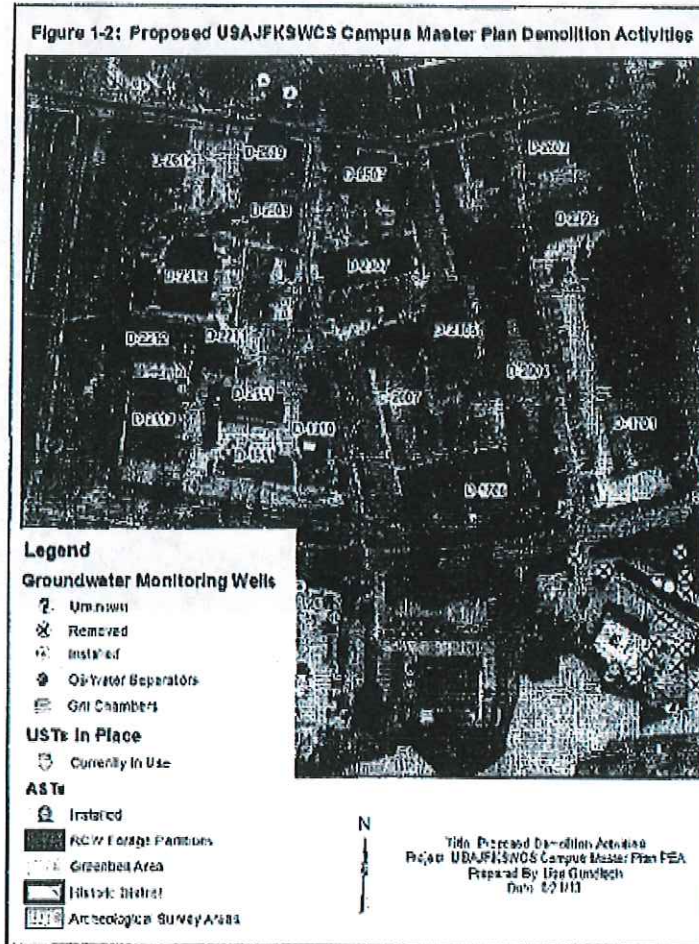


Figure 1-2: Proposed USAJFKSWCS Campus Master Plan Demolition Activities



Map 1. Superfund Sites Identified within 1-Mile Radius of SICFA Project #14-0413, Proposed Upgrade to the US Army JPR Special Warfare Center & School Campus, Fort Bragg, NC. Note: Site locations are estimated based on the best available information.





North Carolina Department of Environment and Natural Resources
Division of Waste Management

Pat McCrory
Governor

John E. Skvarla, III
Secretary

MEMORANDUM

TO: Kathleen Lance, Administrative Assistant
Division of Waste Management

FROM: Dennis Shackelford, Eastern District Supervisor *D.S.*
Solid Waste Section

DATE: April 24, 2014

SUBJECT: SEPA Reylew - Project Number: 14-0413, Cumberland County, NC
US Army John F. Kennedy Special Warfare Center and School Campus Master Plan

The Solid Waste Section has reviewed the project for the US Army John F. Kennedy Special Warfare Center and School Campus Master Plan at Fort Bragg. The project will overhaul existing training and administrative facilities. The review has been completed and has seen no adverse impact on the surrounding community and likewise knows of no situations in the community, which would affect this project.

During construction, The Department of The Army should make every feasible effort to minimize the generation of waste, to recycle materials for which viable markets exist, and to use recycled products and materials in the development of this project where suitable. Any waste generated by this project that cannot be beneficially reused or recycled must be disposed of at a solid waste management facility permitted by the Division. The Division strongly recommends that the Department of the Army require the contractors to provide proof of proper disposal for all waste generated in the form of disposal tickets. The nearest permitted facility to the project is the Fort Bragg Construction and Demolition Landfill, Permit number 2608-CDLF-1998. Additional facilities near this project are the Cumberland County Municipal Solid Waste Landfill, Permit 2601-MSWLF-1997 and the Cumberland County Construction and Demolition Landfill, Permit Number 2601-CDLF-1997.

Questions regarding solid waste management should be directed to Mr. Drew Hammonds, Environmental Senior Specialist, Solid Waste Section, at (910-433-3350).

cc: Michel Scott, Solid Waste Section Chief
Jason Watkins, Western District Supervisor
Andrew Hammonds, Environmental Senior Specialist

225 Green Street, Fayetteville, North Carolina 28301
Phone: 910-433-3340 | Telefax: 910/433-3340 | www.ncdenr.gov/web/ncdenr

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State of North Carolina
Department of Environment and Natural Resources

Reviewing Office: ERO

INTERGOVERNMENTAL REVIEW - PROJECT COMMENTS

Project Number: 14-0413 Date Date: 4-30-14

All reviews of this project shall be completed by the ERO, permittees and regulatory agencies may be included in order for a project to comply with NCAT. Certain laws, codes and regulations must be added to the Regulatory Office indicated on the permit if the Agency, its application, information and guidelines related to that laws and permits are available from the same Regulatory Office.

PERMITS	SPECIAL APPLICATION PROCEDURES or REQUIREMENTS	Normal Process Time (Business Days)
[U] Permit to install & operate stormwater treatment facility in storm water treatment & control system not discharging into surface waters.	Application fee (see below) to be submitted with application. Post application technical conference call.	30 days (30 days)
[L] NPDES permit to discharge into surface waters under permit to discharge into surface waters.	Application fee (see below) to be submitted with application. Pre-application conference call. NPDES permit to discharge into surface waters.	20-30 days (30 days)
[L] Water Use Permit	Pre-application technical conference call necessary.	30 days (30 days)
[L] Water Construction Permit	Complete application must be received and permit issued prior to construction of a well.	7 days (7 days)
[L] Dredge and Fill Permit	Application fee must be received on each adjacent permit property owner. Complete application for application permit to be received. Pre-application conference call. Pre-application conference call. Pre-application conference call.	30 days (30 days)
[L] Permit to construct & operate Air Pollution Abatement Facility in accordance with Section 17 A NCAC (17A 0100.000-020.020)	Application must be submitted and permit received prior to construction and operation of the source. If a permit is required for the source, the permit must be received prior to construction of the source.	30 days
[L] Permit to construct & operate Water Pollution Control Facility as per 17 A NCAC (20.0400.100-020.020)	Application must be submitted at least 30 days prior to construction and installation of the facility.	30 days
[L] Any other existing structure with subject to permit must be in compliance with 17 A NCAC 20.0500		
[L] In addition to the requirements of the above, a building system installed must be in compliance with 17 A NCAC 20.1100(a)(1) as all structures not fully installed must be in compliance with 17 A NCAC 20.1100(a)(1).	N/A	60 days (60 days)
[L] Concrete Storm Water Collection System 17 A NCAC 20.0500		
[L] The Submittal Permit on Central Act of 1973 must be properly addressed for any land disturbing activity. A subdivision and construction permit is not required unless a construction plan filed with proper Regional Director (Lead Quality Section) is filed 30 days before beginning construction. A fee of \$65 for the duration of any part of the year. An extension is available with additional fees.		20 days (20 days)
[L] Stormwater management system must be installed in accordance with MCDOT approved program. Permittee must submit to design and construction of application parameters and monitoring devices as well as stormwater control system and plan.		30 days (30 days)
[L] Mining Permit	On-site inspection and survey by the ERO field office must be completed with appropriate notices of affected land. Any other necessary permits must be obtained. The application fee must be received before the permit can be issued.	30 days (30 days)
[L] North Carolina Damaging Permit	On-site inspection by ERO Division Field Office is required within 4 days.	1 day (1 day)
[L] Special Cases Damaging Permit Form 1-22 contact to obtain NC with organic soils	On-site inspection by ERO Division Field Office is required to insure that the area of proposed clearing activities involves inspection and be completed at least 10 days before actual work is planned.	1 day (1 day)
[L] Oil Refueling Facilities	N/A	90-110 days (90-110 days)
[L] Data Safety Forms	If permit required application 60 days before beginning construction. Applicant must file NC qualified engineer to prepare plan, report construction, and be compliant with existing ENR approved plan. If the applicant is not in compliance with the permit, the permit will be suspended. The permit will be suspended if the applicant is not in compliance with the permit. The permit will be suspended if the applicant is not in compliance with the permit.	30 days (30 days)

PERMITS		SPECIAL APPLICATION PROCEDURES or REQUIREMENTS	Standard Process Time (working time limit)
<input type="checkbox"/>	Permit to Dig (including 10 or gas work)	710 every state of 10,000 with EML, running to limit of NC conditions that they are required by drill operator shall, upon abandonment, be plugged according to RMA rules and regulations.	10 days N/A
<input type="checkbox"/>	Geophysical Exploration Permit	Application filed with EML at least 10 days prior to time of permit. Application by EML. No bonded application fee.	10 days N/A
<input type="checkbox"/>	State Lake Construction Permit	Application for discharge based on previous discharge permit for site construction & disturbance of stream and proof of bank stability of riparian property.	12-20 days N/A
<input type="checkbox"/>	600 Water Quality Certificate	N/A	10 days (120 days)
<input type="checkbox"/>	CAMA Permit for MAROE development	\$150 fee for most necessary applications	15 days (150 days)
<input type="checkbox"/>	CAMA Permit for MBO development	\$50 fee for most necessary applications	25 days (25 days)
<input type="checkbox"/>	Should provide minimum 100' around area on the property. If any area is required to be removed, please call: P.C. Daniels Survey, Inc. 27417 Raleigh, NC 27611		
<input type="checkbox"/>	Abandonment of any well, if required must be in accordance with Title 15A, Subchapter 2C, 0100.		
<input type="checkbox"/>	Notification of the water regional office is required if "topher" is proposed on projects (MSW) in discharge during any excavation operation.		
<input type="checkbox"/>	Compliance with 15A NCAC 21C 1000 (Consolidated Stormwater) is required.		45 days (150)
<input type="checkbox"/>	Yard and/or Storm Water Pollution Prevention Plan required.		
<input type="checkbox"/>	Plans and/or Section for site construction, especially, when there is a job is not approved by the Division of Water Resources/Facility Water Supply Section prior to the start of construction. 15A NCAC 15C 0300 et seq. Plans and specifications should be submitted to 1674 Main Service Center, Raleigh, North Carolina 27609-1674. Call 919-970-3100 for more information. For more information, contact the Facility Water Supply Section, (919) 970-3100.		30 days
<input type="checkbox"/>	Washing water lines will be installed during the construction, plans for the water line relocation work to be submitted to the Division of Water Resources/Facility Water Supply Section at 1674 Main Service Center, Raleigh, North Carolina 27609-1674. For more information, contact the Facility Water Supply Section, (919) 970-3100.		30 days
<input type="checkbox"/>	Other resources (for more information please call or contact the water supply section at 919-970-3100)		

REGIONAL OFFICES

Questions regarding these permits should be addressed to the Regional Office marked below.

Asheville Regional Office
2090 US Highway 70
Swannanoa, NC 28778
(828) 296-4500

Mooresville Regional Office
610 East Center Avenue, Suite 301
Mooresville, NC 28115
(704) 663-1599

Wilmington Regional Office
127 Cardinal Drive Extension
Wilmington, NC 28403
(910) 798-7215

Fayetteville Regional Office
225 North Green Street, Suite 714
Fayetteville, NC 28501-5041
(910) 413-3100

Raleigh Regional Office
3800 Barrett Drive, Suite 101
Raleigh, NC 27609
(919) 791-4200

Winston-Salem Regional Office
585 Woughtown Street
Winston-Salem, NC 27107
(336) 771-5000

Washington Regional Office
943 Washington Square Mall
Washington, NC 27889
(252) 946-6481

For governmental use: Section 2013

NORTH CAROLINA STATE CLEARINGHOUSE
DEPARTMENT OF ADMINISTRATION
INTERGOVERNMENTAL REVIEW

Dominique Boyd

COUNTY: CUMBERLAND

007: MILITARY ACTIVITIES
(TRAINING, FLIGHT ROUTES,
BASE EXPANSIONS)

STATE NUMBER: 14-E-0000-041
DATE RECEIVED: 04/04/2014
AGENCY RESPONSE: 04/30/2014
REVIEW CLOSED: 05/05/2014

MS CARRIE ATKINSON
CLEARINGHOUSE COORDINATOR
DEPT OF TRANSPORTATION
STATEWIDE PLANNING - MDC #1554
RALPHIGH NC

REVIEW DISTRIBUTION
COLEP - DIV OF EMERGENCY MANAGEMENT
DEPT LEGISLATIVE AFFAIRS
DEPT OF CULTURAL RESOURCES
DEPT OF TRANSPORTATION
MID CAROLINA COG

PROJECT INFORMATION
APPLICANT: Department of the Army
TYPE: National Environmental Policy Act
Environmental Assessment/Finding of No Significant Impact

DESC: Proposed project is for the US Army John F. Kennedy Special Warfare Center and School Campus Matur Plan at Fort Bragg. Project will overhaul existing training and administrative facilities.

The attached project has been submitted to the N. C. State Clearinghouse for intergovernmental review. Please review and submit your response by the above indicated date to 1301 Mail Service Center, Raleigh NC 27699-1301.

If additional review time is needed, please contact this office at (919)907-2425.

AS A RESULT OF THIS REVIEW THE FOLLOWING IS SUBMITTED: NO COMMENT COMMENTS ATTACHED

SIGNED BY: *Dominique Boyd*

DATE: 4/21/14



NORTH CAROLINA STATE CLEARINGHOUSE
DEPARTMENT OF ADMINISTRATION
INTERGOVERNMENTAL REVIEW

COUNTY: CUMBERLAND

007: MILITARY ACTIVITIES
TRAINING, FLIGHT ROUTES,
BASE EXPANSIONS

STATE NUMBER: 14-R-0000-0413
DATE RECEIVED: 04/04/2014
AGENCY RESPONSE: 04/30/2014
REVIEW CLOSED: 05/05/2014

MS CAROLYN BENNY
CLEARINGHOUSE COORDINATOR
CC&PS - DIV OF EMERGENCY MANAGEMENT
FLOODPLAIN MANAGEMENT PROGRAM
MSC # 4719
RALEIGH NC

REVIEW DISTRIBUTION

CC&PS - DIV OF EMERGENCY MANAGEMENT
DHNR LEGISLATIVE AFFAIRS
DEPT OF CULTURAL RESOURCES
DEPT OF TRANSPORTATION
MID CAROLINA COG

PROJECT INFORMATION

APPLICANT: Department of the Army
TYPE: National Environmental Policy Act
Environmental Assessment/Finding of No Significant Impact

DESC: Proposed project is for the US Army John F. Kennedy Special Warfare Center and School Campus Master Plan at Fort Bragg. Project will overhaul existing training and administrative facilities.

The attached project has been submitted to the N. C. State Clearinghouse for intergovernmental review. Please review and submit your response by the above indicated date to 1301 Mail Service Center, Raleigh NC 27699-1301.

If additional review time is needed, please contact this office at (919)807-2425.

AS A RESULT OF THIS REVIEW THE FOLLOWING IS SUBMITTED: NO COMMENT COMMENTS ATTACHED

SIGNED BY:

Daniel Halong

DATE:

4/8/14

Ensure project comply with Executive Order 13588



Enclosure 3

Personnel working at this facility will utilize the existing parking lot located across Ardennes and Zabitosky Roads.

Several other projects are also projected to be constructed in the future as part of the modernization and upgrade of the USAJFKSWCS campus. This programmatic environmental assessment (PEA) will include the approximate proposed locations of these projects within the campus master plan. These projects include: PN 81165 (SOF Rehabilitation Facility); PN 79439 (SOF Intelligence Training Facility); PN 78005 (SOF Parking Structure); and a Bryant Hall Parking Structure (currently no PN or funding year associated). Demolition required under these future projects involves Buildings D-2612, D-1910, D-2111D-2113, D-2509, D-2609, D-1701, D-2211, D-2212, and D-2312.

1.0.1 When will the project be executed? Project 76376 is a Fiscal Year (FY) 14 project; PN 79437 is a FY15 project; PN 79439 is a FY16 project; and PNs 81165 and 78005 are FY18 projects.

1.1 WHAT IS THE PURPOSE AND NEED FOR THE PROPOSED ACTION?

The goal of these projects is to replace dilapidated facilities with modernized structures and infrastructure to support the SOF training mission at Fort Bragg.

1.2 WHAT IS THE DECISION TO BE MADE?

The proponent for the proposed action is the Garrison Commander of the Installation who decides which alternative best meets the purpose and need of the proposed action, including location, mitigation, configuration, and supporting infrastructure.

1.3 WHAT IS THE SCOPING AND PUBLIC INVOLVEMENT PROCESS?

This PEA was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 [42 United States Code (USC) 4321 et seq.], Council on Environmental Quality (CEQ) Regulations 40 Code of Federal Regulations (CFR) Parts 1500-1508, and Army Regulations (ARs) 32 CFR Part 651 (Environmental Analysis of Army Actions). This PEA will evaluate the potential impacts of the proposed project, including a determination of a finding of no significant impact (FNSI) or a Notice of Intent to prepare an Environmental Impact Statement (EIS). Pursuant to 32 CFR Part 651, this PEA will evaluate the potential environmental impacts of the projects. These actions are based on the best information and data available as of August 2013. Prior to execution of any particular project within the selected alternative, a subsequent NEPA review of the more defined project will be documented in a separate NEPA analysis to confirm the findings of the PEA.

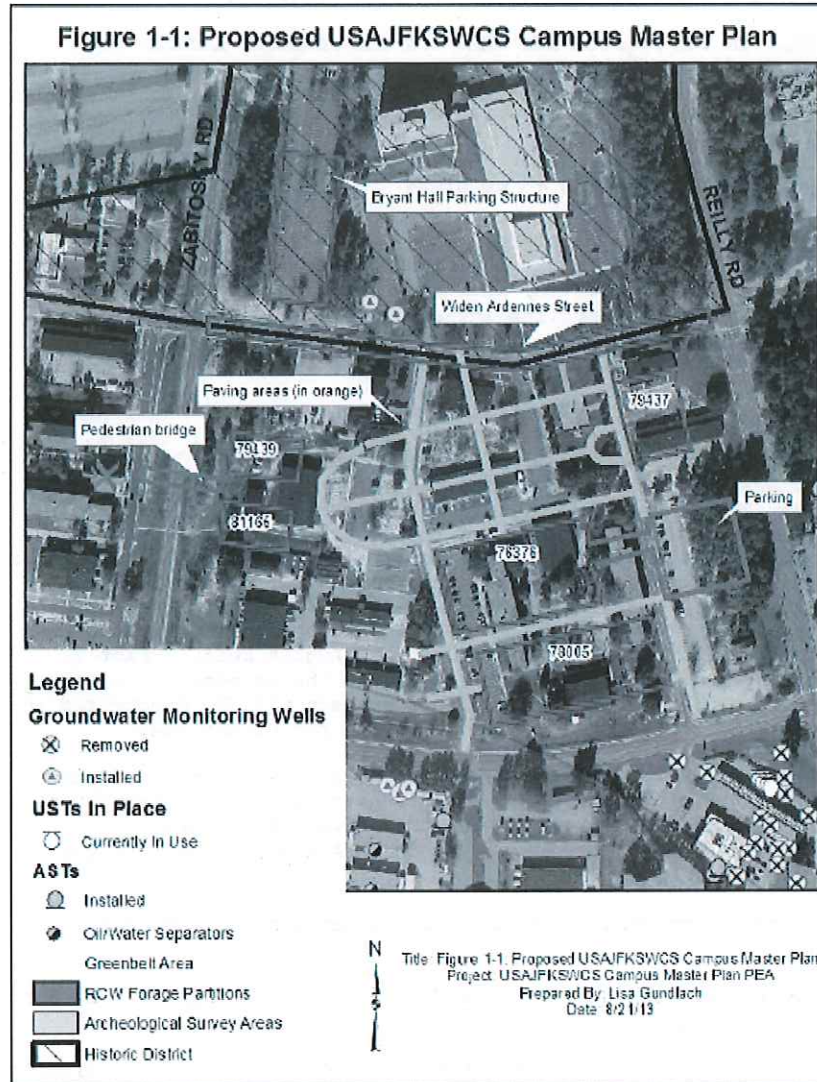
This PEA and draft FNSI will be made available to state and federal agencies (through the North Carolina Department of Administration) and the public for a 30-day review at <http://www.12bragg.army.mil/directorates/dpw/envdiv/emb/Pages/NEPA.aspx>, as well as the following locations:

Cumberland County Public Library, 300 Maiden Lane, Fayetteville, NC 28301.

John L. Throckmorton Library, Building 1-3346, Randolph Street, Fort Bragg, NC 28310.

Written comments and questions about the PEA and FNSI may be directed to Ms. Leslie Stewart, NEPA Analyst, United States Army Installation Management Command, Headquarters, United States Army Garrison, Fort Bragg, 2175 Reilly Road, Stop A, Fort Bragg, NC 28310. Ms. Stewart

Figure 1-1: Proposed USAJFKSWCS Campus Master Plan



Enclosure 4

**Asbestos Table D-2212
Fort Bragg, Building**

MATERIAL		CHARACTERISTICS			ASSESSMENT	
Type	Description/Location/Amount	Asbestos Yes/No/Presumed/ND	Percentage/Type (If ACM)	Friable / Non- Friable	Condition	Disturbance Potential
Misc.	Black Cove Base with Mastic throughout building lower walls/ Approx. 488 Ln. Ft. Total	ND	ND	Non Friable	Damaged	Potential Moderate
Misc.	Blue Commercial Carpet with Mastic throughout building except in the Latrine and Room 5/Approx. 1,000 Sq. Ft.	ND	ND	Non Friable	Damaged	Potential Moderate
Misc.	White Sheetrock Walls throughout building/ Approx. 5,106 Sq. Ft.	ND	ND	Non Friable	Good	Potential Moderate
Misc.	Clear Exterior Sealant around Exterior of Window Frames/ Approx. 84 Ln. Ft.	ND	ND	Non Friable	Damaged	Potential Moderate

Misc.	White Textured Material on Sheetrock Ceilings, throughout building/ Approx. 1,702 Sq. Ft.	ND	ND	Non Friable	Damaged	Potential Moderate
Misc.	White and Beige Vinyl Flooring with Mastic in Latrine and Room 5/ Approx. 160 Sq. Ft.	ND	ND	Non Friable	Good	Potential Moderate

Sq. Ft.-Square Foot, Ln. Ft.-Linear Foot, C. Ft.-cubic Foot
Amounts are estimated, contractor is responsible for exact measurements.

Analytical Report



EMSL Analytical, Inc.
 2500 Gateway Centre Blvd., Suite 600 Morrisville, NC 27560
 Tel/Fax: (919) 465-3900 / (919) 465-3950
 http://www.EMSL.com / raleighlab@emsl.com

EMSL Order: 291708996
 Customer ID: SPEC29
 Customer PO:
 Project ID:

Attention: Bruce Billings
 SpecPro Professional Services, LLC
 3-1137 Bunter Road
 Fort Bragg, NC 28310
 Project: Bldg D-2211, PN63850

Phone: (910) 322-6338
 Fax:
 Received Date: 10/24/2017 10:00 AM
 Analysis Date: 10/24/2017
 Collected Date:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
D-2211-MISC-1-A-Vinyl <small>291708996-0001</small>	Room 5 - Vinyl w/ Mastic, Tan and Gray	Gray/Tan Fibrous Homogeneous	30% Cellulose 10% Glass	60% Non-Fibrous (Other)	None Detected
D-2211-MISC-1-A-Mastic <small>291708996-0001A</small>	Room 5 - Vinyl w/ Mastic, Tan and Gray	Tan Fibrous Homogeneous	3% Cellulose	97% Non-fibrous (Other)	None Detected
D-2211-MISC-1-BN-Cove Base <small>291708996-0002</small>	Room 5 - Cove Base w/ Mastic, Tan	Brown Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2211-MISC-1-BN-Mastic <small>291708996-0002A</small>	Room 5 - Cove Base w/ Mastic, Tan	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2211-FT-1-X-Floor Tile <small>291708996-0003</small>	FT/M, 12" Tan w/ White & Bro	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2211-FT-1-X-Mastic <small>291708996-0003A</small>	FT/M, 12" Tan w/ White & Bro	Black Fibrous Homogeneous	3% Cellulose	97% Non-fibrous (Other)	None Detected
D-2211-CPT-1-CPT-Carpet <small>291708996-0004</small>	Room 5 - Carpet and Mastic (If Applicable)	Various Fibrous Homogeneous	90% Synthetic	10% Non-fibrous (Other)	None Detected
D-2211-CPT-1-CPT-Mastic <small>291708996-0004A</small>	Room 5 - Carpet and Mastic (If Applicable)	Tan Fibrous Homogeneous	5% Cellulose 2% Synthetic	93% Non-fibrous (Other)	None Detected
D-2211-S-1-XH <small>291708996-0005</small>	HVAC Unit #2 - Sealant, Clear Exterior	Clear Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
D-2211-S-1-J <small>291708996-0005</small>	Window-Wall #1 - Sealant, Gray Exterior Window	Gray/White Fibrous Homogeneous	8% Cellulose	92% Non-fibrous (Other)	None Detected
D-2211-MISC-2-A-Vinyl <small>291708996-0007</small>	Room 9 - Vinyl w/ Mastic, Tan and Gray	Gray/Tan Fibrous Homogeneous	30% Cellulose 10% Glass	60% Non-fibrous (Other)	None Detected
D-2211-MISC-2-A-Mastic <small>291708996-0007A</small>	Room 9 - Vinyl w/ Mastic, Tan and Gray	Tan Fibrous Homogeneous	3% Cellulose	97% Non-fibrous (Other)	None Detected
D-2211-MISC-2-BN-Cove Base <small>291708996-0008</small>	Room 9 - Cove Base w/ Mastic, Tan	Brown Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Initial report from: 10/24/2017 17:57:04



EMSL Analytical, Inc.
 2600 Gateway Centre Blvd., Suite 600 Morrisville, NC 27560
 Tel/Fax: (919) 465-3900 / (919) 465-3950
 http://www.EMSL.com / raleighlab@emsl.com

EMSL Order: 291708906
 Customer ID: SPEC29
 Customer PO:
 Project ID:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos % Type
			% Fibrous	% Non-Fibrous	
D-2211-MSC-2-BN-Mastic	Room 9 - Cove Base w/ Mastic, Tan	Tan Fibrous Homogeneous	5% Cellulose	95% Non-Fibrous (Other)	None Detected
29172899-02104					
D-2211-FT-2-X-Floor Tile	FTM, 12" Tan w/ White & Bro	Tan/White Non-Fibrous Homogeneous		100% Non-Fibrous (Other)	None Detected
29172899-02103					
D-2211-FT-2-X-Mastic	FTM, 12" Tan w/ White & Bro	Black Fibrous Homogeneous	2% Cellulose	98% Non-Fibrous (Other)	None Detected
29172899-02104					
D-2211-CPT-3-CPT-Carp	Room 12 - Carpet and Mastic (if Applicable)	Various Fibrous Homogeneous	80% Synthetic	10% Non-Fibrous (Other)	None Detected
29172899-02102					
D-2211-CPT-3-CPT-Mastic	Room 12 - Carpet and Mastic (if Applicable)	Tan Fibrous Homogeneous	2% Cellulose 2% Synthetic	96% Non-Fibrous (Other)	None Detected
29172899-02104					
D-2211-S-2-XH	HVAC Unit #3 - Sealant, Clear Exterior	Clear Non-Fibrous Homogeneous		100% Non-Fibrous (Other)	None Detected
29172899-02117					
D-2211-S-3-J	Window-Wall #1 - Sealant, Gray Exterior Window	Gray Fibrous Homogeneous	5% Cellulose	95% Non-Fibrous (Other)	None Detected
29172899-02102					
D-2211-MSC-3-A-Vinyl	Room 10 - Vinyl w/ Mastic, Tan and Gray	Gray/Tan Fibrous Homogeneous	25% Cellulose 13% Glass	62% Non-Fibrous (Other)	None Detected
29172899-02103					
D-2211-MSC-3-A-Mastic	Room 10 - Vinyl w/ Mastic, Tan and Gray	Yellow Fibrous Homogeneous	2% Cellulose	98% Non-Fibrous (Other)	None Detected
29172899-02104					
D-2211-MSC-3-BN-Cove Base	Room 12 - Cove Base w/ Mastic, Tan	Tan Non-Fibrous Homogeneous		100% Non-Fibrous (Other)	None Detected
29172899-02104					
D-2211-MSC-3-BN-Mastic	Room 12 - Cove Base w/ Mastic, Tan	White Fibrous Homogeneous	3% Cellulose	97% Non-Fibrous (Other)	None Detected
29172899-02104					
D-2211-FT-3-X-Floor Tile	FTM, 12" Tan w/ White & Bro	Brown/Tan/White Non-Fibrous Homogeneous		100% Non-Fibrous (Other)	None Detected
29172899-02102					
D-2211-FT-3-X-Mastic	FTM, 12" Tan w/ White & Bro	Gray/Yellow Fibrous Homogeneous	5% Cellulose	95% Non-Fibrous (Other)	None Detected
29172899-02104					
D-2211-CPT-3-CPT-Carp	Room 9 - Carpet and Mastic (if Applicable)	Various Fibrous Homogeneous	85% Synthetic	15% Non-Fibrous (Other)	None Detected
29172899-02104					
D-2211-CPT-3-CPT-Mastic	Room 9 - Carpet and Mastic (if Applicable)	Yellow Fibrous Homogeneous	2% Cellulose 2% Synthetic	96% Non-Fibrous (Other)	None Detected
29172899-02104					
D-2211-S-3-XH	HVAC Unit #4 - Sealant, Clear Exterior	White/Clear Non-Fibrous Homogeneous		100% Non-Fibrous (Other)	None Detected
29172899-02117					

Initial report from: 10/24/2017 17:57:04

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EMSL Analytical, Inc.
 2600 Gateway Centre Blvd., Suite 600 Morrisville, NC 27560
 Tel/Fax: (919) 465-3900 / (919) 465-3950
 http://www.EMSL.com / raleighlab@emsl.com

EMSL Order: 291708906
 Customer ID: SPEC29
 Customer PO:
 Project ID:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos % Type
			% Fibrous	% Non-Fibrous	
D-2211-S-3-J	Window-Wall #3 - Sealant, Gray Exterior Window	Gray Fibrous Homogeneous	2% Wall/Gelatinite	98% Non-Fibrous (Other)	None Detected
29172899-02118					

Asbestos Containing Materials
Building D-2113

MATERIAL		CHARACTERISTICS			ASSESSMENT	
Sample Type	Homogenous Area Description/Location	% Asbestos Yes/No/Presumed	Quantity/Type (If ACM)	Friable / Non-Friable	Condition	Disturbance Potential
MISC	Black Floor Tile With Mastic Broken Pieces Sporadically Throughout The Building	Asbestos Detected Black Floor Tile – 2% Black Mastic – 3%	Chrysotile Unable to Quantify	Non-Friable	Good	
MISC	9"x9" Tan Floor Tile With Mastic Some Covered With Carpet Located In Chaplain/Asst. Chaplain Office, Supply Office JAG Offices and Connecting Hall, BDE-CDR Office, CSM & Reception Office, S-6 Office & Connecting Conference Room	Asbestos Detected Tan Floor Tile – 5% Black Mastic – 3%	Chrysotile Approximately 1,885 SF	Non-Friable	Good	
TSI	TSI Pipe Insulation & Elbows, Some Pipes Have Both Fiberglass Wrapping and Asbestos Wrapping	Asbestos Detected TSI Piping – 15%	Chrysotile Unable To Quantify	Friable	Good	

Asbestos Table Fort Bragg, Building D-2111

Date of Inspection: November 11, 2012
 Inspector: David L Clark
 Inspector Certification Number: NC 11788

MATERIAL		CHARACTERISTICS			ASSESSMENT	
Type	Description/Location/Amount	Asbestos Yes/No/Presumed	Percentage/Type (If ACM)	Friable / Non- Friable	Condition	Disturbance Potential
Misc	9"x 9" Tan Floor Tile and Mastic Throughout/Quantity Unknown	Yes	5-10% Chrysotile	Non Friable	Damaged	Moderate
Misc	White Transite/Behind Sheetrock Walls In PBO Office Quantity Unknown	Yes	35 % Chrysotile	Non Friable	Good	Low
Misc	Roofing Material	Presumed	Unknown	Non Friable	Damaged	Moderate

Sq. Ft.-Square Foot, LN. Ft.-Linear Foot, C. Ft.-cubic Foot
 Amounts are estimated, contractor is responsible for exact measurements.

Asbestos Table Fort Bragg, Building D-1911

MATERIAL		CHARACTERISTICS			ASSESSMENT	
Type	Description/Location/Amount	Asbestos Yes/No/Presumed	Percentage/Type (If ACM)	Friable / Non- Friable	Condition	Disturbance Potential
Misc	Floor Tile and Black Mastic under Carpet/ Comptroller's office/ Approx. 200 Sq. Ft.	Yes	3-5% Chrysotile	Non Friable	Damaged	Low
Misc	Transite Wall Panels/ Comptroller's office/ Approx. 200 Sq. Ft.	Yes	10% Chrysotile	Non Friable	Damaged	Low
Misc.	Roofing Material	Presumed	Presumed	Non- Friable	Damaged	Low

Sq. Ft.-Square Foot, Ln. Ft.-Linear Foot, C. Ft.-cubic Foot
 Amounts are estimated, contractor is responsible for exact measurements.



Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: Fort Bragg Building # D-1910

CEI LAB CODE: A14-8193

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
01	Layer 1	A1748420	White,Tan	Wallboard	None Detected
	Layer 2	A1748420	White	Joint Compound	None Detected
02	Layer 1	A1748421	White,Tan	Wallboard	None Detected
	Layer 2	A1748421	White	Joint Compound	None Detected
03	Layer 1	A1748422	White,Tan	Wallboard	None Detected
	Layer 2	A1748422	White	Joint Compound	None Detected
04	Layer 1	A1748423	Gray,White	CMU	None Detected
	Layer 2	A1748423	Tan	Mortar	None Detected
05	Layer 1	A1748424	Gray,White	CMU	None Detected
	Layer 2	A1748424	Tan	Mortar	None Detected
06	Layer 1	A1748425	Gray,White	CMU	None Detected
	Layer 2	A1748425	Tan	Mortar	None Detected
07		A1748426	Off-white	Caulking	Chrysotile 2%
08		A1748427		Sample Not Analyzed per COC	
09		A1748428		Sample Not Analyzed per COC	
10		A1748429	Tan	Plaster	None Detected
11		A1748430	Tan	Plaster	None Detected
12		A1748431	Tan	Plaster	None Detected
13	Layer 1	A1748432	Blue	Ceramic Tile	None Detected
	Layer 2	A1748432	Gray	Grout	None Detected
14	Layer 1	A1748433	Blue	Ceramic Tile	None Detected
	Layer 2	A1748433	Gray	Grout	None Detected
15	Layer 1	A1748434	Blue	Ceramic Tile	None Detected
	Layer 2	A1748434	Gray	Grout	None Detected
16		A1748435A	White	Wall Tile	Chrysotile 20%
	Layer 1	A1748435B	White, Yellow	Wall Tile	None Detected
	Layer 2	A1748435B	Brown	Mastic	None Detected
17		A1748436A		Sample Not Analyzed per COC	
	Layer 1	A1748436B	White, Yellow	Wall Tile	None Detected
	Layer 2	A1748436B	Brown	Mastic	None Detected
18		A1748437A		Sample Not Analyzed per COC	



Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: Fort Bragg Building # D-1910

CEI LAB CODE: A14-8193

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
	Layer 1	A1748437B	White, Yellow	Wall Tile	None Detected
	Layer 2	A1748437B	Brown	Mastic	None Detected
19	Layer 1	A1748438	White, Tan	Ceiling Tile	None Detected
	Layer 2	A1748438	Brown	Mastic	None Detected
20	Layer 1	A1748439	White, Tan	Ceiling Tile	None Detected
	Layer 2	A1748439	Brown	Mastic	None Detected
21	Layer 1	A1748440	White, Tan	Ceiling Tile	None Detected
	Layer 2	A1748440	Brown	Mastic	None Detected
22		A1748441	White, Tan	Ceiling Tile	None Detected
23		A1748442	White, Tan	Ceiling Tile	None Detected
24		A1748443	White, Tan	Ceiling Tile	None Detected
25	Layer 1	A1748444	Off-white	Sealer	None Detected
	Layer 2	A1748444	Yellow	Pipe Insulation	None Detected
26	Layer 1	A1748445	Off-white	Sealer	None Detected
	Layer 2	A1748445	Yellow	Pipe Insulation	None Detected
27	Layer 1	A1748448	Off-white	Sealer	None Detected
	Layer 2	A1748448	Yellow	Pipe Insulation	None Detected
28	Layer 1	A1748447	Tan	Insulation Covering	None Detected
	Layer 2	A1748447	Yellow	Insulation	None Detected
29	Layer 1	A1748448	Tan	Insulation Covering	None Detected
	Layer 2	A1748448	Yellow	Insulation	None Detected
30	Layer 1	A1748449	Tan	Insulation Covering	None Detected
	Layer 2	A1748449	Yellow	Insulation	None Detected
31		A1748450	White	Insulation	Chrysotile 65%
32		A1748451		Sample Not Analyzed per COC	
33		A1748452		Sample Not Analyzed per COC	
34	Layer 1	A1748453	Red	Brick	None Detected
	Layer 2	A1748453	Off-white	Mortar	None Detected
35	Layer 1	A1748454	Red	Brick	None Detected
	Layer 2	A1748454	Off-white	Mortar	None Detected
36	Layer 1	A1748455	Red	Brick	None Detected



Asbestos Report Summary

By: POLARIZING LIGHT MICROSCOPY

PROJECT: Fort Bragg Building # D-1910

CEI LAB CODE: A14-8193

METHOD: EPA 600 / R93 / 116 and EPA 600 / M4-82 / 020

Client ID	Layer	Lab ID	Color	Sample Description	ASBESTOS %
	Layer 2	A1748455	Off-white	Mortar	None Detected
37		A1748456	Brown	Caulking	None Detected
38		A1748457	White	Caulking	None Detected
39		A1748458	Silver	Caulking	None Detected

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ASBESTOS REMEDIATION
11/18

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP Z9.2 (2018) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

ASTM INTERNATIONAL (ASTM)

ASTM C732 (2006; R 2012) Aging Effects of Artificial Weathering on Latex Sealants

ASTM D522/D522M (2014) Mandrel Bend Test of Attached Organic Coatings

ASTM D2794 (1993; R 2019) Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

ASTM D4397 (2016) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

ASTM E84 (2018a) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E96/E96M (2016) Standard Test Methods for Water Vapor Transmission of Materials

ASTM E119 (2018c; E 2018) Standard Test Methods for Fire Tests of Building Construction and Materials

ASTM E736/E736M (2017) Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members

ASTM E1368 (2014) Visual Inspection of Asbestos Abatement Projects

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-7 (2014) Compressed Air for Human

Respiration; 6th Edition

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z87.1 (2015) Occupational and Educational
Personal Eye and Face Protection Devices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701 (2019) Standard Methods of Fire Tests for
Flame Propagation of Textiles and Films

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH NMAM (2016; 5th Ed) NIOSH Manual of Analytical
Methods

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 340/1-90/018 (1990) Asbestos/NESHAP Regulated Asbestos
Containing Materials Guidance

EPA 560/5-85-024 (1985) Guidance for Controlling
Asbestos-Containing Materials in Buildings
(Purple Book)

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

29 CFR 1910.147 The Control of Hazardous Energy (Lock
Out/Tag Out)

29 CFR 1926.51 Sanitation

29 CFR 1926.59 Hazard Communication

29 CFR 1926.103 Respiratory Protection

29 CFR 1926.200 Accident Prevention Signs and Tags

29 CFR 1926.1101 Asbestos

40 CFR 61-SUBPART A General Provisions

40 CFR 61-SUBPART M National Emission Standard for Asbestos

40 CFR 763 Asbestos

42 CFR 84 Approval of Respiratory Protective Devices

49 CFR 107 Hazardous Materials Program Procedures

49 CFR 171 General Information, Regulations, and
Definitions

49 CFR 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

49 CFR 173 Shippers - General Requirements for Shipments and Packagings

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

NAVFAC P-502 (2017) Asbestos Program Management

ND OPNAVINST 5100.23 (2005; Rev G) Navy Occupational Safety and Health (NAVOSH) Program Manual

UNDERWRITERS LABORATORIES (UL)

UL 586 (2009; Reprint Dec 2017) UL Standard for Safety High-Efficiency Particulate, Air Filter Units

1.2 DEFINITIONS

1.2.1 ACM

Asbestos Containing Materials.

1.2.2 Amended Water

Water containing a wetting agent or surfactant with a maximum surface tension of 0.00042 psi.

1.2.3 Area Sampling

Sampling of asbestos fiber concentrations which approximates the concentrations of asbestos in the theoretical breathing zone but is not actually collected in the breathing zone of an employee.

1.2.4 Asbestos

The term asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, and actinolite asbestos and any of these minerals that has been chemically treated or altered. Materials are considered to contain asbestos if the asbestos content of the material is determined to be at least one percent.

1.2.5 Asbestos Control Area

That area where asbestos removal operations are performed which is isolated by physical boundaries which assist in the prevention of the uncontrolled release of asbestos dust, fibers, or debris.

1.2.6 Asbestos Fibers

Those fibers having an aspect ratio of at least 3:1 and longer than 5 micrometers as determined by National Institute for Occupational Safety and Health (NIOSH) Method 7400.

1.2.7 Asbestos Permissible Exposure Limit

0.1 fibers per cubic centimeter of air as an 8-hour time weighted average measured in the breathing zone as defined by 29 CFR 1926.1101 or other Federal legislation having legal jurisdiction for the protection of workers health.

1.2.8 Authorized Person

Any person authorized by the Contractor and required by work duties to be present in the regulated areas.

1.2.9 Background

The ambient airborne asbestos concentration in an uncontaminated area as measured prior to any asbestos hazard abatement efforts. Background concentrations for other (contaminated) areas are measured in similar but asbestos free locations.

1.2.10 Competent Person (CP)

A person meeting the requirements for competent person as specified in 29 CFR 1926.1101 including a person capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, and is specifically trained in a training course which meet the criteria of EPA's Model Accreditation Plan (40 CFR 763) for project designer or supervisor, or its equivalent. The competent person must have a current State of North Carolina asbestos contractors or supervisors license.

1.2.11 Contractor

The Contractor is that individual, or entity under contract to perform the herein listed work.

1.2.12 Disposal Bag

A 6 mil thick, leak-tight plastic bag, pre-labeled in accordance with 29 CFR 1926.1101, used for transporting asbestos waste from containment to disposal site.

1.2.13 Disturbance

Activities that disrupt the matrix of ACM, crumble or pulverize ACM, or generate visible debris from ACM. Disturbance includes cutting away small amounts of ACM, no greater than the amount which can be contained in one standard sized glovebag or waste bag, not larger than 60 inches in length and width in order to access a building component.

1.2.14 Encapsulation

The abatement of an asbestos hazard through the appropriate use of chemical encapsulants.

1.2.15 Encapsulants

Specific materials in various forms used to chemically or physically entrap asbestos fibers in various configurations to prevent these fibers

from becoming airborne. There are four types of encapsulants as follows which must comply with performance requirements as specified herein.

- a. Removal Encapsulant (can be used as a wetting agent)
- b. Bridging Encapsulant (used to provide a tough, durable surface coating to asbestos containing material)
- c. Penetrating Encapsulant (used to penetrate the asbestos containing material encapsulating all asbestos fibers and preventing fiber release due to routine mechanical damage)
- d. Lock-Down Encapsulant (used to seal off or "lock-down" minute asbestos fibers left on surfaces from which asbestos containing material has been removed).

1.2.16 Friable Asbestos Material

A term defined in 40 CFR 61-SUBPART M and EPA 340/1-90/018 meaning any material which contains more than 1 percent asbestos, as determined using the method specified in 40 CFR 763, Polarized Light Microscopy (PLM), that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

1.2.17 Glovebag Technique

Those asbestos removal and control techniques put forth in 29 CFR 1926.1101.

1.2.18 Government Consultant (GC)

That qualified person employed directly by the Government to monitor, sample, inspect the work or in some other way advise the Contracting Officer. The GC is normally a private consultant, but can be an employee of the Government.

1.2.19 HEPA Filter Equipment

High efficiency particulate air (HEPA) filtered vacuum and exhaust ventilation equipment with a filter system capable of collecting and retaining asbestos fibers. Filters must retain 99.97 percent of particles 0.3 microns or larger as indicated in UL 586.

1.2.20 Model Accreditation Plan (MAP)

USEPA training accreditation requirements for persons who work with asbestos as specified in 40 CFR 763.

1.2.21 Negative Pressure Enclosure (NPE)

That engineering control technique described as a negative pressure enclosure in 29 CFR 1926.1101.

1.2.22 NESHAP

National Emission Standards for Hazardous Air Pollutants. The USEPA NESHAP regulation for asbestos is at 40 CFR 61-SUBPART M.

1.2.23 Nonfriable Asbestos Material

Material that contains asbestos in which the fibers have been immobilized by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not normally release asbestos fibers during any appropriate use, handling, storage or transportation. It is understood that asbestos fibers may be released under other conditions such as demolition, removal, or mishap.

1.2.24 Permissible Exposure Limits (PELs)

1.2.24.1 PEL-Time Weighted Average(TWA)

Concentration of asbestos not in excess of 0.1 fibers per cubic centimeter of air (f/cc) as an 8-hour time weighted average (TWA).

1.2.24.2 PEL-Excursion Limit

An airborne concentration of asbestos not in excess of 1.0 f/cc of air as averaged over a sampling period of 30 minutes.

1.2.25 Personal Sampling

Air sampling which is performed to determine asbestos fiber concentrations within the breathing zone of a specific employee, as performed in accordance with 29 CFR 1926.1101.

1.2.26 Private Qualified Person (PQP)

That qualified person hired by the Contractor to perform the herein listed tasks.

1.2.27 Qualified Person (QP)

A Registered Architect, Professional Engineer, Certified Industrial Hygienist, consultant or other qualified person who has successfully completed training and is therefore accredited under a legitimate State Model Accreditation Plan as described in 40 CFR 763 as a Building Inspector, Contractor/Supervisor Abatement Worker, and Asbestos Project Designer; and has successfully completed the National Institute of Occupational Safety and Health (NIOSH) 582 course "Sampling and Evaluating Airborne Asbestos Dust" or equivalent. The QP must be qualified to perform visual inspections as indicated in ASTM E1368. The QP must be appropriately licensed in the State of North Carolina.

1.2.28 TEM

Refers to Transmission Electron Microscopy.

1.2.29 Time Weighted Average (TWA)

The TWA is an 8-hour time weighted average airborne concentration of asbestos fibers.

1.2.30 Transite

A generic name for asbestos cement wallboard and pipe.

1.2.31 Wetting Agent

A chemical added to water to reduce the water's surface tension thereby increasing the water's ability to soak into the material to which it is applied. An equivalent wetting agent must have a surface tension of at most 0.00042 psi.

1.2.32 Worker

Individual (not designated as the Competent Person or a supervisor) who performs asbestos work and has completed asbestos worker training required by 29 CFR 1926.1101, to include EPA Model Accreditation Plan (MAP) "Worker" training; accreditation, if required by the OSHA Class of work to be performed or by the state where the work is to be performed. The worker must be appropriately licensed in the State of North Carolina.

1.3 REQUIREMENTS

1.3.1 Description of Work

The work covered by this section includes the handling and control of asbestos containing materials and describes some of the resultant procedures and equipment required to protect workers, the environment and occupants of the building or area, or both, from contact with airborne asbestos fibers. The work also includes the disposal of any asbestos containing materials generated by the work. More specific operational procedures must be outlined in the Asbestos Hazard Abatement Plan called for elsewhere in this specification. The asbestos work includes the demolition and removal of asbestos located in those areas and buildings identified in the asbestos survey reports attached in Section 02 41 00 DEMOLITION; which is governed by 40 CFR 763 and NAVFAC P-502. Under normal conditions non-friable or chemically bound materials containing asbestos would not be considered hazardous; however, this material may release airborne asbestos fibers during demolition and removal and therefore must be handled in accordance with the removal and disposal procedures as specified herein. Provide negative pressure enclosure and/or wet removal methods techniques as outlined in this specification. The work area will be evacuated during the asbestos abatement work. A competent person must supervise asbestos removal work as specified herein.

1.3.1.1 Wallboard/Joint Compound

Both composite samples of the wallboard and discrete samples of the components (wallboard and joint compound) have been tested and results are attached.

1.3.2 Unexpected Discovery of Asbestos

Notify the Contracting Officer if any previously untested building components suspected to contain asbestos are impacted by the work.

1.3.3 Medical Requirements

Provide medical requirements including but not limited to medical surveillance and medical record keeping as listed in 29 CFR 1926.1101.

1.3.3.1 Medical Examinations

Before exposure to airborne asbestos fibers, provide workers with a

comprehensive medical examination as required by 29 CFR 1926.1101 or other pertinent State or local directives. This requirement must have been satisfied within the 12 months prior to the start of work on this contract. The same medical examination must be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation. Specifically identify x-ray films of asbestos workers to the consulting radiologist and mark medical record jackets with the word "ASBESTOS."

1.3.3.2 Medical Records

Maintain complete and accurate records of employees' medical examinations, medical records, and exposure data for a period of 50 years after termination of employment and make records of the required medical examinations and exposure data available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health (OSHA), or authorized representatives of them, and an employee's physician upon the request of the employee or former employee.

1.3.4 Employee Training

Submit certificates, prior to the start of work but after the main abatement submittal, signed by each employee indicating that the employee has received training in the proper handling of materials and wastes that contain asbestos in accordance with 40 CFR 763; understands the health implications and risks involved, including the illnesses possible from exposure to airborne asbestos fibers; understands the use and limits of the respiratory equipment to be used; and understands the results of monitoring of airborne quantities of asbestos as related to health and respiratory equipment as indicated in 29 CFR 1926.1101 on an initial and annual basis. Organize certificates by individual worker, not grouped by type of certification. Post appropriate evidence of compliance with the training requirements of 40 CFR 763. Train personnel involved in the asbestos control work in accordance with United States Environmental Protection Agency (USEPA) Asbestos Hazard Emergency Response Act (AHERA) training criteria or State training criteria whichever is more stringent. Document the training by providing: dates of training, training entity, course outline, names of instructors, and qualifications of instructors upon request by the Contracting Officer. Furnish each employee with respirator training and fit testing administered by the PQP as required by 29 CFR 1926.1101 and 29 CFR 1926.103. Fully cover engineering and other hazard control techniques and procedures. Asbestos workers must have a current State of North Carolina asbestos worker's license.

1.3.5 Permits, Licenses, and Notifications

Prior to the start of work, obtain necessary permits and licenses in conjunction with asbestos removal, encapsulation, hauling, and disposition, and furnish notification of such actions required by Federal, State, regional, and local authorities. Notify the State's environmental protection agency local air pollution control district/agency and the Contracting Officer in writing 10 working days prior to commencement of work in accordance with 40 CFR 61-SUBPART M. Notify the Contracting Officer and other appropriate Government agencies in writing 20 working days prior to the start of asbestos work as indicated in applicable laws, ordinances, criteria, rules, and regulations. Submit copies of all Notifications to the Contracting Officer. Notify the local fire department 3 days prior to removing fire-proofing material from the

building including notice that the material contains asbestos.

1.3.6 Environment, Safety and Health Compliance

In addition to detailed requirements of this specification, comply with those applicable laws, ordinances, criteria, rules, and regulations of Federal, State, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials. Comply with the applicable requirements of the current issue of EM 385-1-1, 29 CFR 1926.1101, 40 CFR 61-SUBPART A, 40 CFR 61-SUBPART M, 40 CFR 763 and ND OPNAVINST 5100.23. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the work. Where the requirements of this specification, applicable laws, rules, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirement as defined by the Government apply. The following laws, ordinances, criteria, rules and regulations regarding removal, handling, storing, transporting and disposing of asbestos materials apply:

1.3.7 Respiratory Protection Program

Establish and implement a respirator program as required by 29 CFR 1926.1101, and 29 CFR 1926.103. Submit a written description of the program to the Contracting Officer. Submit a written program manual or operating procedure including methods of compliance with regulatory statutes.

1.3.7.1 Respirator Program Records

Submit records of the respirator program as required by 29 CFR 1926.103, and 29 CFR 1926.1101.

1.3.7.2 Respirator Fit Testing

The Contractor's PQP must conduct a qualitative or quantitative fit test conforming to 29 CFR 1926.103 for each worker required to wear a respirator, and any authorized visitors who enter a regulated area where respirators are required to be worn. A respirator fit test must be performed prior to initially wearing a respirator and every 12 months thereafter. If physical changes develop that will affect the fit, a new fit test must be performed. Functional fit checks must be performed each time a respirator is put on and in accordance with the manufacturer's recommendation.

1.3.7.3 Respirator Selection and Use Requirements

Provide respirators, and ensure that they are used as required by 29 CFR 1926.1101 and in accordance with CGA G-7 and the manufacturer's recommendations. Respirators must be approved by the National Institute for Occupational Safety and Health NIOSH, under the provisions of 42 CFR 84, for use in environments containing airborne asbestos fibers. For air-purifying respirators, the particulate filter must be high-efficiency particulate air (HEPA)/(N-,R-,P-100). The initial respirator selection and the decisions regarding the upgrading or downgrading of respirator type must be made by the Contractor's Designated IH based on the measured or anticipated airborne asbestos fiber concentrations to be encountered.

1.3.8 Asbestos Hazard Control Supervisor

The Contractor must be represented on site by a supervisor, trained using the model Contractor accreditation plan as indicated in the Federal statutes for all portions of the herein listed work.

1.3.9 Hazard Communication

Adhere to all parts of 29 CFR 1926.59 and provide the Contracting Officer with a copy of the Safety Data Sheets (SDS) for all materials brought to the site.

1.3.10 Asbestos Hazard Abatement Plan

Submit a detailed plan of the safety precautions such as lockout, tagout, tryout, fall protection, and confined space entry procedures and equipment and work procedures to be used in the removal and demolition of materials containing asbestos. The plan, not to be combined with other hazard abatement plans, must be prepared, signed, and sealed by the PQP. Provide a Table of Contents for each abatement submittal, which follows the sequence of requirements in the contract. The plan must include but not be limited to the precise personal protective equipment to be used including, but not limited to, respiratory protection, type of whole-body protection and if reusable coveralls are to be employed decontamination methods (operations and quality control plan), the location of asbestos control areas including clean and dirty areas, buffer zones, showers, storage areas, change rooms, removal method, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos sealer to be used, locations of local exhaust equipment, planned air monitoring strategies, and a detailed description of the method to be employed in order to control environmental pollution. The plan must also include (both fire and medical emergency) response plans and an Activity Hazard Analyses (AHAs) in accordance with EM 385-1-1. The Asbestos Hazard Abatement Plan must be approved in writing prior to starting any asbestos work. The Contractor, Asbestos Hazard Control Supervisor, CP and PQP must meet with the Contracting Officer prior to beginning work, to discuss in detail the Asbestos Hazard Abatement Plan, including work procedures and safety precautions. Once approved by the Contracting Officer, the plan will be enforced as if an addition to the specification. Any changes required in the specification as a result of the plan must be identified specifically in the plan to allow for free discussion and approval by the Contracting Officer prior to starting work.

1.3.11 Testing Laboratory

Submit the name, address, and telephone number of each testing laboratory selected for the sampling, analysis, and reporting of airborne concentrations of asbestos fibers along with evidence that each laboratory selected holds the appropriate State license and permits and certification that each laboratory is American Industrial Hygiene Association (AIHA) accredited and that persons counting the samples have been judged proficient by current inclusion on the AIHA Asbestos Analysis Registry (AAR) and successful participation of the laboratory in the Proficiency Analytical Testing (PAT) Program. Where analysis to determine asbestos content in bulk materials or transmission electron microscopy is required, submit evidence that the laboratory is accredited by the National Institute of Science and Technology (NIST) under National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos analysis. The

testing laboratory firm must be independent of the asbestos contractor and must have no employee or employer relationship which could constitute a conflict of interest.

1.3.12 Landfill Approval

Submit written evidence that the landfill is approved for asbestos disposal by the U.S. Environmental Protection Agency, Region 3, Air Enforcement Section (38W12), and local regulatory agencies. Within three working days after delivery, submit detailed delivery tickets, prepared, signed, and dated by an agent of the landfill, certifying the amount of asbestos materials delivered to the landfill. Submit a copy of the waste shipment records within one day of the shipment leaving the project site.

1.3.13 Transporter Certification

Submit written evidence that the transporter is approved to transport asbestos waste in accordance with the DOT requirements of 49 CFR 171, 49 CFR 172 and 49 CFR 173 as well as registration requirements of 49 CFR 107 and all other State and local regulatory agency requirements.

1.3.14 Medical Certification

Provide a written certification for each worker and supervisor, signed by a licensed physician indicating that the worker and supervisor has met or exceeded all of the medical prerequisites listed herein and in 29 CFR 1926.1101 and 29 CFR 1926.103 as prescribed by law. Submit certificates prior to the start of work but after the main abatement submittal.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-03 Product Data

Amended Water; G

Safety Data Sheets (SDS) for All Materials; G

Encapsulants; G

Respirators; G

Local Exhaust Equipment; G

Pressure Differential Automatic Recording Instrument; G

Vacuums; G

Glovebags; G

SD-06 Test Reports

Air Sampling Results; G

Pressure Differential Recordings for Local Exhaust System; G

Clearance Sampling; G

Asbestos Disposal Quantity Report; G

SD-07 Certificates

Employee Training; G

Notifications; G

Respiratory Protection Program; G

Asbestos Hazard Abatement Plan; G

Testing Laboratory; G

Landfill Approval; G

Delivery Tickets; G

Waste Shipment Records; G

Transporter Certification; G

Medical Certification; G

Private Qualified Person Documentation; G

Designated Competent Person; G

Worker's License; G

Contractor's License; G

Federal, State or Local Citations on Previous Projects; G

Encapsulants; G

Equipment Used to Contain Airborne Asbestos Fibers; G

Water Filtration Equipment; G

Vacuums; G

Ventilation Systems; G

SD-11 Closeout Submittals

Permits and Licenses; G

Notifications; G

Respirator Program Records; G

Protective Clothing Decontamination Quality Control Records; G

Protective Clothing Decontamination Facility Notification; G

Rental Equipment; G

1.5 QUALITY ASSURANCE

1.5.1 Private Qualified Person Documentation

Submit the name, address, and telephone number of the Private Qualified Person (PQP) selected to prepare the Asbestos Hazard Abatement Plan, direct monitoring and training, and documented evidence that the PQP has successfully completed training in and is accredited and where required is certified as, a Building Inspector, Contractor/Supervisor Abatement Worker, and Asbestos Project Designer as described by 40 CFR 763 and has successfully completed the National Institute of Occupational Safety and Health (NIOSH) 582 course "Sampling and Evaluating Airborne Asbestos Dust" or equivalent. The PQP must be appropriately licensed in the State of North Carolina as a Project Monitor. The PQP and the asbestos contractor must not have an employee/employer relationship or financial relationship which could constitute a conflict of interest. The PQP must be a first tier subcontractor.

1.5.2 Designated Competent Person Documentation

The Designated Competent Person must be experienced in the administration and supervision of asbestos abatement projects including exposure assessment and monitoring, work practices, abatement methods, protective measures for personnel, setting up and inspecting asbestos abatement work areas, evaluating the integrity of containment barriers, placement and operation of local exhaust systems, ACM generated waste containment and disposal procedures, decontamination units installation and maintenance requirements, site safety and health requirements, notification of other employees onsite. The Designated Competent Person must be on-site at all times when asbestos abatement activities are underway. Submit training certification and a current State of North Carolina Asbestos Contractor's and Supervisor's License. Submit evidence that the Designated Competent Person has a minimum of 2 years of on-the-job asbestos abatement experience relevant to OSHA designated competent person requirements. The Designated Competent Person must be a first tier subcontractor.

1.5.3 Worker's License

Submit documentation that workers meet the requirements of 29 CFR 1926.1101, 40 CFR 61-SUBPART M and have a current State of North Carolina Asbestos Workers License.

1.5.4 Contractor's License

Submit a copy of the asbestos contractor's license issued by the State of North Carolina. Submit the following certification along with the license: "I certify that the personnel I am responsible for during the course of this project fully understand the contents of 29 CFR 1926.1101, 40 CFR 61-SUBPART MEM 385-1-1, and the Federal, State and local requirements for those asbestos abatement activities that they will be involved in." This certification statement must be signed by the Company's President or Chief Executive.

1.5.5 Air Sampling Results

Complete fiber counting and provide results to the PQP for review within 16 hours of the "time off" of the sample pump. Notify the Contracting Officer immediately of any airborne levels of asbestos fibers in excess of the acceptable limits. Submit sampling results to the Contracting Officer and the affected Contractor employees where required by law within three working days, signed by the testing laboratory employee performing air sampling, the employee that analyzed the sample, and the PQP. Notify the Contractor and the Contracting Officer immediately of any variance in the pressure differential which could cause adjacent unsealed areas to have asbestos fiber concentrations in excess of 0.01 fibers per cubic centimeter or background whichever is higher. In no circumstance must levels exceed 0.1 fibers per cubic centimeter.

1.5.6 Pressure Differential Recordings for Local Exhaust System

Provide a local exhaust system that creates a negative pressure of at least 0.02 inches of water relative to the pressure external to the enclosure and operate it continuously, 24-hours a day, until the temporary enclosure of the asbestos control area is removed. Submit pressure differential recordings for each work day to the PQP for review and to the Contracting Officer within 24-hours from the end of each work day.

1.5.7 Protective Clothing Decontamination Quality Control Records

Provide all records that document quality control for the decontamination of reusable outer protective clothing.

1.5.8 Protective Clothing Decontamination Facility Notification

Submit written evidence that persons who decontaminate, store, or transport asbestos contaminated clothing used in the performance of this contract were duly notified in accordance with 29 CFR 1926.1101.

1.5.9 Federal, State or Local Citations on Previous Projects

Submit a statement, signed by an officer of the company, containing a record of any citations issued by Federal, State or local regulatory agencies relating to asbestos activities within the last 5 years (including projects, dates, and resolutions); a list of penalties incurred through non-compliance with asbestos project specifications, including liquidated damages, overruns in scheduled time limitations and resolutions; and situations in which an asbestos-related contract has been terminated (including projects, dates, and reasons for terminations). If there are none, a negative declaration signed by an officer of the company must be provided.

1.5.10 Preconstruction Conference

Conduct a safety preconstruction conference to discuss the details of the Asbestos Hazard Abatement Plan, Accident Prevention Plan (APP) including the AHAs required in specification Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. The safety preconstruction conference must include the Contractor and their Designated Competent Person, Designated IH and Project Supervisor and the Contracting Officer. Deficiencies in the APP will be discussed. Onsite work must not begin until the APP has been accepted.

1.6 EQUIPMENT

1.6.1 Rental Equipment

Provide a copy of the written notification to the rental company concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.

PART 2 PRODUCTS

2.1 ENCAPSULANTS

Encapsulants must conform to current USEPA requirements, contain no toxic or hazardous substances as defined in 29 CFR 1926.59, and conform to the following performance requirements.

2.1.1 Removal Encapsulants

<u>Requirement</u>	<u>Test Standard</u>
Flame Spread - 25, Smoke Emission - 50	ASTM E84
Life Expectancy - 20 years	ASTM C732 Accelerated Aging Test
Permeability - Minimum 0.4 perms	ASTM E96/E96M
Fire Resistance - Negligible affect on fire resistance rating over 3 hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E119
Impact Resistance - Minimum 43 in/lb	ASTM D2794 Gardner Impact Test
Flexibility - no rupture or cracking	ASTM D522/D522M Mandrel Bend Test

2.1.2 Bridging Encapsulant

<u>Requirement</u>	<u>Test Standard</u>
Flame Spread - 25, Smoke Emission - 50	ASTM E84
Life Expectancy - 20 years	ASTM C732 Accelerated Aging Test
Permeability - Minimum 0.4 perms	ASTM E96/E96M

<u>Requirement</u>	<u>Test Standard</u>
Fire Resistance - Negligible affect on fire resistance rating over 3-hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E119
Impact Resistance - Minimum 43 in/lb	ASTM D2794 Gardner Impact Test
Flexibility - no rupture or cracking	ASTM D522/D522M Mandrel Bend Test

2.1.3 Penetrating Encapsulant

<u>Requirement</u>	<u>Test Standard</u>
Flame Spread - 25, Smoke Emission - 50	ASTM E84
Life Expectancy - 20 years	ASTM C732 Accelerated Aging Test
Permeability - Minimum 0.4 perms	ASTM E96/E96M
Cohesion/Adhesion Test - 50 pounds of force/foot	ASTM E119
Fire Resistance - Negligible affect on fire resistance rating over 3-hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E119
Impact Resistance - Minimum 43 in/lb	ASTM D2794 Gardner Impact Test
Flexibility - no rupture or cracking	ASTM D522/D522M Mandrel Bend Test

2.1.4 Lock-down Encapsulant

<u>Requirement</u>	<u>Test Standard</u>
Flame Spread - 25, Smoke Emission - 50	ASTM E84
Life Expectancy - 20 years	ASTM C732 Accelerated Aging Test

Requirement	Test Standard
Permeability - Minimum 0.4 perms	ASTM E96/E96M
Fire Resistance - Negligible affect on fire resistance rating over 3-hour test (Tested with fireproofing over encapsulant applied directly to steel member)	ASTM E119
Bond Strength: 100 pounds of force/foot	ASTM E736/E736M
(Tests compatibility with cementitious and fibrous fireproofing)	

2.2 ENCASEMENT PRODUCTS

Encasement must consist of primary cellular polymer coat, polymer finish coat, and any other finish coat as approved by the Contracting Officer.

2.3 DUCT TAPE

Industrial grade duct tape of appropriate widths suitable for bonding sheet plastic and disposal container.

2.4 DISPOSAL CONTAINERS

Leak-tight (defined as solids, liquids, or dust that cannot escape or spill out) disposal containers must be provided for ACM wastes as required by 29 CFR 1926.1101. Disposal containers can be in the form of:

- a. Disposal Bags
- b. Fiberboard Drums
- c. Cardboard Boxes

2.5 SHEET PLASTIC

Sheet plastic must be polyethylene of 6 mil minimum thickness and must be provided in the largest sheet size necessary to minimize seams. Film must be clearfrosted or black and conform to ASTM D4397, except as specified below

2.5.1 Flame Resistant

Where a potential for fire exists, flame-resistant sheets must be provided. Film must be frosted or black and must conform to the requirements of NFPA 701.

2.5.2 Reinforced

Reinforced sheets must be provided where high skin strength is required, such as where it constitutes the only barrier between the regulated area and the outdoor environment. The sheet stock must consist of translucent,

nylon-reinforced or woven-polyethylene thread laminated between 2 layers of polyethylene film. Film must meet flame resistant standards of NFPA 701.

2.6 MASTIC REMOVING SOLVENT

Mastic removing solvent must be nonflammable and must not contain methylene chloride, glycol ether, or halogenated hydrocarbons. Solvents used onsite must have a flash point greater than 140 degrees F.

2.7 LEAK-TIGHT WRAPPING

Two layers of 6 mil minimum thick polyethylene sheet stock must be used for the containment of removed asbestos-containing components or materials such as large tanks, boilers, insulated pipe segments and other materials. Upon placement of the ACM component or material, each layer must be individually leak-tight sealed with duct tape.

2.8 VIEWING INSPECTION WINDOW

Where feasible, a minimum of one clear, 1/8 inch thick, acrylic sheet, 18 by 24 inches, must be installed as a viewing inspection window at eye level on a wall in each containment enclosure. The windows must be sealed leak-tight with industrial grade duct tape.

2.9 WETTING AGENTS

Removal encapsulant (a penetrating encapsulant) must be provided when conducting removal abatement activities that require a longer removal time or are subject to rapid evaporation of amended water. The removal encapsulant must be capable of wetting the ACM and retarding fiber release during disturbance of the ACM greater than or equal to that provided by amended water. Performance requirements for penetrating encapsulants are specified in paragraph ENCAPSULANTS above.

PART 3 EXECUTION

3.1 EQUIPMENT

Provide the Contracting Officer or the Contracting Officer's Representative, with at least two complete sets of personal protective equipment as required for entry to and inspection of the asbestos control area. Provide equivalent training to the Contracting Officer or a designated representative as provided to Contractor employees in the use of the required personal protective equipment. Provide manufacturer's certificate of compliance for all equipment used to contain airborne asbestos fibers.

3.1.1 Air Monitoring Equipment

The Contractor's PQP must approve air monitoring equipment. The equipment must include, but must not be limited to:

- a. High-volume sampling pumps that can be calibrated and operated at a constant airflow up to 16 liters per minute.
- b. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute, and a self-contained rechargeable power pack capable of sustaining the calibrated flow rate for a minimum of 10

hours. The pumps must also be equipped with an automatic flow control unit which must maintain a constant flow, even as filter resistance increases due to accumulation of fiber and debris on the filter surface.

- c. Single use standard 25 mm diameter cassette, open face, 0.8 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive extension cowl, and shrink bands for personal air sampling.
- d. Single use standard 25 mm diameter cassette, open face, 0.45 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive cowl, and shrink bands when conducting environmental area sampling using NIOSH NMAM Methods 7400 and 7402, (and the transmission electric microscopy method specified at 40 CFR 763 if required).
- e. A flow calibrator capable of calibration to within plus or minus 2 percent of reading over a temperature range of minus 4 to plus 140 degrees F and traceable to a NIST primary standard.

3.1.2 Respirators

Select respirators from those approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.

3.1.2.1 Respirators for Handling Asbestos

Provide personnel engaged in pre-cleaning, cleanup, handling, removal and or demolition of asbestos materials with respiratory protection as indicated in 29 CFR 1926.1101 and 29 CFR 1926.103. Breathing air must comply with CGA G-7.

3.1.3 Exterior Whole Body Protection

3.1.3.1 Outer Protective Clothing

Provide personnel exposed to asbestos with disposable "non-breathable," or reusable "non-breathable" whole body outer protective clothing, head coverings, gloves, and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but must not be used alone. Make sleeves secure at the wrists, make foot coverings secure at the ankles, and make clothing secure at the neck by the use of tape. Reusable whole body outer protective clothing must be either disposed of as asbestos contaminated waste upon exiting from the asbestos regulated work area or be properly decontaminated.

3.1.3.2 Work Clothing

Provide cloth work clothes for wear under the outer protective clothing and foot coverings and either dispose of or properly decontaminate them as recommended by the PQP after each use.

3.1.3.3 Personal Decontamination Unit

Provide a temporary, negative pressure unit with a separate decontamination locker room and clean locker room with a shower that

complies with 29 CFR 1926.51(f)(4)(ii) through (V) in between for personnel required to wear whole body protective clothing. Provide two separate lockers for each asbestos worker, one in each locker room. Keep street clothing and street shoes in the clean locker. HEPA vacuum and remove asbestos contaminated disposable protective clothing while still wearing respirators at the boundary of the asbestos work area and seal in impermeable bags or containers for disposal. HEPA vacuum and remove asbestos contaminated reusable protective clothing while still wearing respirators at the boundary of the asbestos work area, seal in two impermeable bags, label outer bag as asbestos contaminated waste, and transport for decontamination. Do not wear work clothing between home and work. Locate showers between the decontamination locker room and the clean locker room and require that all employees shower before changing into street clothes. Collect used shower water and filter with approved water filtration equipment to remove asbestos contamination. Dispose of filters and residue as asbestos waste. Discharge clean water to the sanitary system. Dispose of asbestos contaminated work clothing as asbestos contaminated waste or properly decontaminate as specified in the Contractor's Asbestos Hazard Abatement Plan. Keep the floor of the decontamination unit's clean room dry and clean at all times. Proper housekeeping and hygiene requirements must be maintained. Provide soap and towels for showering, washing and drying. Cloth towels provided must be disposed of as ACM waste or must be laundered in accordance with 29 CFR 1926.1101. Physically attach the decontamination units to the asbestos control area. Construct both a personnel decontamination unit and an equipment decontamination unit onto and integral with each asbestos control area.

3.1.3.4 Decontamination of Reusable Outer Protective Clothing

When reusable outer protective clothing is used, transport the double bagged clothing to a previously notified commercial/industrial decontamination facility for decontamination. Perform non-destructive testing to determine the effectiveness of asbestos decontamination. If representative sampling is used, ensure the statistical validity of the sampling results. If representative sampling is used, reject any entire batch in which any of the pieces exceed 40 fibers per square millimeter. Inspect reusable protective clothing prior to use to ensure that it will provide adequate protection and is not or is not about to become ripped, torn, deteriorated, or damaged, and that it is not visibly contaminated. Notify, in writing, all personnel involved in the decontamination of reusable outer protective clothing as indicated in 29 CFR 1926.1101.

3.1.3.5 Eye Protection

Provide eye protection that complies with ANSI/ISEA Z87.1 when operations present a potential eye injury hazard. Provide goggles to personnel engaged in asbestos abatement operations when the use of a full face respirator is not required.

3.1.4 Regulated Areas

All Class I, II, and III asbestos work must be conducted within regulated areas. The regulated area must be demarcated to minimize the number of persons within the area and to protect persons outside the area from exposure to airborne asbestos. Control access to regulated areas, ensure that only authorized personnel enter, and verify that Contractor required medical surveillance, training and respiratory protection program requirements are met prior to allowing entrance.

3.1.5 Load-out Unit

Provide a temporary load-out unit that is adjacent and connected to the regulated area and access tunnel. Attach the load-out unit in a leak-tight manner to each regulated area.

3.1.6 Warning Signs and Labels

Provide bilingual warning signs printed in English and Spanish at all approaches to asbestos control areas. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to all asbestos materials, scrap, waste, debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to the requirements are acceptable

3.1.6.1 Warning Sign

Provide vertical format conforming to 29 CFR 1926.200, and 29 CFR 1926.1101 minimum 20 by 14 inches displaying the following legend in the lower panel:

<u>Legend</u>	<u>Notation</u>
DANGER	one inch Sans Serif Gothic or Block
ASBESTOS	one inch Sans Serif Gothic or Block
MAY CAUSE CANCER	one inch Sans Serif Gothic or Block
CAUSES DAMAGE TO LUNGS	1/4 inch Sans Serif Gothic or Block
AUTHORIZED PERSONNEL ONLY	1/4 inch Sans Serif Gothic or Block
WEAR RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING IN THIS AREA	1/4 inch Sans Serif Gothic or Block

Spacing between lines must be at least equal to the height of the upper of any two lines.

3.1.6.2 Warning Labels

Provide labels conforming to 29 CFR 1926.1101 of sufficient size to be clearly legible, displaying the following legend:

DANGER

CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST AVOID CREATING DUST

3.1.7 Local Exhaust System

Provide a local exhaust system in the asbestos control area in accordance with ASSP Z9.2 and 29 CFR 1926.1101 that will provide at least four air changes per hour inside of the negative pressure enclosure. Local exhaust equipment must be operated 24-hours per day, until the asbestos control area is removed and must be leak proof to the filter and equipped with HEPA filters. Maintain a minimum pressure differential in the control area of minus 0.02 inch of water column relative to adjacent, unsealed areas. Provide continuous 24-hour per day monitoring of the pressure differential with a pressure differential automatic recording instrument. The building ventilation system must not be used as the local exhaust system for the asbestos control area. Filters on exhaust equipment must conform to ASSP Z9.2 and UL 586. Terminate the local exhaust system out of doors and remote from any public access or ventilation system intakes.

3.1.8 Tools

Vacuums must be leak proof to the filter and equipped with HEPA filters. Filters on vacuums must conform to ASSP Z9.2 and UL 586. Do not use power tools to remove asbestos containing materials unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation systems. Remove all residual asbestos from reusable tools prior to storage or reuse. Reusable tools must be thoroughly decontaminated prior to being removed from the regulated areas.

3.1.9 Rental Equipment

If rental equipment is to be used, furnish written notification to the rental agency concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.

3.1.10 Glovebags

Submit written manufacturers proof that glovebags will not break down under expected temperatures and conditions.

3.2 WORK PROCEDURE

Perform asbestos related work in accordance with 29 CFR 1926.1101, 40 CFR 61-SUBPART M, NAVFAC P-502, and as specified herein. Use wet or if given prior EPA approval, dry removal procedures and negative pressure enclosure techniques. Wear and utilize protective clothing and equipment as specified herein. No eating, smoking, drinking, chewing gum, tobacco, or applying cosmetics permitted in the asbestos work or control areas. Personnel of other trades not engaged in the removal and demolition of asbestos containing material must not be exposed at any time to airborne concentrations of asbestos unless all the personnel protection and training provisions of this specification are complied with by the trade personnel. Seal all roof top penetrations, except plumbing vents, prior

to asbestos roofing work. Shut down the building heating, ventilating, and air conditioning system, cap the openings to the system, prior to the commencement of asbestos work. Power to the regulated area must be locked-out and tagged in accordance with 29 CFR 1910.147. Disconnect electrical service when wet removal is performed and provide temporary electrical service with verifiable ground fault circuit interrupter (GFCI) protection prior to the use of any water. All electrical work must be performed by a licensed electrician. Stop abatement work in the regulated area immediately when the airborne total fiber concentration: (1) equals or exceeds 0.01 f/cc, or the pre-abatement concentration, whichever is greater, outside the regulated area; or (2) equals or exceeds 1.0 f/cc inside the regulated area. Correct the condition to the satisfaction of the Contracting Officer, including visual inspection and air sampling. Work must resume only upon notification by the Contracting Officer. Corrective actions must be documented. If an asbestos fiber release or spill occurs outside of the asbestos control area, stop work immediately, correct the condition to the satisfaction of the Contracting Officer including clearance sampling, prior to resumption of work.

3.2.1 Building Ventilation System and Critical Barriers

Building ventilation system supply and return air ducts in a regulated area must be shut down and isolated by lockable switch or other positive means in accordance with 29 CFR 1910.147. isolated by airtight seals to prevent the spread of contamination throughout the system. The airtight seals must consist of air-tight rigid covers for building ventilation supply and exhaust grills where the ventilation system is required to remain in service during abatement 2 layers of polyethylene. Edges to wall, ceiling and floor surfaces must be sealed with industrial grade duct tape.

- a. A Competent Person must supervise the work.
- b. For indoor work, critical barriers must be placed over all openings to the regulated area.
- c. Impermeable dropcloths must be placed on surfaces beneath all removal activity.

3.2.2 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent work. Where such work is damaged or contaminated as verified by the Contracting Officer using visual inspection or sample analysis, it must be restored to its original condition or decontaminated by the Contractor at no expense to the Government as deemed appropriate by the Contracting Officer. This includes inadvertent spill of dirt, dust, or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, stop work immediately. Then clean up the spill. When satisfactory visual inspection and air sampling results are obtained from the PQP work may proceed at the discretion of the Contracting Officer.

3.2.3 Furnishings

Furniture and equipment will be removed from the area of work by the Government before asbestos work begins.

3.2.4 Precleaning

Wet wipe and HEPA vacuum all surfaces potentially contaminated with asbestos prior to establishment of an enclosure.

3.2.5 Asbestos Control Area Requirements

3.2.5.1 Negative Pressure Enclosure

Removal of asbestos contaminated acoustical ceiling tiles, spray applied fireproofing, thermal system insulation require the use of a negative pressure enclosure. Block and seal openings in areas where the release of airborne asbestos fibers can be expected. Establish an asbestos negative pressure enclosure with the use of curtains, portable partitions, or other enclosures in order to prevent the escape of asbestos fibers from the contaminated asbestos work area. Negative pressure enclosure development must include protective covering of uncontaminated walls, and ceilings with a continuous membrane of two layers of minimum 6-mil plastic sheet sealed with tape to prevent water or other damage. Provide two layers of 6-mil plastic sheet over floors and extend a minimum of 12 inches up walls. Seal all joints with tape. Provide local exhaust system in the asbestos control area. Openings will be allowed in enclosures of asbestos control areas for personnel and equipment entry and exit, the supply and exhaust of air for the local exhaust system and the removal of properly containerized asbestos containing materials. Replace local exhaust system filters as required to maintain the efficiency of the system.

3.2.5.2 Glovebag

If the construction of a negative pressure enclosure is infeasible for the removal of asbestos containing materials located within the buildings. Use alternate techniques as indicated in 29 CFR 1926.1101. Establish designated limits for the asbestos regulated area with the use of rope or other continuous barriers, and maintain all other requirements for asbestos control areas. The PQP must conduct personal samples of each worker engaged in asbestos handling (removal, disposal, transport and other associated work) throughout the duration of the project. If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers at any time exceeds background or 0.01 fibers per cubic centimeter whichever is greater, stop work, evacuate personnel in adjacent areas or provide personnel with approved protective equipment at the discretion of the Contracting Officer. This sampling may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those obtained by the Contractor, the Government will determine which results predominate. If adjacent areas are contaminated as determined by the Contracting Officer, clean the contaminated areas, monitor, and visually inspect the area as specified herein.

3.2.5.3 Regulated Area for Class II Removal

Removal of asbestos containing floor tile/mastic, sealants, are Class II removal activities. Establish designated limits for the asbestos regulated work area with the use of red barrier tape; install critical barriers, splash guards and signs, and maintain all other requirements for asbestos control area except local exhaust. Place impermeable dropcloths on surfaces beneath removal activity extending out 3 feet in all directions. A detached decontamination system may be used. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the

asbestos work area and conduct personal samples of each worker engaged in the work. If workers the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.6 Removal Procedures

Wet asbestos material with a fine spray of amended water a specific wetting agent such as light oil during removal, cutting, or other handling so as to reduce the emission of airborne fibers. Remove material and immediately place in 6 mil plastic disposal bags. Remove asbestos containing material in a gradual manner, with continuous application of the amended water or wetting agent in such a manner that no asbestos material is disturbed prior to being adequately wetted. Where unusual circumstances prohibit the use of 6 mil plastic bags, submit an alternate proposal for containment of asbestos fibers to the Contracting Officer for approval. For example, in the case where both piping and insulation are to be removed, the Contractor may elect to wet the insulation, wrap the pipes and insulation in plastic and remove the pipe by sections. Containerize asbestos containing material while wet. Do not allow asbestos material to accumulate or become dry. Lower and otherwise handle asbestos containing material as indicated in 40 CFR 61-SUBPART M.

3.2.6.1 Sealing Contaminated Items Designated for Disposal

Remove contaminated architectural, mechanical, and electrical appurtenances such as venetian blinds, full-height partitions, carpeting, duct work, pipes and fittings, radiators, light fixtures, conduit, panels, and other contaminated items designated for removal by completely coating the items with an asbestos lock-down encapsulant at the demolition site before removing the items from the asbestos control area. These items need not be vacuumed. The asbestos lock-down encapsulant must be tinted a contrasting color and spray-applied by airless method. Thoroughness of sealing operation must be visually gauged by the extent of colored coating on exposed surfaces. Lock-down encapsulants must comply with the performance requirements specified herein.

3.2.6.2 Exposed Pipe Insulation Edges

Contain edges of asbestos insulation to remain that are exposed by a removal operation. Wet and cut the rough ends true and square with sharp tools and then encapsulate the edges with a 1/4 inch thick layer of non-asbestos containing insulating cement troweled to a smooth hard finish. When cement is dry, lag the end with a layer of non-asbestos lagging cloth, overlapping the existing ends by at least 4 inches. When insulating cement and cloth is an impractical method of sealing a raw edge of asbestos, take appropriate steps to seal the raw edges as approved by the Contracting Officer.

3.2.7 Methods of Compliance

3.2.7.1 Mandated Practices

The specific abatement techniques and items identified must be detailed in the Contractor's AHAP. Use the following engineering controls and work practices in all operations, regardless of the levels of exposure:

- a. Vacuum cleaners equipped with HEPA filters.

- b. Wet methods or wetting agents except where it can be demonstrated that the use of wet methods is unfeasible due to the creation of electrical hazards, equipment malfunction, and in roofing.
- c. Prompt clean-up and disposal.
- d. Inspection and repair of polyethylene.
- e. Cleaning of equipment and surfaces of containers prior to removing them from the equipment room or area.

3.2.7.2 Control Methods

Use the following control methods:

- a. Local exhaust ventilation equipped with HEPA filter;
- b. Enclosure or isolation of processes producing asbestos dust;
- c. Where the feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PELs, use them to reduce employee exposure to the lowest levels attainable and must supplement them by the use of respiratory protection.

3.2.7.3 Unacceptable Practices

The following work practices must not be used:

- a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.
- b. Compressed air used to remove asbestos containing materials, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.
- c. Dry sweeping, shoveling, or other dry clean up.
- d. Employee rotation as a means of reducing employee exposure to asbestos.

3.2.8 Class I Work Procedures

In addition to requirements of paragraphs MANDATED PRACTICES and CONTROL METHODS, the following engineering controls and work practices must be used:

- a. A Competent Person must supervise the installation and operation of the control methods.
- b. For jobs involving the removal of more than 25 feet or 10 square feet of TSI or surfacing material, place critical barriers over all openings to the regulated area.
- c. HVAC systems must be isolated in the regulated area by sealing with a double layer of plastic or air-tight rigid covers.
- d. Impermeable dropcloths (6 mil or greater thickness) must be placed on surfaces beneath all removal activity.

- e. Where a negative exposure assessment has not been provided or where exposure monitoring shows the PEL was exceeded, the regulated area must be ventilated with a HEPA unit and employees must use PPE.

3.2.9 Specific Control Methods for Class I Work

Use Class I work procedures, control methods and removal methods for the following ACM:

- a. Spray Applied Fireproofing
- b. Gypsum Wallboard and Joint Compound
- c. Thermal System Insulation and Mudded Pipe Fittings
- d. Plaster and Textured Ceilings and Walls
- e. Vermiculite

3.2.9.1 Negative Pressure Enclosure (NPE) System

The system must provide at least four air changes per hour inside the containment. The local exhaust unit equipment must be operated 24-hours per day until the containment is removed. The NPE must be smoke tested for leaks at the beginning of each shift and be sufficient to maintain a minimum pressure differential of minus 0.02 inch of water column relative to adjacent, unsealed areas. Pressure differential must be monitored continuously, 24-hours per day, with an automatic manometric recording instrument and Records must be provided daily on the same day collected to the Contracting Officer. The Contracting Officer must be notified immediately if the pressure differential falls below the prescribed minimum. The building ventilation system must not be used as the local exhaust system for the regulated area. The NPE must terminate outdoors unless an alternate arrangement is allowed by the Contracting Officer. All filters used must be new at the beginning of the project and must be periodically changed as necessary and disposed of as ACM waste.

3.2.9.2 Glovebag Systems

Glovebags must be used without modification, smoke-tested for leaks, and completely cover the circumference of pipe or other structures where the work is to be done. Glovebags must be used only once and must not be moved. Glovebags must not be used on surfaces that have temperatures exceeding 150 degrees F. Prior to disposal, glovebags must be collapsed using a HEPA vacuum. Before beginning the operation, loose and friable material adjacent to the glovebag operation must be wrapped and sealed in 2 layers of plastic or otherwise rendered intact. At least two persons must perform glovebag removal. Asbestos regulated work areas must be established for glovebag abatement. Designated boundary limits for the asbestos work must be established with rope or other continuous barriers and all other requirements for asbestos control areas must be maintained, including area signage and boundary warning tape.

- a. Attach HEPA vacuum systems to the bag to prevent collapse during removal of ACM.
- b. The negative pressure glove boxes must be fitted with gloved apertures and a bagging outlet and constructed with rigid sides from metal or

other material which can withstand the weight of the ACM and water used during removal. A negative pressure must be created in the system using a HEPA filtration system. The box must be smoke tested for leaks prior to each use.

3.2.9.3 Mini-Enclosure

Single bulkhead containment or Mini-containment (small walk-in enclosure) to accommodate no more than two persons, may be used if the disturbance or removal can be completely contained by the enclosure. The mini-enclosure must be inspected for leaks and smoke tested before each use. Air movement must be directed away from the employee's breathing zone within the mini-enclosure.

3.2.9.4 Wrap and Cut Operation

Prior to cutting pipe, the asbestos-containing insulation must be wrapped with polyethylene and securely sealed with duct tape to prevent asbestos becoming airborne as a result of the cutting process. The following steps must be taken: install glovebag, strip back sections to be cut 6 inches from point of cut, and cut pipe into manageable sections.

3.2.9.5 Class I Removal Method

Class I ACM must be removed using a control method described above. Prepare work area as previously specified. Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area. Spread one layer of 6-mil seamless plastic sheeting on the floor below the work area. Bag all asbestos debris which has fallen to the floor as asbestos-containing debris. Place all debris in plastic disposal bags of 6-mil minimum thickness. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Lower and otherwise handle asbestos containing materials as indicated in 40 CFR 61-SUBPART M. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers or the designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work, and immediately correct the situation.

3.2.10 Class II Work Procedures

In addition to the requirements of paragraphs MANDATED PRACTICES and CONTROL METHODS, the following engineering controls and work practices must be used:

- a. A Competent Person must supervise the work.
- b. For indoor work, critical barriers must be placed over all openings to the regulated area.
- c. Impermeable dropcloths must be placed on surfaces beneath all removal activity.

3.2.11 Specific Control Methods for Class II Work

3.2.11.1 Vinyl and Asphaltic Flooring Materials

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. A detached decontamination system may be used. When removing vinyl floor tile and mastic which contains ACM, use the following practices. Remove floor tile and mastic using adequately wet methods. Remove floor tiles intact (if possible). Do not sand flooring or its backing. Scrape residual adhesive and backing using wet methods. Mechanical chipping is prohibited unless performed in a negative pressure enclosure. Dry sweeping is prohibited. Use vacuums equipped with HEPA filter, disposable dust bag, and metal floor tool (no brush) to clean floors. Place debris into a 6-mil minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Lower and otherwise handle asbestos containing materials as indicated in 40 CFR 61-SUBPART M. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If workers the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.11.2 Sealants and Mastic

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers and signs, and maintain all other requirements for asbestos control area except local exhaust. Spread 6-mil plastic sheeting on the ground around the perimeter of the work area extending out in all directions. Using adequately wet methods, carefully remove the ACM sealants and mastics using a scraper or knife blade. As it is removed place the material into a disposal bag. Make every effort to keep the asbestos material from falling to the ground or work area floor below. Dry sweeping is prohibited. Use vacuums equipped with HEPA filter and disposable dust bag. Place debris into a 6-mil minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Lower and otherwise handle asbestos containing materials as indicated in 40 CFR 61-SUBPART M. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or at designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.11.3 Suspect Fire Doors

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. A detached decontamination system may be used. Spread 6-mil plastic sheeting on the ground beneath the work area and around the perimeter of the work area extending out in all directions. Remove door intact from hinges and wrap with 6-mil plastic sheeting. Inspect the interior areas of the door to determine if ACM is present. If ACM is not present the door may be disposed of as general construction debris. If ACM is present place whole door in enclosed container for disposal. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.11.4 Roofing Materials

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. When removing roofing materials which contain ACM as described in 29 CFR 1926.1101(g)(8)(ii), use the following practices. Roofing material must be removed in an intact state. Wet methods must be used to remove roofing materials that are not intact, or that will be rendered not intact during removal, unless such wet methods are not feasible or will create safety hazards. When removing built-up roofs, with asbestos-containing roofing felts and an aggregate surface, using a power roof cutter, all dust resulting from the cutting operations must be collected by a HEPA dust collector, or must be HEPA vacuumed by vacuuming along the cut line. Asbestos-containing roofing material must not be dropped or thrown to the ground, but must be lowered to the ground via covered, dust-tight chute, crane, hoist or other method approved by the Contracting Officer. Any ACM that is not intact must be lowered to the ground as soon as practicable, but not later than the end of the work shift. While the material remains on the roof it must be kept wet or placed in an impermeable waste bag or wrapped in plastic sheeting. Intact ACM must be lowered to the ground as soon as practicable, but not later than the end of the work shift. Unwrapped material must be transferred to a closed receptacle. Critical barriers must be placed over roof level heating and ventilation air intakes. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.11.5 Cementitious Siding and Shingles or Transite Panels

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. When removing cementitious asbestos-containing siding, shingles or Transite panels use the following work practices. Intentionally cutting, abrading or breaking is prohibited. Each panel or shingle must be sprayed with amended water prior to removal. Nails must be cut with flat, sharp

instruments. Unwrapped or unbagged panels or shingles must be immediately lowered to the ground via covered dust-tight chute, crane or hoist, or placed in an impervious waste bag or wrapped in plastic sheeting and lowered to the ground no later than the end of the work shift. Place debris into a 6-mil minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.11.6 Gaskets

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. Gaskets must be thoroughly wetted with amended water prior to removal and immediately placed in a disposal container. If a gasket is visibly deteriorated and unlikely to be removed intact, removal must be undertaken within a glovebag. Any scraping to remove residue must be performed wet. Place debris into a 6-mil minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 6-mil minimum thickness disposal bag. Containerize asbestos containing waste while wet. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.12 Air Sampling

Perform sampling of airborne concentrations of asbestos fibers in accordance with 29 CFR 1926.1101, the Contractor's air monitoring plan and as specified herein. Sampling performed in accordance with 29 CFR 1926.1101 must be performed by the PQP. Sampling performed for environmental and quality control reasons must be performed by the PQP. Unless otherwise specified, use NIOSH Method 7400 for sampling and analysis. Monitoring may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those results obtained by the Contractor, the Government will determine which results predominate. Results of breathing zone samples must be posted at the job site and made available to the Contracting Officer. Submit all documentation regarding initial exposure assessments, negative exposure assessments, and air-monitoring results.

3.2.12.1 Sampling Prior to Asbestos Work

Provide area air sampling and establish the baseline one day prior to the masking and sealing operations for each demolition removal site. Establish the background by performing area sampling in similar but uncontaminated sites in the building.

3.2.12.2 Sampling During Asbestos Work

The PQP must provide personal and area sampling as indicated in 29 CFR 1926.1101 and governing environmental regulations. Breathing zone samples must be taken for at least 25 percent of the workers in each shift, or a minimum of two, whichever is greater. Air sample fiber counting must be completed and results provided within 24-hours (breathing zone samples), and 24 hours (environmental/clearance monitoring) after completion of a sampling period. In addition, provided the same type of work is being performed, provide area sampling at least once every work shift close to the work inside the enclosure, outside the clean room entrance to the enclosure, and at the exhaust opening of the local exhaust system. If sampling outside the enclosure shows airborne levels have exceeded background or 0.01 fibers per cubic centimeter, whichever is greater, stop all work, correct the condition(s) causing the increase, and notify the Contracting Officer immediately. Where alternate methods are used, perform personal and area air sampling at locations and frequencies that will accurately characterize the evolving airborne asbestos levels. The written results must be signed by testing laboratory analyst, testing laboratory principal and the Contractor's PQP. The air sampling results must be documented on a Contractor's daily air monitoring log.

3.2.12.3 Final Clearance Requirements, NIOSH PCM Method

For PCM sampling and analysis using NIOSH NMAM Method 7400, the fiber concentration inside the abated regulated area, for each airborne sample, must be less than 0.01 f/cc. The abatement inside the regulated area is considered complete when every PCM final clearance sample is below the clearance limit. If any sample result is greater than 0.01 total f/cc, the asbestos fiber concentration (asbestos f/cc) must be confirmed from that same filter using NIOSH NMAM Method 7402 (TEM) at Contractor's expense. If any confirmation sample result is greater than 0.01 asbestos f/cc, abatement is incomplete and cleaning must be repeated at the Contractor's expense. Upon completion of any required recleaning, resampling with results to meet the above clearance criteria must be done at the Contractor's expense.

3.2.12.4 Sampling After Final Clean-Up (Clearance Sampling)

Provide area sampling of asbestos fibers using aggressive air sampling techniques as defined in the EPA 560/5-85-024 and establish an airborne asbestos concentration of less than 0.01 fibers per cubic centimeter after final clean-up but before removal of the enclosure or the asbestos work control area. After final cleanup and the asbestos control area is dry but prior to clearance sampling, the PQP must perform a visual inspection in accordance with ASTM E1368 to ensure that the asbestos control and work area is free of any accumulations of dirt, dust, or debris. Prepare a written report signed and dated by the PQP documenting that the asbestos control area is free of dust, dirt, and debris and all waste has been removed. Perform at least 2 samples. Use transmission electron microscopy (TEM) to analyze clearance samples and report the results in accordance with current NIOSH criteria. The asbestos fiber counts from

these samples must be less than 0.01 fibers per cubic centimeter or be not greater than the background, whichever is greater. Should any of the final samples indicate a higher value take appropriate actions to re-clean the area and repeat the sampling and TEM analysis at the Contractor's expense.

3.2.12.5 Air Clearance Failure

If clearance sampling results fail to meet the final clearance requirements, pay all costs associated with the required recleaning, resampling, and analysis, until final clearance requirements are met.

3.2.13 Site Inspection

While performing asbestos engineering control work, the Contractor must be subject to on-site inspection by the Contracting Officer who may be assisted by or represented by safety or industrial hygiene personnel. If the work is found to be in violation of this specification, the Contracting Officer or his representative will issue a stop work order to be in effect immediately and until the violation is resolved. All related costs including standby time required to resolve the violation must be at the Contractor's expense.

3.3 CLEAN-UP AND DISPOSAL

3.3.1 Housekeeping

Essential parts of asbestos dust control are housekeeping and clean-up procedures. Maintain surfaces of the asbestos control area free of accumulations of asbestos fibers. Give meticulous attention to restricting the spread of dust and debris; keep waste from being distributed over the general area. Use HEPA filtered vacuum cleaners. DO NOT BLOW DOWN THE SPACE WITH COMPRESSED AIR. When asbestos removal is complete, all asbestos waste is removed from the work-site, and final clean-up is completed, the Contracting Officer will attest that the area is safe before the signs can be removed. After final clean-up and acceptable airborne concentrations are attained but before the HEPA unit is turned off and the enclosure removed, remove all pre-filters on the building HVAC system and provide new pre-filters. Dispose of filters as asbestos contaminated materials. Reestablish HVAC mechanical, and electrical systems in proper working order. The Contracting Officer will visually inspect all surfaces within the enclosure for residual material or accumulated dust or debris. The Contractor must re-clean all areas showing dust or residual materials. If re-cleaning is required, air sample and establish an acceptable asbestos airborne concentration after re-cleaning. The Contracting Officer must agree that the area is safe in writing before unrestricted entry will be permitted. The Government must have the option to perform monitoring to determine if the areas are safe before entry is permitted.

3.3.2 Title to Materials

All waste materials, except as specified otherwise, become the property of the Contractor and must be disposed of as specified in applicable local, State, and Federal regulations and herein.

3.3.3 Disposal of Asbestos

3.3.3.1 Procedure for Disposal

Coordinate all waste disposal manifests with the Contracting Officer and NAVFAC EV. Collect asbestos waste, contaminated waste water filters, asbestos contaminated water, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing which may produce airborne concentrations of asbestos fibers and place in sealed fiber-proof, waterproof, non-returnable containers (e.g. double plastic bags 6 mils thick, cartons, drums or cans). Wastes within the containers must be adequately wet in accordance with 40 CFR 61-SUBPART M. Affix a warning and Department of Transportation (DOT) label to each container including the bags or use at least 6 mils thick bags with the approved warnings and DOT labeling preprinted on the bag. Clearly indicate on the outside of each container the name of the waste generator and the location at which the waste was generated. Prevent contamination of the transport vehicle (especially if the transport vehicle is a rented truck likely to be used in the future for non-asbestos purposes). These precautions include lining the vehicle cargo area with plastic sheeting (similar to work area enclosure) and thorough cleaning of the cargo area after transport and unloading of asbestos debris is complete. Dispose of waste asbestos material at an Environmental Protection Agency (EPA) or State-approved asbestos landfill off Government property. For temporary storage, store sealed impermeable bags in asbestos waste drums or skids. An area for interim storage of asbestos waste-containing drums or skids will be assigned by the Contracting Officer or his authorized representative. Comply with 40 CFR 61-SUBPART M, State, regional, and local standards for hauling and disposal. Sealed plastic bags may be dumped from drums into the burial site unless the bags have been broken or damaged. Damaged bags must remain in the drum and the entire contaminated drum must be buried. Uncontaminated drums may be recycled. Workers unloading the sealed drums must wear appropriate respirators and personal protective equipment when handling asbestos materials at the disposal site.

3.3.3.2 Asbestos Disposal Quantity Report

Direct the PQP to record and report, to the Contracting Officer, the amount of asbestos containing material removed and released for disposal. Deliver the report for the previous day at the beginning of each day shift with amounts of material removed during the previous day reported in linear feet or square feet as described initially in this specification and in cubic feet for the amount of asbestos containing material released for disposal.

Allow the GC to inspect, record and report the amount of asbestos containing material removed and released for disposal on a daily basis.

-- End of Section --

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LEAD REMEDIATION
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PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP Z9.2 (2018) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

ASTM INTERNATIONAL (ASTM)

ASTM E1613 (2012) Standard Test Method for Determination of Lead by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), Flame Atomic Absorption Spectrometry (FAAS), or Graphite Furnace Atomic Absorption Spectrometry (GFAAS) Techniques

ASTM E1644 (2017) Standard Practice for Hot Plate Digestion of Dust Wipe Samples for the Determination of Lead

ASTM E1727 (2016) Standard Practice for Field Collection of Soil Samples for Subsequent Lead Determination

ASTM E1728/E1728M (2020) Standard Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Lead Determination

ASTM E1792 (2003; R 2016) Standard Specification for Wipe Sampling Materials for Lead in Surface Dust

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701 (2019) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD 6780 (1995; Errata Aug 1996; Rev Ch. 7 - 1997)
Guidelines for the Evaluation and Control
of Lead-Based Paint Hazards in Housing

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

29 CFR 1926.21	Safety Training and Education
29 CFR 1926.33	Access to Employee Exposure and Medical Records
29 CFR 1926.55	Gases, Vapors, Fumes, Dusts, and Mists
29 CFR 1926.59	Hazard Communication
29 CFR 1926.62	Lead
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response
29 CFR 1926.103	Respiratory Protection
29 CFR 1926.1126	Chromium
29 CFR 1926.1127	Cadmium
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 745	Lead-Based Paint Poisoning Prevention in Certain Residential Structures
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 178	Specifications for Packagings

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

ND OPNAVINST 5100.23 (2005; Rev G) Navy Occupational Safety and Health (NAVOSH) Program Manual

UNDERWRITERS LABORATORIES (UL)

UL 586 (2009; Reprint Dec 2017) UL Standard for Safety High-Efficiency Particulate, Air Filter Units

1.2 DEFINITIONS

1.2.1 Abatement

Measures defined in 40 CFR 745, Section 223, designed to permanently eliminate lead-based paint hazards.

1.2.2 Action Level

Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period; to an airborne concentration of cadmium of 2.5 micrograms per cubic meter of air averaged over an 8-hour period; to an airborne concentration of chromium (VI) of 2.5 micrograms per cubic meter of air averaged over an 8-hour period.

1.2.3 Area Sampling

Sampling of lead, cadmium, chromium concentrations within the lead, cadmium, chromium control area and inside the physical boundaries which is representative of the airborne lead, cadmium, chromium concentrations but is not collected in the breathing zone of personnel (approximately 5 to 6 feet above the floor).

1.2.4 Cadmium Permissible Exposure Limit (PEL)

Five micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.1127. If an employee is exposed for more than 8-hours in a work day, determine the PEL by the following formula:

$$\text{PEL (micrograms/cubic meter of air)} = 40/\text{No. hrs worked per day}$$

1.2.5 Certified Industrial Hygienist (CIH)

As used in this section refers to a person retained by the Contractor who is certified as an industrial hygienist and who is trained in the recognition and control of lead, cadmium and chromium hazards in accordance with current federal, State, and local regulations. CIH must be certified for comprehensive practice by the American Board of Industrial Hygiene. The Certified Industrial Hygienist must be independent of the Contractor and must have no employee or employer relationship which could constitute a conflict of interest.

1.2.6 Child-Occupied Facility

Real property which is a building or portion of a building constructed prior to 1978 visited regularly by the same child, six-years of age or under, on at least two different days within any week (Sunday through

Saturday period), provided that each day's visit lasts at least 3-hours, and the combined annual visits last at least 60-hours. Child-occupied facilities include but are not limited to, day-care centers, preschools and kindergarten classrooms.

1.2.7 Chromium Permissible Exposure Limit (PEL)

Five micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.1126. If an employee is exposed for more than 8-hours in a work day, determine the PEL by the following formula:

$$\text{PEL (micrograms/cubic meter of air)} = 40/\text{No. hrs worked per day}$$

1.2.8 Competent Person (CP)

As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead, cadmium and chromium hazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the lead, cadmium and chromium hazard. The Contractor may provide more than one CP as required to supervise and monitor the work. The CP must be a Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene or a Certified Safety Professional (CSP) certified by the Board of Certified Safety Professionals or a licensed lead-based paint abatement Supervisor/Project Designer in the State of North Carolina.

1.2.9 Contaminated Room

Refers to a room for removal of contaminated personal protective equipment (PPE).

1.2.10 Decontamination Shower Facility

That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.

1.2.11 Deleading

Activities conducted by a person who offers to eliminate lead-based paint or lead-based paint hazards or paints containing cadmium/chromium or to plan such activities in commercial buildings, bridges or other structures.

1.2.12 Eight-Hour Time Weighted Average (TWA)

Airborne concentration of lead, cadmium, chromium to which an employee is exposed, averaged over an 8-hour workday as indicated in 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

1.2.13 High Efficiency Particulate Air (HEPA) Filter Equipment

HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead, cadmium, chromium contaminated particulate. A high efficiency particulate filter demonstrates at least 99.97 percent efficiency against 0.3 micron or larger size particles.

1.2.14 Lead

Metallic lead, inorganic lead compounds, and organic lead soaps. Excludes

other forms of organic lead compounds. The use of the term Lead in this section also refers to paints which contain detectable concentrations of Cadmium and Chromium. For the purposes of the section lead-based paint (LBP) and paint with lead (PWL) also contains cadmium and chromium.

1.2.15 Lead-Based Paint (LBP)

Paint or other surface coating that contains lead in excess of 1.0 milligrams per centimeter squared or 0.5 percent by weight.

1.2.16 Lead-Based Paint Activities

In the case of target housing or child occupied facilities, lead-based paint activities include; a lead-based paint inspection, a risk assessment, or abatement of lead-based paint hazards.

1.2.17 Lead-Based Paint Hazards

Paint-lead hazard, dust-lead hazard or soil-lead hazard as identified in 40 CFR 745, Section 65. Any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, lead-based paint that is deteriorated or present in accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects.

1.2.18 Lead, Cadmium, Chromium Control Area

A system of control methods to prevent the spread of lead, cadmium, chromium dust, paint chips or debris to adjacent areas that may include temporary containment, floor or ground cover protection, physical boundaries, and warning signs to prevent unauthorized entry of personnel. HEPA filtered local exhaust equipment may be used as engineering controls to further reduce personnel exposures or building/outdoor environmental contamination.

1.2.19 Lead Permissible Exposure Limit (PEL)

Fifty micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than 8-hours in a work day, determine the PEL by the following formula:

$$\text{PEL (micrograms/cubic meter of air)} = 400/\text{No. hrs worked per day}$$

1.2.20 Material Containing Lead/Paint with Lead (MCL/PWL)

Any material, including paint, which contains lead as determined by the testing laboratory using a valid test method. The requirements of this section does not apply if no detectable levels of lead are found using a quantitative method for analyzing paint or MCL using laboratory instruments with specified limits of detection (usually 0.01 percent). An X-Ray Fluorescence (XRF) instrument is not considered a valid test method.

1.2.21 Personal Sampling

Sampling of airborne lead, cadmium, chromium concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Samples must be representative of the employees' work tasks. Breathing zone must be considered an area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches and centered at

the nose or mouth of an employee.

1.2.22 Physical Boundary

Area physically roped or partitioned off around lead, cadmium, chromium control area to limit unauthorized entry of personnel.

1.2.23 Target Housing

Residential real property which is housing constructed prior to 1978, except housing for the elderly or persons with disabilities (unless any one or more children age 6-years or under resides or is expected to reside in such housing for the elderly or persons with disabilities) or any zero bedroom dwelling.

1.3 DESCRIPTION

Construction activities impacting PWL or material containing lead, cadmium, chromium which are covered by this specification include the demolition or removal of material containing lead, cadmium, chromium in unknown condition, located in the buildings. The work covered by this section includes work tasks and the precautions specified in this section for the protection of building occupants and the environment during and after the performance of the hazard abatement activities.

1.3.1 Protection of Existing Areas To Remain

Project work including, but not limited to, lead, cadmium, chromium hazard abatement work, storage, transportation, and disposal must be performed without damaging or contaminating adjacent work and areas. Where such work or areas are damaged or contaminated, restore work and areas to the original condition.

1.3.2 Coordination with Other Work

Coordinate with work being performed in adjacent areas to ensure there are no exposure issues. Explain coordination procedures in the Lead, Cadmium, Chromium Compliance Plan and describe how the Contractor will prevent lead, cadmium and chromium exposure to other contractors and Government personnel performing work unrelated to lead, cadmium and chromium activities.

1.3.3 Sampling and Analysis

Submit a log of the analytical results from sampling conducted during the abatement. Keep the log of results current with project activities and brief the results to the Contracting Officer as analytical results are reported.

1.3.3.1 Dust Wipe Materials, Sampling and Analysis

Sampling must conform to ASTM E1728/E1728M ASTM E1792. Analysis must conform to ASTM E1613 and ASTM E1644.

1.3.3.2 Soil Sampling and Analysis

Sampling must conform to ASTM E1727.

1.3.3.3 Clearance Monitoring

- a. Collect dust wipe samples inside the lead, cadmium and chromium hazard control area after the final visual inspection in the quantities and at the locations specified.
 - (1) Floors.
 - (2) Interior Window Sills.
 - (3) Window Troughs.

- b. Collect exterior bare soil samples inside the lead, cadmium and chromium hazard control area after the final visual inspection in the quantities and at the locations specified.
 - (1) Near the building foundation.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Competent Person Qualifications; G

Training Certification; G

Occupational and Environmental Assessment Data Report; G

Medical Examinations; G

Lead, Cadmium, Chromium Waste Management Plan; G

Licenses, Permits and Notifications; G

Occupant Protection Plan; G

Lead, Cadmium, Chromium Compliance Plan; G

Initial Sample Results; G

Written Evidence of TSD Approval; G

SD-03 Product Data

Respirators; G

Vacuum Filters; G

Negative Air Pressure System; G

Materials and Equipment; G

Expendable Supplies; G

Local Exhaust Equipment; G

Pressure Differential Automatic Recording Instrument; G

Pressure Differential Log; G

SD-06 Test Reports

Sampling and Analysis; G

Occupational and Environmental Assessment Data Report; G

Sampling Results; G

Pressure Differential Recordings For Local Exhaust System; G

SD-07 Certificates

Testing Laboratory; G

Third Party Consultant Qualifications; G

Notification of the Commencement of LBP Hazard Abatement; G

Clearance Certification; G

SD-11 Closeout Submittals

Hazardous Waste Manifest; G

Turn-In Documents or Weight Tickets; G

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

1.5.1.1 Competent Person (CP)

Submit name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph COMPETENT PERSON (CP) RESPONSIBILITIES. Provide documented construction project-related experience with implementation of OSHA's Lead in Construction standard (29 CFR 1926.62), Chromium standard (29 CFR 1926.1126), Cadmium standard (29 CFR 1926.1127) which shows ability to assess occupational and environmental exposure to lead, cadmium, chromium; experience with the use of respirators, personal protective equipment and other exposure reduction methods to protect employee health. Demonstrate a minimum of 3 years experience implementing OSHA's Lead in Construction standard (29 CFR 1926.62), Chromium standard (29 CFR 1926.1126), and Cadmium standard (29 CFR 1926.1127). Submit proper documentation that the CP is trained and licensed and certified in accordance with federal, State and local laws. The competent person must be a licensed lead-based paint abatement Supervisor/Project Designer in the State of North Carolina.

1.5.1.2 Training Certification

Submit a certificate for each worker and supervisor, signed and dated by

the accredited training provider, stating that the employee has received the required lead, cadmium and chromium training specified in 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 40 CFR 745 and is certified to perform or supervise deleading, lead removal or demolition activities in the State of North Carolina.

1.5.1.3 Testing Laboratory

Submit the name, address, and telephone number of the testing laboratory selected to perform the air soil and wipe analysis, testing, and reporting of airborne concentrations of lead, cadmium and chromium. Use a laboratory participating in the EPA National Lead Laboratory Accreditation Program (NLLAP) by being accredited by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis. Laboratories selected to perform blood lead analysis must be OSHA approved.

1.5.1.4 Third Party Consultant Qualifications

Submit the name, address and telephone number of the third party consultant selected to perform the wipe sampling for determining concentrations of lead, cadmium and chromium in dust. Submit proper documentation that the consultant is trained and certified as an inspector technician or inspector/risk assessor by the USEPA authorized State (or local) certification and accreditation program.

1.5.1.5 Certified Risk Assessor

The Certified Risk Assessor must be certified pursuant to 40 CFR 745, Section 226 and be responsible to perform the clearance sampling, clearance sample data evaluation and summarize clearance sampling results in a section of the abatement report. The risk assessor must sign the abatement report to indicate clearance requirements for the contract have been met.

1.5.2 Requirements

1.5.2.1 Competent Person (CP) Responsibilities

- a. Verify training meets all federal, State, and local requirements.
- b. Review and approve Lead, Cadmium, Chromium Compliance Plan for conformance to the applicable referenced standards.
- c. Continuously inspect LBP/PWL or MCL work for conformance with the approved plan.
- d. Perform (or oversee performance of) air sampling. Recommend upgrades or downgrades (whichever is appropriate based on exposure) on the use of PPE (respirators included) and engineering controls.
- e. Ensure work is performed in strict accordance with specifications at all times.
- f. Control work to prevent hazardous exposure to human beings and to the environment at all times.

- g. Supervise final cleaning of the lead, cadmium, chromium control area, take clearance wipe samples if necessary; review clearance sample results and make recommendations for further cleaning.
- h. Certify the conditions of the work as called for elsewhere in this specification.
- i. The CP must be certified pursuant to 40 CFR 745, Section 226 and is responsible for development and implementation of the occupant protection plan, the abatement report and supervise lead, cadmium and chromium hazard abatement work activities.

1.5.2.2 Lead, Cadmium, Chromium Compliance Plan

Submit a detailed job-specific plan of the work procedures to be used in the disturbance of lead, cadmium and chromium, LBP/PWL or MCL. Include in the plan a sketch showing the location, size, and details of lead, cadmium, chromium control areas, critical barriers, physical boundaries, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include a description of equipment and materials, work practices, controls and job responsibilities for each activity from which lead, cadmium, chromium is emitted. Include in the plan, eating, drinking, smoking, hygiene facilities and sanitary procedures, interface of trades, sequencing of lead, cadmium, chromium related work, collected waste water and dust containing lead, cadmium, chromium and debris, air sampling, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that lead, cadmium, chromium is not released outside of the lead, cadmium, chromium control area. Include site preparation, cleanup and clearance procedures. Include occupational and environmental sampling, training and strategy, sampling and analysis strategy and methodology, frequency of sampling, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan. Include a description of arrangements made among contractors on multicontractor worksites to inform affected employees and to clarify responsibilities to control exposures.

The plan must be developed and signed by a certified Lead Project Designer in the State of North Carolina. The plan must include the name and certification number of the person signing the plan.

1.5.2.3 Occupational and Environmental Assessment Data Report

If initial monitoring is necessary, submit occupational and environmental sampling results to the Contracting Officer within three working days of collection, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the CP.

In order to reduce the full implementation of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 the Contractor must provide documentation. Submit a report that supports the determination to reduce full implementation of the requirements of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and supporting the Lead, Cadmium, Chromium Compliance Plan.

- a. The initial monitoring must represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures per 29 CFR 1926.62, 29 CFR 1926.1126,

29 CFR 1926.1127. The data must represent the worker's regular daily exposure to lead, cadmium, chromium for stated work.

- b. Submit worker exposure data gathered during the task based trigger operations of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 with a complete process description. This includes manual demolition, manual scraping, manual sanding, heat gun, power tool cleaning, rivet busting, cleanup of dry expendable abrasives, abrasive blast enclosure removal, abrasive blasting, welding, cutting and torch burning where lead, cadmium and chromium containing coatings are present.
- c. The initial assessment must determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the lead, cadmium, chromium compliance plan per 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

1.5.2.4 Medical Examinations

Submit pre-work blood lead levels and post-work blood lead levels for all workers performing lead, cadmium, chromium activities during the execution of the work. Initial medical surveillance as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 must be made available to all employees exposed to lead, cadmium, chromium at any time (one day) above the action level. Full medical surveillance must be made available to all employees on an annual basis who are or may be exposed to lead, cadmium and chromium in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Adequate records must show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and 29 CFR 1926.103. Provide medical surveillance to all personnel exposed to lead, cadmium, chromium as indicated in 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Maintain complete and accurate medical records of employees for the duration of employment plus 30 years.

1.5.2.5 Training

Train each employee performing work that disturbs lead, cadmium, chromium, who performs LBP/MCL/PWL disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127, 40 CFR 745 and State of North Carolina and local regulations where appropriate.

1.5.2.6 Respiratory Protection Program

- a. Provide each employee required to wear a respirator a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.
- b. Establish and implement a respiratory protection program as required by 29 CFR 1926.103, 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and 29 CFR 1926.55.

1.5.2.7 Hazard Communication Program

Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.

1.5.2.8 Lead, Cadmium, Chromium Waste Management

The Lead, Cadmium, Chromium Waste Management Plan must comply with applicable requirements of federal, State, and local hazardous waste regulations and address:

- a. Identification and classification of wastes associated with the work.
- b. Estimated quantities of wastes to be generated and disposed of.
- c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and operator and a 24-hour point of contact. Furnish two copies of USEPA State and local hazardous waste permits manifests and USEPA Identification numbers.
- d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
- e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
- f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.
- g. Work plan and schedule for waste containment, removal and disposal. Proper containment of the waste includes using acceptable waste containers (e.g., 55-gallon drums) as well as proper marking/labeling of the containers. Clean up and containerize wastes daily.
- h. Include any process that may alter or treat waste rendering a hazardous waste non hazardous.
- i. Unit cost for hazardous waste disposal according to this plan.

1.5.2.9 Environmental, Safety and Health Compliance

In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, State, and local authorities regarding lead, cadmium and chromium. Comply with the applicable requirements of the current issue of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127, EM 385-1-1, ND OPNAVINST 5100.23. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirements apply.

1.5.3 Pressure Differential Recordings for Local Exhaust System

Provide a local exhaust system that creates a negative pressure of at least 0.02 inches of water relative to the pressure external to the enclosure and operate it continuously, 24-hours a day, until the temporary enclosure of the lead, cadmium, chromium control area is removed. Submit pressure differential recordings for each work day to the PQP for review and to the Contracting Officer within 24-hours from the end of each work day.

1.5.4 Licenses, Permits and Notifications

Certify and submit in writing to the state's environmental protection agency responsible for lead hazard abatement activities and the Contracting Officer at least 10 days prior to the commencement of work that licenses, permits and notifications have been obtained. All associated fees or costs incurred in obtaining the licenses, permits and notifications are included in the contract price.

1.5.5 Occupant Protection Plan

The certified project designer must develop and implement an Occupant Protection Plan describing the measures and management procedures to be taken during lead, cadmium and chromium hazard abatement activities to protect the building occupants/building facilities and the outside environment from exposure to any lead, cadmium and chromium contamination while lead, cadmium and chromium hazard abatement activities are performed.

1.5.6 Pre-Construction Conference

Along with the CP, meet with the Contracting Officer to discuss in detail the Lead, Cadmium, Chromium Waste Management Plan and the Lead, Cadmium, Chromium Compliance Plan, including procedures and precautions for the work.

1.6 EQUIPMENT

1.6.1 Respirators

Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead, cadmium and chromium dust, fume and mist. Respirators must comply with the requirements of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

1.6.2 Special Protective Clothing

Personnel exposed to lead, cadmium, chromiumcontaminated dust must wear proper disposable protective whole body clothing, head covering, gloves, eye, and foot coverings as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.

1.6.3 Rental Equipment Notification

If rental equipment is to be used during PWL or MCL handling and disposal, notify the rental agency in writing concerning the intended use of the equipment.

1.6.4 Vacuum Filters

UL 586 labeled HEPA filters.

1.6.5 Equipment for Government Personnel

Furnish the Contracting Officer with two complete sets of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the lead, cadmium and chromium removal work within the lead,

cadmium and chromium controlled area. Personal protective equipment must include disposable whole body covering, including appropriate foot, head, eye, and hand protection. PPE remains the property of the Contractor. The Government will provide respiratory protection for the Contracting Officer.

1.6.6 Abrasive Removal Equipment

The use of powered machine for vibrating, sanding, grinding, or abrasive blasting is prohibited unless equipped with local exhaust ventilation systems equipped with high efficiency particulate air (HEPA) filters.

1.6.7 Negative Air Pressure System

1.6.7.1 Minimum Requirements

Do not proceed with work in the area until containment is set up and HEPA filtration systems are in place. The negative air pressure system must meet the requirements of ASSP Z9.2 including approved HEPA filters in accordance with UL 586. Negative air pressure equipment must be equipped with new HEPA filters, and be sufficient to maintain a minimum pressure differential of minus 0.02 inch of water column relative to adjacent, unsealed areas. Negative air pressure system minimum requirements are listed as follows:

- a. The unit must be capable of delivering its rated volume of air with a clean first stage filter, an intermediate filter and a primary HEPA filter in place.
- b. The HEPA filter must be certified as being capable of trapping and retaining mono-disperse particles as small as 0.3 micrometers at a minimum efficiency of 99.97 percent.
- c. The unit must be capable of continuing to deliver no less than 70 percent of rated capacity when the HEPA filter is 70 percent full or measures 2.5 inches of water static pressure differential on a magnehelic gauge.
- d. Equip the unit with a manometer-type negative pressure differential monitor with minor scale division of 0.02 inch of water and accuracy within plus or minus 1.0 percent. The manometer must be calibrated daily as recommended by the manufacturer.
- e. Equip the unit with a means for the operator to easily interpret the readings in terms of the volumetric flow rate of air per minute moving through the machine at any given moment.
- f. Equip the unit with an electronic mechanism that automatically shuts the machine off in the event of a filter breach or absence of a filter.
- g. Equip the unit with an audible horn that sounds an alarm when the machine has shut itself off.
- h. Equip the unit with an automatic safety mechanism that prevents a worker from improperly inserting the main HEPA filter.

1.6.7.2 Auxiliary Generator

Provide an auxiliary generator with capacity to power a minimum of 50

percent of the negative air machines at any time during the work. When power fails, the generator controls must automatically start the generator and switch the negative air pressure system machines to generator power. The generator must not present a carbon monoxide hazard to workers.

1.6.8 Vacuum Systems

Vacuum systems must be suitably sized for the project, and filters must be capable of trapping and retaining all mono-disperse particles as small as 0.3 micrometers (mean aerodynamic diameter) at a minimum efficiency of 99.97 percent. Properly dispose of used filters that are being replaced.

1.6.9 Heat Blower Guns

Heat blower guns must be flameless, electrical, paint-softener type with controls to limit temperature to 1,100 degrees F. Heat blower must be (grounded) 120 volts ac, and must be equipped with cone, fan, glass protector and spoon reflector nozzles.

1.7 PROJECT/SITE CONDITIONS

1.7.1 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better as determined by the Contracting Officer.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Keep materials and equipment needed to complete the project available and on the site. Submit a description of the materials and equipment required; including Safety Data Sheets (SDSs) for material brought onsite to perform the work.

2.1.1 Expendable Supplies

Submit a description of the expendable supplies required.

2.1.1.1 Polyethylene Bags

Disposable bags must be polyethylene plastic and be a minimum of 6 mils thick (4 mils thick if double bags are used) or any other thick plastic material shown to demonstrate at least equivalent performance; and capable of being made leak-tight. Leak-tight means that solids, liquids or dust cannot escape or spill out.

2.1.1.2 Polyethylene Leak-tight Wrapping

Wrapping used to wrap lead, cadmium, chromium contaminated debris must be polyethylene plastic that is a minimum of 6 mils thick or any other thick plastic material shown to demonstrate at least equivalent performance.

2.1.1.3 Polyethylene Sheeting

Sheeting must be polyethylene plastic with a minimum thickness of 6 mil, or any other thick plastic material shown to demonstrate at least equivalent performance; and be provided in the largest sheet size

reasonably accommodated by the project to minimize the number of seams. Where the project location constitutes an out of the ordinary potential for fire, or where unusual fire hazards cannot be eliminated, provide flame-resistant polyethylene sheets which conform to the requirements of NFPA 701.

2.1.1.4 Tape and Adhesive Spray

Tape and adhesive must be capable of sealing joints between polyethylene sheets and for attachment of polyethylene sheets to adjacent surfaces. After dry application, tape or adhesive must retain adhesion when exposed to wet conditions, including amended water. Tape must be minimum 2 inches wide, industrial strength.

2.1.1.5 Containers

When used, containers must be leak-tight and be labeled in accordance with EPA, DOT and OSHA standards.

2.1.1.6 Chemical Paint Strippers

Chemical paint strippers must not contain methylene chloride and be formulated to prevent stain, discoloration, or raising of the substrate materials.

2.1.1.7 Chemical Paint Stripper Neutralizer

Neutralizers for paint strippers must be compatible with the substrate and suitable for use with the chemical stripper that has been applied to the surface.

2.1.1.8 Detergents and Cleaners

Detergents or cleaning agents must not contain trisodium phosphate and have demonstrated effectiveness in lead, cadmium and chromium control work using cleaning techniques specified by HUD 6780 guidelines.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

3.1.1.1 Notification

- a. Notify the Contracting Officer 20 days prior to the start of any lead, cadmium and chromium work.
- b. Notification of the Commencement of LBP Hazard Abatement

3.1.1.2 Lead, Cadmium, Chromium Control Area

- a. Physical Boundary - Provide physical boundaries around the lead, cadmium, chromium control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that lead, cadmium and chromium will not escape outside of the lead, cadmium and chromium control area. Prohibit the general public from accessing the lead, cadmium, chromium control areas.

- b. Warning Signs - Provide warning signs at approaches to lead, cadmium, chromium control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs must comply with the requirements of 29 CFR 1926.62.

3.1.1.3 Furnishings

The Government will remove furniture and equipment from the building before lead, cadmium and chromium work begins.

3.1.1.4 Heating, Ventilating and Air Conditioning (HVAC) Systems

Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead, cadmium, chromium control areas. Seal intake and exhaust vents in the lead, cadmium, chromium control area with 6 mil plastic sheet and tape. Seal seams in HVAC components that pass through the lead, cadmium, chromium control area. Provide temporary HVAC system for areas in which HVAC has been shut down outside the lead, cadmium, chromium control area.

3.1.1.5 Local Exhaust System

Provide a local exhaust system in the lead, cadmium, chromium control area in accordance with ASSP Z9.2, 29 CFR 1926.62, 29 CFR 1926.1126 and 29 CFR 1926.1127 that will provide at least 4 air changes per hour inside of the negative pressure enclosure. Local exhaust equipment must be operated 24-hours per day, until the lead, cadmium, chromium control area is removed and must be leak proof to the filter and equipped with HEPA filters. Maintain a minimum pressure differential in the lead, cadmium, chromium control area of minus 0.02 inch of water column relative to adjacent, unsealed areas. Provide continuous 24-hour per day monitoring of the pressure differential with a pressure differential automatic recording instrument. The building ventilation system must not be used as the local exhaust system for the lead, cadmium, chromium control area. Filters on exhaust equipment must conform to ASSP Z9.2 and UL 586. Terminate the local exhaust system out of doors and remote from any public access or ventilation system intakes.

3.1.1.6 Negative Air Pressure System Containment

- a. Operate the negative air pressure systems to provide at least 4 air changes per hour inside the containment. Operate the local exhaust unit equipment continuously until the containment is removed. Smoke test the negative air pressure system for leaks at the beginning of each shift. The certified supervisor is responsible to continuously monitor and keep a pressure differential log with an automatic manometric recording instrument. Notify the Contracting Officer immediately if the pressure differential falls below the prescribed minimum. Submit the continuously monitored pressure differential log, as specified. Do not use the building ventilation system as the local exhaust system. Terminate the local exhaust system out of doors unless the Contracting Officer allows an alternate arrangement. All filters must be new at the beginning of the project and be periodically changed as necessary to maintain specified pressure differential and disposed of as lead, cadmium and chromium contaminated waste.

- b. Discontinuing Negative Air Pressure System. Operate the negative air pressure system continuously during abatement activities unless otherwise authorized by the Contracting Officer. At the completion of the project, units must be run until full cleanup has been completed and final clearance testing requirements have been met. Dismantling of the negative air pressure systems must be approved by the Contracting Officer be as presented in the Lead, Cadmium, Chromium Compliance Plan. Seal the HEPA filter machine intakes with polyethylene to prevent environmental contamination.

3.1.1.7 Decontamination Shower Facility

Provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

3.1.1.8 Eye Wash Station

Provide suitable facilities within the work area for quick drenching or flushing of the eyes where eyes may be exposed to injurious corrosive materials.

3.1.1.9 Mechanical Ventilation System

- a. Use adequate ventilation to control personnel exposure to lead, cadmium and chromium in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. To the extent feasible, use local exhaust ventilation or other collection systems, approved by the CP. Evaluate and maintain local exhaust ventilation systems in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.
- b. Vent local exhaust outside the building and away from building ventilation intakes or ensure system is connected to HEPA filters.
- c. Use locally exhausted, power actuated tools or manual hand tools.

3.1.1.10 Personnel Protection

Personnel must wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead, cadmium, chromium control area. No one will be permitted in the lead, cadmium, chromium control area unless they have been appropriately trained and provided with protective equipment.

3.2 ERECTION

3.2.1 Lead, Cadmium, Chromium Control Area Requirements

Establish a lead, cadmium, chromium control area by completely establishing barriers and physical boundaries around the area or structure where PWL or MCL removal operations will be performed.

3.3 APPLICATION

3.3.1 Lead, Cadmium, Chromium Work

Perform lead, cadmium, chromium work in accordance with approved Lead, Cadmium, Chromium Compliance Plan. Use procedures and equipment required to limit occupational exposure and environmental contamination with lead,

cadmium, chromium when the work is performed in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 or 40 CFR 745, and as specified herein. Dispose of all PWL or MCL and associated waste in compliance with federal, State, and local requirements.

3.3.2 Paint with Lead, Cadmium, Chromium or Material Containing Lead, Cadmium, Chromium Removal

Manual or power sanding or grinding of lead, cadmium, chromium surfaces or materials is not permitted unless tools are equipped with HEPA attachments or wet methods. The dry sanding or grinding of surfaces that contain lead, cadmium, chromium is prohibited. Provide methodology for removing lead, cadmium, chromium in the Lead, Cadmium, Chromium Compliance Plan. Select lead, cadmium, chromium removal processes to minimize contamination of work areas outside the control area with lead, cadmium, chromium contaminated dust or other lead, cadmium, chromium contaminated debris or waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead, cadmium, chromium. Describe this removal process in the Lead, Cadmium, Chromium Compliance Plan.

Avoid flash rusting deterioration of the substrate. Provide surface preparations for painting in accordance with Section 09 90 00 PAINTS AND COATINGS.

Provide methodology for lead, cadmium and chromium, LBP/PWL removal and processes to minimize contamination of work areas outside the control area with lead, cadmium, chromium contaminated dust or other lead, cadmium, chromium contaminated debris/waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead, cadmium, chromium. Describe this lead, cadmium and chromium, LBP/PWL removal/control process in the Lead, Cadmium, Chromium Compliance Plan.

3.3.2.1 Paint with Lead, Cadmium, Chromium or Material Containing Lead, Cadmium, Chromium - Indoor Removal

Perform manual mechanical removal in the lead, cadmium, chromium control areas using enclosures, barriers or containments and powered locally exhausted tools equipped with HEPA filters. Collect residue and debris for disposal in accordance with federal, State, and local requirements.

3.3.2.2 Paint with Lead, Cadmium, Chromium or Material Containing Lead, Cadmium, Chromium - Outdoor Removal

Perform outdoor removal as indicated in federal, State, and local regulations and in the Lead, Cadmium, Chromium Compliance Plan. The worksite preparation (barriers or containments) must be job dependent and presented in the Lead, Cadmium, Chromium Compliance Plan.

3.3.3 Personnel Exiting Procedures

Whenever personnel exit the lead, cadmium, chromium controlled area, they must perform the following procedures and must not leave the work place wearing any clothing or equipment worn in the control area:

- a. Vacuum all clothing before entering the contaminated change room.
- b. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.

- c. Shower.
- d. Wash hands and face at the site, don appropriate disposable or uncontaminated reusable clothing, move to an appropriate shower facility, shower.
- e. Change to clean clothes prior to leaving the clean clothes storage area.

3.4 FIELD QUALITY CONTROL

3.4.1 Tests

3.4.1.1 Air and Wipe Sampling

Conduct sampling for lead, cadmium, chromium in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and as specified herein. Air and wipe sampling must be directed or performed by the CP.

- a. The CP must be on the job site directing the air and wipe sampling and inspecting the PWL or MCL removal work to ensure that the requirements of the contract have been satisfied during the entire PWL or MCL operation.
- b. Collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least twenty-five percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.
- c. Submit results of air samples, signed by the CP, within 72-hours after the air samples are taken.
- d. Conduct area air sampling daily, on each shift in which lead, cadmium and chromium and lead-based paint removal operations are performed, in areas immediately adjacent to the lead, cadmium and chromium control area. Conduct sufficient area monitoring to ensure unprotected personnel are not exposed at or above 30 micrograms of lead per cubic meter of air or 2.5 micrograms of cadmium/chromium per cubic meter of air. If 30 micrograms of lead per cubic meter of air or 2.5 micrograms of cadmium/chromium per cubic meter of air is reached or exceeded, stop work, correct the condition(s) causing the increased levels. Notify the Contracting Officer immediately. Determine if condition(s) require any further change in work methods. Resume removal work only after the CP and the Contracting Officer give approval.
- e. Before any work begins, a third party consultant must collect and analyze baseline wipe and soil samples in accordance with methods defined by federal, State, and local standards inside and outside of the physical boundary to assess the degree of dust contamination in the facility prior to lead, cadmium and chromium disturbance or removal. Provide Initial Sample Results to the Contracting Officer before work begins.

3.4.1.2 Sampling After Removal

After the visual inspection, conduct soil sampling if bare soil is present during external removal operations and collect wipe and soil samples according to the HUD protocol contained in HUD 6780 to determine the lead,

cadmium and chromium content of settled dust in micrograms per square meter foot of surface area and parts per million (ppm) for soil.

3.4.1.3 Testing of Material Containing Lead, Cadmium, Chromium Residue

Test residue in accordance with 40 CFR 261 for hazardous waste.

3.5 CLEANING AND DISPOSAL

3.5.1 Cleanup

Maintain surfaces of the lead, cadmium, chromium control area free of accumulations of dust and debris. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use pressurized air to clean up the area. At the end of each shift and when the lead, cadmium, chromium operation has been completed, clean the controlled area of all visible contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the Lead, Cadmium, Chromium Compliance Plan. Reclean areas showing dust or debris. After visible dust and debris is removed, wet wipe and HEPA vacuum all surfaces in the controlled area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then wipe sample all contaminated areas. The CP must then certify in writing that the area has been cleaned of lead, cadmium and chromium contamination before clearance testing.

3.5.1.1 Clearance Certification

The CP must certify in writing that air samples collected outside the lead, cadmium, chromium control area during paint removal operations are less than 30 micrograms of lead per cubic meter of air and less than 2.5 micrograms of cadmium/chromium per cubic meter of air; the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127; and that there were no visible accumulations of material and dust containing lead, cadmium, chromium left in the work site. Do not remove the lead, cadmium, chromium control area or roped off boundary and warning signs prior to the Contracting Officer's acknowledgement of receipt of the CP certification.

Certify surface wipe samples are not significantly greater than the initial surface loading determined prior to work.

Clear the lead, cadmium, chromium control area in industrial facilities of all visible dust and debris.

For exterior work, soil samples taken at the exterior of the work site must be used to determine if soil lead, cadmium, chromium levels have increased at a statistically significant level (significant at the 95 percent confidence limit) from the soil lead, cadmium, chromium levels prior to the operation. If soil lead, cadmium, chromium levels either show a statistically significant increase above soil lead, cadmium, chromium levels prior to work or soil lead, cadmium, chromium levels above any applicable federal or state standard for lead, cadmium, chromium in soil, the soil must be remediated.

For lead, cadmium and chromium-based paint hazard abatement work, surface wipe and soil sampling must be conducted and clearance determinations made according to the work practice standards presented in 40 CFR 745.227.

3.5.2 Disposal

- a. Dispose of material, whether hazardous or non-hazardous in accordance with all laws and provisions and all federal, State or local regulations. Ensure all waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.
- b. Contractor is responsible for segregation of waste. Collect lead, cadmium, chromium contaminated waste, scrap, debris, bags, containers, equipment, and lead, cadmium, chromium contaminated clothing that may produce airborne concentrations of lead, cadmium, chromium particles. Label the containers in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and 40 CFR 261, 40 CFR 262 and corresponding state regulations.
- c. Dispose of lead, cadmium, chromium contaminated material classified as hazardous waste at an EPA and State approved hazardous waste treatment, storage, or disposal facility off Government property.
- d. Accumulate waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon drums or appropriately sized container for smaller volumes. Properly label each drum to identify the type of hazardous material (49 CFR 172). For hazardous waste, the collection container requires marking/labeling in accordance with 40 CFR 262 and corresponding state regulations during the accumulation/collection timeframe. The Contracting Officer or an authorized representative will assign an area for accumulation of waste containers. Coordinate authorized accumulation volumes and time limits with the host installation environmental function.
- e. Handle, store, transport, and dispose lead, cadmium, chromium or lead, cadmium, chromium contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.
- f. All lead, cadmium, and chromium waste generation, management, and disposal will be coordinated with the host installation environmental function.

3.5.2.1 Disposal Documentation

Coordinate all disposal or off-site shipments of lead, cadmium, and chromium waste with the host installation environmental function. Submit written evidence of TSD approval to demonstrate the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead, cadmium, chromium disposal by the EPA, State or local regulatory agencies. Submit one copy of the completed hazardous waste manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Provide a certificate that the waste was accepted by the disposal facility.

Provide turn-in documents or weight tickets for non-hazardous waste disposal.

3.5.2.2 Payment for Hazardous Waste

Payment for disposal of hazardous and non-hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal

facility is received and approved by the Contracting Officer. The manifest must detail and certify the amount of lead, cadmium, chromium containing materials or non-hazardous waste delivered to the treatment or disposal facility.

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HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBs AND MERCURY
05/20

PART 1 GENERAL

1.1 REFERENCES

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

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

29 CFR 1910.1000	Air Contaminants
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 273	Standards for Universal Waste Management
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
49 CFR 178	Specifications for Packagings

1.2 REQUIREMENTS

Removal and disposal of PCB containing lighting ballasts and associated mercury-containing lamps. Contractor may encounter leaking PCB ballasts.

1.3 DEFINITIONS

1.3.1 Certified Industrial Hygienist (CIH)

A industrial hygienist hired by the contractor shall be certified by the American Board of Industrial Hygiene.

1.3.2 Leak

Leak or leaking means any instance in which a PCB article, PCB container, or PCB equipment has any PCBs on any portion of its external surface.

1.3.3 Lamps

Lamp is defined as the bulb or tube portion of an electric lighting device. A lamp is specifically designed to produce radiant energy, most often in the ultraviolet, visible, and infra-red regions of the electromagnetic spectrum. Examples of common electric lamps include, but are not limited to, fluorescent, high intensity discharge, neon, mercury vapor, high pressure sodium, and metal halide lamps.

1.3.4 Polychlorinated Biphenyls (PCBs)

PCBs as used in this specification shall mean the same as PCBs, and all related items, as defined in 40 CFR 761, Section 3, Definitions.

1.3.5 Spill

Spill means both intentional and unintentional spills, leaks, and other uncontrolled discharges when the release results in any quantity of PCBs running off or about to run off the external surface of the equipment or other PCB source, as well as the contamination resulting from those releases.

1.3.6 Universal Waste

Universal Waste means any of the following hazardous wastes that are managed under the universal waste requirements 40 CFR 273:

- (1) Batteries as described in Sec. 273.2 of this chapter;
- (2) Pesticides as described in Sec. 273.3 of this chapter;
- (3) Mercury containing equipment as described in Sec. 273.4 of this chapter; and
- (4) Lamps as described in Sec. 273.5 of this chapter.

1.4 QUALITY ASSURANCE

1.4.1 Regulatory Requirements

Perform PCB related work in accordance with 40 CFR 761 and NCAC Title 15A, Ch. 13. Perform mercury-containing lamps storage and transport in accordance with 40 CFR 261, 40 CFR 264, 40 CFR 265, 40 CFR 273.

1.4.2 Training

Certified industrial hygienist (CIH) shall instruct and certify the

training of all persons involved in the removal of PCB containing lighting ballasts and mercury-containing lamps. The instruction shall include: The dangers of PCB and mercury exposure, decontamination, safe work practices, and applicable OSHA and EPA regulations. The CIH shall review and approve the PCB and Mercury-Containing Lamp Removal Work Plans.

1.4.3 Regulation Documents

Maintain at all times one copy each at the office and one copy each in view at the job site of 29 CFR 1910.1000, 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 265, 40 CFR 268, 40 CFR 270, 40 CFR 273 and of the Contractor removal work plan and disposal plan for PCB and for associated mercury-containing lamps.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-07 Certificates

Qualifications of CIH; G

Training Certification; G

PCB and Lamp Removal Work Plan; G

PCB and Lamp Disposal Plan; G

SD-11 Closeout Submittals

Transporter Certification of notification to EPA of their PCB waste activities and EPA ID numbers; G

Certification of Decontamination

Certificate of Disposal and/or recycling. Submit to the Government before application for payment within 30 days of the date that the disposal of the PCB and mercury-containing lamp waste identified on the manifest was completed.

Testing Results

1.6 ENVIRONMENTAL REQUIREMENTS

Use special clothing:

- a. Disposable gloves (polyethylene)
- b. Eye protection
- c. PPE as required by CIH

1.7 SCHEDULING

Notify the Contracting Officer 20 days prior to the start of PCB and mercury-containing lamp removal work.

1.8 QUALITY ASSURANCE

1.8.1 Qualifications of CIH

Submit the name, address, and telephone number of the Industrial Hygienist selected to perform the duties in paragraph CERTIFIED INDUSTRIAL HYGIENIST. Submit training certification that the Industrial Hygienist is certified, including certification number and date of certification or re certification.

1.8.2 PCB and Lamp Removal Work Plan

Submit a job-specific plan within 20 calendar days after award of contract of the work procedures to be used in the removal, packaging, and storage of PCB-containing lighting ballasts and associated mercury-containing lamps. Include in the plan: Requirements for Personal Protective Equipment (PPE), spill cleanup procedures and equipment, eating, smoking and restroom procedures. The plan shall be approved and signed by the Certified Industrial Hygienist. Obtain approval of the plan by the Contracting Officer prior to the start of PCB and/or lamp removal work.

1.8.3 PCB and Lamp Disposal Plan

Submit a PCB and lamp Disposal Plan with 45 calendar days after award of contract. The PCB and Lamp Disposal Plan shall comply with applicable requirements of federal, state, and local PCB and Universal waste regulations and address:

- a. Estimated quantities of wastes to be generated, disposed of, and recycled.
- b. Names and qualifications of each Contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location. Furnish two copies of EPA and state PCB and mercury-containing lamp waste permit applications and EPA identification numbers, as required.
- c. Names and qualifications (experience and training) of personnel who will be working on-site with PCB and mercury-containing lamp wastes.
- d. Spill prevention, containment, and cleanup contingency measures to be implemented.
- e. Work plan and schedule for PCB and mercury-containing lamp waste removal, containment, storage, transportation, disposal and or recycling. Wastes shall be cleaned up and containerize daily.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 WORK PROCEDURE

Furnish labor, materials, services, and equipment necessary for the removal of PCB containing lighting ballasts, associated mercury-containing fluorescent lamps, and high intensity discharge (HID) lamps in accordance with local, state, or federal regulations. Do not expose PCBs to open flames or other high temperature sources since toxic decomposition by-products may be produced. Do not break mercury containing fluorescent lamps or high intensity discharge lamps.

3.1.1 Work Operations

Ensure that work operations or processes involving PCB or PCB-contaminated materials are conducted in accordance with 40 CFR 761, 40 CFR 262 40 CFR 263, and the applicable requirements of this section, including but not limited to:

- a. Obtaining suitable PCB and mercury-containing lamp storage sites.
- b. Notifying Contracting Officer prior to commencing the operation.
- c. Reporting leaks and spills to the Contracting Officer.
- d. Cleaning up spills.
- e. Inspecting PCB and PCB-contaminated items and waste containers for leaks and forwarding copies of inspection reports to the Contracting Officer.
- f. Maintaining inspection, inventory and spill records.

3.2 PCB SPILL CLEANUP REQUIREMENTS

3.2.1 PCB Spills

Immediately report to the Contracting Officer any PCB spills.

3.2.2 PCB Spill Control Area

Rope off an area around the edges of a PCB leak or spill and post a "PCB Spill Authorized Personnel Only" caution sign. Immediately transfer leaking items to a drip pan or other container.

3.2.3 PCB Spill Cleanup

40 CFR 761, subpart G. Initiate cleanup of spills as soon as possible, but no later than 24 hours of its discovery. Mop up the liquid with rags or other conventional absorbent. The spent absorbent shall be properly contained and disposed of as solid PCB waste.

3.2.4 Records and Certification

Document the cleanup with records of decontamination in accordance with 40 CFR 761, Section 125, Requirements for PCB Spill Cleanup. Provide test results of cleanup and certification of decontamination.

3.3 REMOVAL

3.3.1 Ballasts

As ballast are removed from the lighting fixture, inspect label on ballast. Ballasts without a "No PCB" label shall be assumed to contain PCBs and containerized and disposed of as required under paragraphs STORAGE FOR DISPOSAL and DISPOSAL. If there are less than 1600 "No PCB" labeled lighting ballasts, dispose of them as normal demolition debris. If there are more than 1600 "No PCB" labeled ballasts, establish whether the "No PCB" labeled ballasts contain diethylhexyl phthalate (DEHP) either by test or by checking with the ballast manufacturer indicated on the label. Submit testing results and/or written confirmation from the manufacturer to the Contracting Officer. If the ballasts do not contain DEHP, dispose of them as normal construction debris. If they do contain DEHP, dispose of them as hazardous material in accordance with Federal, State, and local regulations. As a basis of bid assume ballasts with "No PCB" labels do not contain DEHP and may disposed of as normal construction debris. If 1600 or more DEHP ballasts are disposed of in a 24 hour period, notify the National Response Team at 800-424-8802.

3.3.2 Lighting Lamps

Remove lighting tubes/lamps from the lighting fixture and carefully place (unbroken) into appropriate containers (original transport boxes or equivalent). In the event of a lighting tube/lamp breaking, sweep and place waste in double plastic taped bags and dispose of as universal waste as specified herein.

3.4 STORAGE FOR DISPOSAL

3.4.1 Storage Containers for PCBs

49 CFR 178. Store PCB in containers approved by DOT for PCB.

3.4.2 Storage Containers for lamps

Store mercury containing lamps in appropriate DOT containers. The boxes shall be stored and labeled for transport in accordance with 40 CFR 273.

3.4.3 Labeling of Waste Containers

Label with the following:

- a. Date the item was placed in storage and the name of the cognizant activity/building.
- b. "Caution Contains PCB," conforming to 40 CFR 761, CFR Subpart C. Affix labels to PCB waste containers.
- c. Label mercury-containing lamp waste in accordance with 40 CFR 273. Affix labels to all lighting waste containers.

3.5 DISPOSAL

Dispose of off Government property in accordance with EPA, DOT, and local regulations at a permitted site.

3.5.1 Identification Number

Federal regulations 40 CFR 761, and 40 CFR 263 require that generators, transporters, commercial storers, and disposers of PCB waste possess U.S. EPA identification numbers. The contractor shall verify that the activity has a U.S. EPA generator identification number for use on the Uniform Hazardous Waste manifest. If not, the contractor shall advise the activity that it must file and obtain an I.D. number with EPA prior to commencement of removal work. For mercury containing lamp removal, Federal regulations 40 CFR 273 require that large quantity handlers of Universal waste (LQHUW) must provide notification of universal waste management to the appropriate EPA Region (or state director in authorized states), obtain an EPA identification number, and retain for three years records of off-site shipments of universal waste. The contractor shall verify that the activity has a U.S. EPA generator identification number for use on the Universal Waste manifest. If not, the contractor shall advise the activity that it must file and obtain an I.D. number with EPA prior to commencement of removal work.

3.5.2 Transporter Certification

Comply with disposal and transportation requirements outlined in 40 CFR 761 and 40 CFR 263. Before transporting the PCB waste, sign and date the manifest acknowledging acceptance of the PCB waste from the Government. Return a signed copy to the Government before leaving the job site. Ensure that the manifest accompanies the PCB waste at all times. Submit transporter certification of notification to EPA of their PCB waste activities (EPA Form 7710-53).

3.5.2.1 Certificate of Disposal and/or Recycling

40 CFR 761. Certificate for the PCBs and PCB items disposed shall include:

- a. The identity of the disposal and or recycling facility, by name, address, and EPA identification number.
- b. The identity of the PCB waste affected by the Certificate of Disposal including reference to the manifest number for the shipment.
- c. A statement certifying the fact of disposal and or recycling of the identified PCB waste, including the date(s) of disposal, and identifying the disposal process used.
- d. A certification as defined in 40 CFR 761.

-- End of Section --

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CAST-IN-PLACE CONCRETE

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CAST-IN-PLACE CONCRETE
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PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 121R	(2008) Guide for Concrete Construction Quality Systems in Conformance with ISO 9001
ACI 213R	(2014; E2017) Guide for Structural Lightweight-Aggregate Concrete
ACI 301	(2016) Specifications for Structural Concrete
ACI 302.1R	(2015) Guide for Concrete Floor and Slab Construction
ACI 304.2R	(2017) Guide to Placing Concrete by Pumping Methods
ACI 304R	(2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	(2010) Guide to Hot Weather Concreting
ACI 306.1	(1990; R 2002) Standard Specification for Cold Weather Concreting
ACI 306R	(2016) Guide to Cold Weather Concreting
ACI 308.1	(2011) Specification for Curing Concrete
ACI SP-2	(2007; Abstract: 10th Edition) ACI Manual of Concrete Inspection
ACI SP-15	(2011) Field Reference Manual: Standard Specifications for Structural Concrete ACI 301-05 with Selected ACI References

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1995; R 2004) Basic Hardboard
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AMERICAN WELDING SOCIETY (AWS)

AWS D1.4 (2011) Structural Welding Code -
Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A615 (2016) Standard Specification for Deformed
and Plain Carbon-Steel Bars for Concrete
Reinforcement

ASTM A1064 (2017) Standard Specification for
Carbon-Steel Wire and Welded Wire
Reinforcement, Plain and Deformed, for
Concrete

ASTM C31 (2019) Standard Practice for Making and
Curing Concrete Test Specimens in the Field

ASTM C33 (2018) Standard Specification for Concrete
Aggregates

ASTM C39 (2018) Standard Test Method for
Compressive Strength of Cylindrical
Concrete Specimens

ASTM C42 (2018a) Standard Test Method for Obtaining
and Testing Drilled Cores and Sawed Beams
of Concrete

ASTM C78 (2018) Standard Test Method for Flexural
Strength of Concrete (Using Simple Beam
with Third-Point Loading)

ASTM C94 (2018) Standard Specification for
Ready-Mixed Concrete

ASTM C143 (2015) Standard Test Method for Slump of
Hydraulic-Cement Concrete

ASTM C150 (2018) Standard Specification for Portland
Cement

ASTM C172 (2017) Standard Practice for Sampling
Freshly Mixed Concrete

ASTM C173 (2016) Standard Test Method for Air
Content of Freshly Mixed Concrete by the
Volumetric Method

ASTM C231 (2017a) Standard Test Method for Air
Content of Freshly Mixed Concrete by the
Pressure Method

ASTM C260 (2010a; R 2016) Standard Specification for
Air-Entraining Admixtures for Concrete

ASTM C311 (2018) Standard Test Methods for Sampling

and Testing Fly Ash or Natural Pozzolans
for Use in Portland-Cement Concrete

ASTM C330	(2017a) Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C494	(2017) Standard Specification for Chemical Admixtures for Concrete
ASTM C552	(2017; E 2018) Standard Specification for Cellular Glass Thermal Insulation
ASTM C567	(2014) Determining Density of Structural Lightweight Concrete
ASTM C578	(2018) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C591	(2017; 2019) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C618	(2019) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C803	(2018) Standard Test Method for Penetration Resistance of Hardened Concrete
ASTM C845	(2018) Standard Specification for Expansive Hydraulic Cement
ASTM C873	(2015) Standard Test Method for Compressive Strength of Concrete Cylinders Cast in Place in Cylindrical Molds
ASTM C900	(2015) Standard Test Method for Pullout Strength of Hardened Concrete
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C1077	(2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1107	(2017) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C1157	(2017) Standard Performance Specification for Hydraulic Cement
ASTM C1260	(2014) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1293	(2008; R 2015) Standard Test Method for

Determination of Length Change of Concrete
Due to Alkali-Silica Reaction

ASTM C1567	(2013) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C1602	(2018) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM D1751	(2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D5759	(2012) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
ASTM D6690	(2015) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM E96	(2016) Standard Test Methods for Water Vapor Transmission of Materials
ASTM E329	(2018) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
ASTM E1155	(2014) Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers
ASTM E1643	(2018a) Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
ASTM E1745	(2017) Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP	(2009; 28th Ed; Errata) Manual of Standard Practice
CRSI RB4.1	(2016) Supports for Reinforcement Used in Concrete

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST PS 1

(2009) DOC Voluntary Product Standard PS
1-07, Structural Plywood

1.2 DEFINITIONS

- a. "Cementitious material" as used herein must include all portland cement, pozzolan, fly ash, and slag cement.
- b. "Exposed to public view" means situated so that it can be seen from eye level from a public location after completion of the building. A public location is accessible to persons not responsible for operation or maintenance of the building.
- c. "Chemical admixtures" are materials in the form of powder or fluids that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes.
- d. "Supplementary cementing materials" (SCM) include coal fly ash, slag cement, natural or calcined pozzolans, and ultra-fine coal ash when used in such proportions to replace the portland cement that result in improvement to sustainability and durability and reduced cost.
- e. "Design strength" (f'_c) is the specified compressive strength of concrete at time(s) specified in this section to meet structural design criteria.
- f. "Mass Concrete" is any concrete system that approaches a maximum temperature of 158 degrees F within the first 72 hours of placement. In addition, it includes all concrete elements with a section thickness of 3 feet or more regardless of temperature.
- g. "Mixture proportioning" is the process of designing concrete mixture proportions to enable it to meet the strength, service life and constructability requirements of the project while minimizing the initial and life-cycle cost.
- h. "Mixture proportions" are the masses or volumes of individual ingredients used to make a unit measure (cubic meter or cubic yard) of concrete.
- i. "Pozzolan" is a siliceous or siliceous and aluminous material, which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.
- j. "Workability (or consistence)" is the ability of a fresh (plastic) concrete mix to fill the form/mould properly with the desired work (vibration) and without reducing the concrete's quality. Workability depends on water content, chemical admixtures, aggregate (shape and size distribution), cementitious content and age (level of hydration).

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office

that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Quality Control Plan; G

Quality Control Personnel Certifications; G

Quality Control Organizational Chart

Laboratory Accreditation; G

SD-02 Shop Drawings

Reinforcing Steel; G

SD-03 Product Data

Joint Sealants

Joint Filler

Formwork Materials

Recycled Cementitious Materials; S

Vapor Retarder

Concrete Curing Materials; S

Reinforcement; S

Liquid Chemical Floor Hardeners and Sealers; S

Admixtures

Environment Product Declaration for Cement, Steel Reinforcement

Nonshrink Grout

SD-05 Design Data

Concrete Mix Design; G

SD-06 Test Reports

Concrete Mix Design; G

Fly Ash

Pozzolan

Aggregates

Tolerance Report

Compressive Strength Tests; G

Unit Weight of Structural Concrete

Air Content

Slump Tests

Water

SD-07 Certificates

VOC content and emissions testing for curing compounds and
concrete sealers

Reinforcing Bars

Welder Qualifications

Field Testing Technician and Testing Agency

Curing Compound

1.4 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Contracting Officer.

1.5 DELIVERY, STORAGE, AND HANDLING

Follow ACI 301 and ACI 304R requirements and recommendations. Do not deliver concrete until vapor retarder, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. Do not store concrete curing compounds or sealers with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions, including acoustical ceilings, carpet, textiles, and unprimed gypsum wall board. Do not store concrete curing compounds or sealers in occupied spaces.

1.5.1 Reinforcement

Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

1.6 QUALITY ASSURANCE

1.6.1 Design Data

1.6.1.1 Concrete Mix Design

Sixty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, supplementary cementitious materials, and admixtures; and applicable reference specifications. Submit mill test and all other test for cement,

supplementary cementitious materials, aggregates, and admixtures. Provide documentation of maximum nominal aggregate size, gradation analysis, percentage retained and passing sieve, and a graph of percentage retained verses sieve size. Provide mix proportion data using at least three different water-cementitious material ratios for each type of mixture, which produce a range of strength encompassing those required for each type of concrete required. If source material changes, resubmit mix proportion data using revised source material. Provide only materials that have been proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Contracting Officer. Indicate clearly in the submittal where each mix design is used when more than one mix design is submitted. Resubmit data on concrete components if the qualities or source of components changes. For previously approved concrete mix designs used within the past twelve months, the previous mix design may be re-submitted without further trial batch testing if accompanied by material test data conducted within the last six months. Obtain mix design approval from the contracting officer prior to concrete placement.

1.6.2 Shop Drawings

1.6.2.1 Reinforcing Steel

Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars. Reproductions of contract drawings are unacceptable.

1.6.3 Control Submittals

1.6.4 Test Reports

1.6.4.1 Fly Ash and Pozzolan

Submit test results in accordance with ASTM C618 for fly ash and pozzolan. Submit test results performed within 6 months of submittal date.

1.6.4.2 Aggregates

Submit test results in accordance with ASTM C33, or ASTM C330 for lightweight aggregate, and ASTM C1293 or ASTM C1567 as required in the paragraph titled ALKALI-AGGREGATE REACTION.

1.6.5 Quality Control Plan

Develop and submit for approval a concrete quality control program in accordance with the guidelines of ACI 121R and as specified herein. The plan must include approved laboratories. Provide direct oversight for the concrete qualification program inclusive of associated sampling and testing. All quality control reports must be provided to the Contracting Officer, Quality Manager and Concrete Supplier. Maintain a copy of ACI SP-15 and CRSI 10MSP at project site.

1.6.6 Quality Control Personnel Certifications

The Contractor must submit for approval the responsibilities of the various quality control personnel, including the names and qualifications of the individuals in those positions and a quality control organizational

chart defining the quality control hierarchy and the responsibility of the various positions. Quality control personnel must be employed by the Contractor.

Submit American Concrete Institute certification for the following:

- a. CQC personnel responsible for inspection of concrete operations.
- b. Lead Foreman or Journeyman of the Concrete Placing, Finishing, and Curing Crews.
- c. Field Testing Technicians: ACI Concrete Field Testing Technician, Grade I.

1.6.6.1 Field Testing Technician and Testing Agency

Submit data on qualifications of proposed testing agency and technicians for approval by the Contracting Officer prior to performing testing on concrete.

- a. Work on concrete under this contract must be performed by an ACI Concrete Field Testing Technician Grade 1 qualified in accordance with ACI SP-2 or equivalent. Equivalent certification programs must include requirements for written and performance examinations as stipulated in ACI SP-2.
- b. Testing agencies that perform testing services on reinforcing steel must meet the requirements of ASTM E329.
- c. Testing agencies that perform testing services on concrete materials must meet the requirements of ASTM C1077.

1.6.7 Laboratory Qualifications for Concrete Qualification Testing

The concrete testing laboratory must have the necessary equipment and experience to accomplish required testing. The laboratory must meet the requirements of ASTM C1077 and be Cement and Concrete Reference Laboratory (CCRL) inspected.

1.6.8 Laboratory Accreditation

Laboratory and testing facilities must be provided by and at the expense of the Contractor. The laboratories performing the tests must be accredited in accordance with ASTM C1077, including ASTM C78 and ASTM C1260. The accreditation must be current and must include the required test methods, as specified. Furthermore, the testing must comply with the following requirements:

- a. Aggregate Testing and Mix Proportioning: Aggregate testing and mixture proportioning studies must be performed by an accredited laboratory and under the direction of a registered professional engineer in a U.S. state or territory competent in concrete materials who is competent in concrete materials and must sign all reports and designs.
- b. Acceptance Testing: Furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Furnish and maintain boxes or other facilities suitable for storing and curing the specimens at the site while in the mold within the temperature range stipulated by

ASTM C31.

- c. Contractor Quality Control: All sampling and testing must be performed by an approved, onsite, independent, accredited laboratory.

1.7 ENVIRONMENTAL REQUIREMENTS

1.7.1 Submittals for Environmental Performance

- a. Provide data indication the percentage of post-industrial pozzolan (fly ash) cement substitution as a percentage of the full product composite by weight.
- b. Provide data indicating the percentage of post-industrial and post-consumer recycled content aggregate.
- c. Provide product data indicating the percentage of post-consumer recycled steel content in each type of steel reinforcement as a percentage of the full product composite by weight.
- d. For projects using FSC certified formwork, provide chain-of-custody documentation for all certified wood products.
- e. For projects using reusable formwork, provide data showing how formwork is reused.
- f. Provide SDS product information data showing that form release agents meet any environmental performance goals such as using vegetable and soy based products.
- g. Provide SDS product information data showing that concrete adhesives meet any environmental performance goals including low emitting, low volatile organic compound products.

1.8 SUSTAINABLE DESIGN REQUIREMENTS

Provide Environment Product Declaration for Cement, Steel Reinforcement. Provide VOC content and emissions testing for curing compounds and concrete sealers

1.9 QUALIFICATIONS FOR WELDING WORK

Welding procedures must be in accordance with AWS D1.4.

Verify that Welder qualifications are in accordance with AWS D1.4 for welding of reinforcement or under an equivalent qualification test approved in advance. Welders are permitted to do only the type of welding for which each is specifically qualified.

PART 2 PRODUCTS

2.1 FORMWORK MATERIALS

- a. Form-facing material in contact with concrete must be lumber, plywood, tempered concrete-form-grade hardboard, metal, plastic, or treated paper that creates specified appearance and texture of concrete surface. Submit product information on proposed form-facing materials if different from that specified herein.

- b. Design formwork, shores, reshores, and backshores to support loads transmitted to them and to comply with applicable building code requirements.
- c. Design formwork to withstand pressure resulting from placement and vibration of concrete and to maintain specified tolerances.
- d. Design formwork to accommodate waterstop materials in joints at locations indicated in Contract Documents.
- e. Provide temporary openings in formwork if needed to facilitate cleaning and inspection.
- f. Design formwork joints to inhibit leakage of mortar.
- g. Limit deflection of facing materials for concrete surfaces exposed to view to 1/240 of center-to-center spacing of facing supports.
- h. Except for footings. Do not use earth cuts as forms for vertical or sloping surfaces.
- i. Submit product information on proposed form-facing materials if different from that specified herein.

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 NIST PS 1, B-B concrete form panels or better or AHA A135.4, hardboard for smooth form lining. Virgin wood used must be FSC-certified.

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 FORMWORK ACCESSORIES

- a. Use commercially manufactured formwork accessories, including ties and hangers.
- b. Form ties and accessories must not reduce the effective cover of the reinforcement.

2.2.1 Chamfer Materials

Use lumber materials with dimensions of 3/4 x 3/4 in.

2.2.2 Construction and movement joints

- a. Submit details and locations of construction joints in accordance with the requirements herein.
- b. Locate construction joints within middle one-third of spans of slabs, beams, and girders. If a beam intersects a girder within the middle one-third of girder span, the distance between the construction joint in the girder and the edge of the beam must be at least twice the width of the larger member.
- c. Locate construction joints in walls and columns at underside of slabs, beams, or girders and at tops of footings or slabs.
- d. Make construction joints perpendicular to main reinforcement.
- e. Provide movement joints where indicated in Contract Documents or in accepted alternate locations.
- f. Submit location and detail of movement joints if different from those indicated in Contract Documents.
- g. Submit manufacturer's data sheet on expansion joint materials.
- h. Provide keyways where indicated in Contract Documents.

2.2.3 Perimeter Insulation

Perimeter insulation must be polystyrene conforming to ASTM C578, Type II; polyurethane conforming to ASTM C591, Type II; or cellular glass conforming to ASTM C552, Type I or IV. Comply with EPA requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

2.2.4 Other Embedded items

Use sleeves, inserts, anchors, and other embedded items of material and design indicated in Contract Documents.

2.3 CONCRETE MATERIALS

2.3.1 Recycled Cementitious Materials

2.3.1.1 Portland Cement

- a. Unless otherwise specified, provide cement that conforms to ASTM C150 Type I/II.
- b. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.
- c. Supplier must certify that no hazardous waste is used in the fuel mix or raw materials. Supplier must certify that the hazardous waste is neutralized by the manufacturing process and that no additional pollutants are discharged.
- d. Submit information along with evidence demonstrating compliance with referenced standards. Submittals must include types of cementitious materials, manufacturing locations, shipping locations, and

certificates showing compliance.

- e. Cementitious materials must be stored and kept dry and free from contaminants.

2.3.1.2 Fly Ash

- a. ASTM C618, Class F, except that the maximum allowable loss on ignition must not exceed 6 percent.
- b. Fly ash content must be a minimum of 15 and a maximum of 25 percent by weight of cementitious material, provided the fly ash does not reduce the amount of cement in the concrete mix below the minimum requirements of local building codes. Where the use of fly ash cannot meet the minimum level, provide the maximum amount of fly ash permissible that meets the code requirements for cement content. Report the chemical analysis of the fly ash in accordance with ASTM C311. Evaluate and classify fly ash in accordance with ASTM D5759.

2.3.2 Water

- a. Water or ice must comply with the requirements of ASTM C1602.
- b. Minimize the amount of water in the mix. Improve workability by adjusting the grading of the aggregate and using admixture rather than by adding water.
- c. Water must be potable; free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete.
- d. Protect mixing water and ice from contamination during storage and delivery.
- e. Submit test report showing water complies with ASTM C1602.

2.3.3 Aggregate

2.3.3.1 Normal-Weight Aggregate

- a. Aggregates must conform to ASTM C33.
- b. Aggregates used in concrete must be obtained from the same sources and have the same size range as aggregates used in concrete represented by submitted field test records or used in trial mixtures.
- c. Provide sand that is at least 50 percent natural sand.
- d. Store and handle aggregate in a manner that will avoid segregation and prevents contamination by other materials or other sizes of aggregates. Store aggregates in locations that will permit them to drain freely. Do not use aggregates that contain frozen lumps.
- e. Submit types, pit or quarry locations, producers' names, aggregate supplier statement of compliance with ASTM C33, and ASTM C1293 expansion data not more than 18 months old.

2.3.3.2 Lightweight Aggregate

Lightweight aggregate in accordance with ASTM C330.

2.3.4 Admixtures

- a. Chemical admixtures must conform to ASTM C494.
- b. Air-entraining admixtures must conform to ASTM C260.
- c. Do not use calcium chloride admixtures.
- d. Admixtures used in concrete must be the same as those used in the concrete represented by submitted field test records or used in trial mixtures.
- e. Protect stored admixtures against contamination, evaporation, or damage.
- f. To ensure uniform distribution of constituents, provide agitating equipment for admixtures used in the form of suspensions or unstable solutions. Protect liquid admixtures from freezing and from temperature changes that would adversely affect their characteristics.
- g. Submit types, brand names, producers' names, manufacturer's technical data sheets, and certificates showing compliance with standards required herein.

2.4 MISCELLANEOUS MATERIALS

2.4.1 Concrete Curing Materials

Provide concrete curing material in accordance with ACI 301 Section 5 and ACI 308.1 Section 2. Submit product data for concrete curing compounds. Submit manufactures instructions for placement of curing compound.

2.4.2 Nonshrink Grout

Nonshrink grout in accordance with ASTM C1107.

2.4.3 Floor Finish Materials

2.4.3.1 Liquid Chemical Floor Hardeners and Sealers

- a. Hardener must be a colorless aqueous solution containing a blend of inorganic silicate or silicate material and proprietary components combined with a wetting agent; that penetrates, hardens, and densifies concrete surfaces. Submit manufactures instructions for placement of liquid chemical floor hardener.
- b. Use concrete penetrating sealers with a low (maximum 100 grams/liter, less water and less exempt compounds) VOC content. Submit manufactures instructions for placement of sealers.

2.4.4 Expansion/Contraction Joint Filler

ASTM D1751 or ASTM D1752 Type I or Type II. Material must be 1/2 inch thick.

2.4.5 Joint Sealants

Submit manufacturer's product data, indicating VOC content.

2.4.5.1 Horizontal Surfaces, 3 Percent Slope, Maximum

ASTM D6690 or ASTM C920, Type M, Class 25, Use T.

2.4.5.2 Vertical Surfaces Greater Than 3 Percent Slope

ASTM C920, Type M, Grade NS, Class 25, Use T.

2.4.6 Vapor Retarder

ASTM E1745 Class A polyethylene sheeting, minimum 15 mil thickness or other equivalent material with a maximum permeance rating of 0.04 perms per ASTM E96.

Consider plastic vapor retarders and adhesives with a high recycled content, low toxicity low VOC (Volatile Organic Compounds) levels.

2.5 CONCRETE MIX DESIGN

2.5.1 Properties and Requirements

- a. Use materials and material combinations listed in this section and the contract documents.
- b. Cementitious material content must be adequate for concrete to satisfy the specified requirements for strength, w/cm, durability, and finishability described in this section and the contract documents.

The minimum cementitious material content for concrete used in floors must meet the following requirements:

Nominal maximum size of aggregate, in.	Minimum cementitious material content, pounds per cubic yard
1-1/2	470
1	520
3/4	540
3/8	610

- c. Selected target slump must meet the requirements of this section, the contract documents, and must not exceed 9 in. Concrete must not show visible signs of segregation.
- d. The target slump must be enforced for the duration of the project. Determine the slump by ASTM C143. Slump tolerances must meet the requirements of ACI 117.
- e. The nominal maximum size of coarse aggregate for a mixture must not exceed three-fourths of the minimum clear spacing between

reinforcement, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

- f. Concrete must be air entrained for members assigned to Exposure Class F1, F2, or F3. The total air content must be in accordance with the requirements of the paragraph titled DURABILITY.
- g. Measure air content at the point of delivery in accordance with ASTM C173 or ASTM C231.
- h. Concrete for slabs to receive a hard-troweled finish must not contain an air-entraining admixture or have a total air content greater than 3 percent.
- i. Concrete properties and requirements for each portion of the structure are specified in the table below. Refer to the paragraph titled DURABILITY for more details on exposure categories and their requirements.

	Minimum <i>f'c</i> psi	Exposure	Miscellaneous Requirements
Footings	3000 at 28 days	F0	Nominal maximum aggregate size must be 1 in. Slump range: 4 in. plus or minus 1 in.
Walls	4500 at 28 days	F0	Nominal maximum aggregate size must be 1 in.
Slabs-on-ground	3000 at 28 days	F0	
Lightweight concrete suspended slab	4000 at 28 days	F0	Max. density of 115 (pounds per cubic foot, plus or minus 3 pounds per cubic foot)
Normal weight concrete suspended slab	4000 at 28 days	F0	

2.5.2 Durability

2.5.2.1 Freezing and Thawing Resistance

- a. Provide concrete meeting the following requirements based on exposure

class assigned to members for freezing-and-thawing exposure in
 Contract Documents:

Exposure class	Maximum w/cm^*	Minimum $f'c$, psi	Air content	Additional Requirements
F0	0.45	2500		N/A
F1	0.45	3500	Depends on aggregate size	N/A
F2	0.45	4500	Depends on aggregate size	See limits on maximum cementitious material by mass
F3	0.40	5000	Depends on aggregate size	See limits on maximum cementitious material by mass
F3 plain concrete	0.45	4500	Depends on aggregate size	See limits on maximum cementitious material by mass

*The maximum w/cm limits do not apply to lightweight concrete.

- b. Concrete must be air entrained for members assigned to Exposure Class F1, F2, or F3. The total air content must meet the requirements of the following table:

Nominal maximum aggregate size, in.	Total air content, percent* [^]	
	Exposure Class F2 and F3	Exposure Class F1
3/4	6.0	5.0
1	6.0	4.5
1-1/2	5.5	4.5

*Tolerance on air content as delivered must be plus/minus 1.5 percent.
[^]For $f'c$ greater than 5000 psi, reducing air content by 1.0 percentage point is acceptable.

- c. Submit documentation verifying compliance with specified requirements.
 d. For sections of the structure that are assigned Exposure Class F3, submit certification on cement composition verifying that concrete

mixture meets the requirements of the following table:

Cementitious material	Maximum percent of total cementitious material by mass*
Fly ash or other pozzolans conforming to ASTM C618	25

*Total cementitious material also includes ASTM C150, ASTM C845, and ASTM C1157 cement. The maximum percentages above must include:

- i. Fly ash or other pozzolans present in ASTM C1157.

2.5.2.2 Concrete Temperature

The temperature of concrete as delivered must not exceed 95°F.

2.5.3 Trial Mixtures

Trial mixtures must be in accordance to ACI 301.

2.5.4 Ready-Mix Concrete

Provide concrete that meets the requirements of ASTM C94.

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:

- a. Type and brand cement
- b. Cement and supplementary cementitious materials content in 94-pound bags per cubic yard of concrete
- c. Maximum size of aggregate
- d. Amount and brand name of admixtures
- e. Total water content expressed by water cementitious material ratio

2.6 REINFORCEMENT

- a. Bend reinforcement cold. Fabricate reinforcement in accordance with fabricating tolerances of ACI 117.
- b. Submit manufacturer's certified test report for reinforcement.
- c. Submit placing drawings showing fabrication dimensions and placement locations of reinforcement and reinforcement supports. Placing drawings must indicate locations of splices, lengths of lap splices, and details of mechanical and welded splices.
- d. Submit request with locations and details of splices not indicated in Contract Documents.
- e. Submit request for field cutting, including location and type of bar to be cut and reason field cutting is required.

2.6.1 Reinforcing Bars

- a. Reinforcing bars must be deformed, except spirals, load-transfer dowels, and welded wire reinforcement, which may be plain.
- b. ASTM A615 with the bars marked A, Grade 60. Provide reinforcing bars that contain a minimum of 90 percent recycled content. See Section 01 33 29 SUSTAINABILITY REPORTING for cumulative total recycled content requirements.

2.6.2 Wire

- a. Plain or deformed steel wire must conform to ASTM A1064.

2.6.3 Welded wire reinforcement

- a. Use welded wire reinforcement specified in Contract Documents and conforming to one or more of the specifications given herein.
- b. Plain welded wire reinforcement must conform to ASTM A1064, with welded intersections spaced no greater than 12 in. apart in direction of principal reinforcement.

2.6.4 Reinforcing Bar Supports

- a. Provide reinforcement support types within structure as required by Contract Documents. Reinforcement supports must conform to CRSI RB4.1. Submit description of reinforcement supports and materials for fastening coated reinforcement if not in conformance with CRSI RB4.1.
- b. Legs of supports in contact with formwork must be hot-dip galvanized, or plastic coated after fabrication, or stainless-steel bar supports.
- c. Minimum 10 percent post-consumer recycled content, or minimum 40 percent post-industrial recycled content. See Section 01 33 29 SUSTAINABILITY REPORTING for cumulative total recycled content requirements. Plastic and steel may contain post-consumer or post-industrial recycled content.

PART 3 EXECUTION

3.1 EXAMINATION

- a. Do not begin installation until substrates have been properly constructed; verify that substrates are level.
- b. If substrate preparation is the responsibility of another installer, notify Contracting Officer of unsatisfactory preparation before processing.
- c. Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Contracting Officer and wait for instructions before beginning installation.

3.2 PREPARATION

Determine quantity of concrete needed and minimize the production of excess concrete. Designate locations or uses for potential excess concrete

before the concrete is poured.

3.2.1 General

- a. 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.
- b. 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

- a. When subgrade material is semi-porous and dry, sprinkle subgrade surface with water as required to eliminate suction at the time concrete is deposited, or seal subgrade surface by covering surface with specified vapor retarder.
- b. When subgrade material is porous, seal subgrade surface by covering surface with specified vapor retarder.

3.2.3 Subgrade Under Slabs on Ground

- a. Before construction of slabs on ground, have underground work on pipes and conduits completed and approved.
- b. Previously constructed subgrade or fill must be cleaned of foreign materials
- c. 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.
- d. Finished surface of subgrade or fill under exterior slabs on ground must not be more than 0.02-foot above or 0.10-foot below elevation indicated.

3.2.4 Edge Forms and Screed Strips for Slabs

- a. 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.
- b. Align concrete surface to elevation of screed strips by use of strike-off templates or approved compacting-type screeds.

3.2.5 Reinforcement and Other Embedded Items

- a. Secure reinforcement, joint materials, and other embedded materials in position, inspected, and approved before start of concrete placing.
- b. When concrete is placed, reinforcement must be free of materials deleterious to bond. Reinforcement with rust, mill scale, or a combination of both will be considered satisfactory, provided minimum nominal dimensions, nominal weight, and minimum average height of deformations of a hand-wire-brushed test specimen are not less than

applicable ASTM specification requirements.

3.3 FORMS

- a. Provide forms, shoring, and scaffolding for concrete placement. Set forms mortar-tight and true to line and grade.
- b. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch. Place chamfer strips in corners of formwork to produce beveled edges on permanently exposed surfaces.
- c. Provide formwork with clean-out openings to permit inspection and removal of debris.
- d. Inspect formwork and remove foreign material before concrete is placed.
- e. At construction joints, lap form-facing materials over the concrete of previous placement. Ensure formwork is placed against hardened concrete so offsets at construction joints conform to specified tolerances.
- f. Provide positive means of adjustment (such as wedges or jacks) of shores and struts. Do not make adjustments in formwork after concrete has reached initial setting. Brace formwork to resist lateral deflection and lateral instability.
- g. Fasten form wedges in place after final adjustment of forms and before concrete placement.
- h. Provide anchoring and bracing to control upward and lateral movement of formwork system.
- i. Construct formwork for openings to facilitate removal and to produce opening dimensions as specified and within tolerances.
- j. Provide runways for moving equipment. Support runways directly on formwork or structural members. Do not support runways on reinforcement. Loading applied by runways must not exceed capacity of formwork or structural members.
- k. Position and support expansion joint materials, waterstops, and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with removable material to prevent concrete entry into voids.
- l. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign materials before concrete placement.

3.3.1 Coating

- a. Cover formwork surfaces with an acceptable material that inhibits bond with concrete.
- b. If formwork release agent is used, apply to formwork surfaces in accordance with manufacturer's recommendations before placing reinforcement. Remove excess release agent on formwork prior to concrete placement.
- c. Do not allow formwork release agent to contact reinforcement or

hardened concrete against which fresh concrete is to be placed.

3.3.2 Reuse

- a. Reuse forms providing the structural integrity of concrete and the aesthetics of exposed concrete are not compromised.
- b. Wood forms must not be clogged with paste and must be capable of absorbing high water-cementitious material ratio paste.
- c. Remove leaked mortar from formwork joints before reuse.

3.3.3 Forms for Standard Rough Form Finish

Provide formwork in accordance with ACI 301 Section 5 with a surface finish, SF-1.0, for formed surfaces that are to be concealed by other construction.

3.3.4 Forms for Standard Smooth Form Finish

Provide formwork in accordance with ACI 301 Section 5 with a surface finish, SF-3.0, for formed surfaces that are exposed to view. Do not provide mockup of concrete surface appearance and texture.

3.3.5 Form Ties

- a. For post-tensioned structures, do not remove formwork supports until stressing records have been accepted by the Contracting Officer.
- b. After ends or end fasteners of form ties have been removed, repair tie holes in accordance with ACI 301 Section 5 requirements.

3.3.6 Tolerances for Form Construction

- a. Construct formwork so concrete surfaces conform to tolerances in ACI 117.
- b. Position and secure sleeves, inserts, anchors, and other embedded items such that embedded items are positioned within ACI 117 tolerances.
- c. To maintain specified elevation and thickness within tolerances, install formwork to compensate for deflection and anticipated settlement in formwork during concrete placement. Set formwork and intermediate screed strips for slabs to produce designated elevation, camber, and contour of finished surface before formwork removal. If specified finish requires use of vibrating screeds or roller pipe screeds, ensure that edge forms and screed strips are strong enough to support such equipment.

3.3.7 Removal of Forms and Supports

- a. If vertical formed surfaces require finishing, remove forms as soon as removal operations will not damage concrete.
- b. Remove top forms on sloping surfaces of concrete as soon as removal will not allow concrete to sag. Perform repairs and finishing operations required. If forms are removed before end of specified curing period, provide curing and protection.

- c. Do not damage concrete during removal of vertical formwork for columns, walls, and sides of beams. Perform needed repair and finishing operations required on vertical surfaces. If forms are removed before end of specified curing period, provide curing and protection.
- d. Leave formwork and shoring in place to support construction loads and weight of concrete in beams, slabs, and other structural members until in-place required strength of concrete is reached.
- e. Form-facing material and horizontal facing support members may be removed before in-place concrete reaches specified compressive strength if shores and other supports are designed to allow facing removal without deflection of supported slab or member.

3.3.8 Strength of Concrete Required for Removal of Formwork

If removal of formwork, reshoring, or backshoring is based on concrete reaching a specified in-place strength, mold and field-cure cylinders in accordance with ASTM C31. Test cylinders in accordance with ASTM C39. Alternatively, use one or more of the methods listed herein to evaluate in-place concrete strength for formwork removal.

- a. Tests of cast-in-place cylinders in accordance with ASTM C873. This option is limited to slabs with concrete depths from 5 to 12 in.
- b. Penetration resistance in accordance with ASTM C803.
- c. Pullout strength in accordance with ASTM C900.

3.4 WATERSTOP INSTALLATION AND SPLICES

- a. Provide waterstops in construction joints as indicated.
- b. Install formwork to accommodate waterstop materials. Locate waterstops in joints where indicated in Contract Documents. Minimize number of splices in waterstop. Splice waterstops in accordance with manufacturer's written instructions. Install factory-manufactured premolded mitered corners.
- c. Install waterstops to form a continuous diaphragm in each joint. Make adequate provisions to support and protect waterstops during progress of work. Protect waterstops protruding from joints from damage.

3.5 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

- a. Unless otherwise specified, placing reinforcement and miscellaneous materials must be in accordance to ACI 301. Provide bars, welded wire reinforcement, wire ties, supports, and other devices necessary to install and secure reinforcement.
- b. 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.
- c. Nonprestressed cast-in-place concrete members must have concrete cover

for reinforcement given in the following table:

Concrete Exposure	Member	Reinforcement	Specified cover, in.
Cast against and permanently in contact with ground	All	All	3
Exposed to weather or in contact with ground	All	No. 6 through No. 18 bars	2
		No. 5 bar, W31 or D31 wire, and smaller	1-1/2
Not exposed to weather or in contact with ground	Slabs, joists, and walls	No. 14 and No. 18 bars	1-1/2
		No. 11 bar and smaller	1
	Beams, columns, pedestals, and tension ties	Primary reinforcement, stirrups, ties, spirals, and hoops	1-1/2

3.5.1 General

Provide details of reinforcement that are in accordance with the Contract Documents.

3.5.2 Vapor Retarder

- a. Install in accordance with ASTM E1643. Provide beneath the on-grade concrete floor slab. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of 12 inches and tape.
- b. Remove torn, punctured, or damaged vapor retarder material and provide with new vapor retarder prior to placing concrete. Concrete placement must not damage vapor retarder.

3.5.3 Perimeter Insulation

Install perimeter insulation at locations indicated. Adhesive must be used where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

3.5.4 Reinforcement Supports

Provide reinforcement support in accordance with CRSI RB4.1 and ACI 301 Section 3 requirements. Supports for coated or galvanized bars must also be coated with electrically compatible material for a distance of at least 2 inches beyond the point of contact with the bars.

3.5.5 Splicing

As indicated in the Contract Documents. For splices not indicated follow ACI 301. Do not splice at points of maximum stress. Overlap welded wire reinforcement the spacing of the cross wires, plus 2 inches.

3.5.6 Future Bonding

Plug exposed, threaded, mechanical reinforcement bar connectors with a greased bolt. Provide bolt threads that match the connector. Countersink the connector in the concrete. Caulk the depression after the bolt is installed.

3.5.7 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement and support against displacement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

3.5.8 Fabrication

Shop fabricate reinforcing bars to conform to shapes and dimensions indicated for reinforcement, and as follows:

- a. Provide fabrication tolerances that are in accordance with ACI 117.
- b. Provide hooks and bends that are in accordance with the Contract Documents.

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.

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.

3.5.9 Placing Reinforcement

Place reinforcement in accordance with ACI 301.

For slabs on grade (over earth or over capillary water barrier) and for footing reinforcement, support bars or welded wire reinforcement on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

For slabs other than on grade, supports for which any portion is less than 1 inch from concrete surfaces that are exposed to view or to be painted must be of precast concrete units, plastic-coated steel, or stainless steel protected bar supports. Precast concrete units must be wedge shaped, not larger than 3-1/2 by 3-1/2 inches, and of thickness equal to that indicated for concrete protection of reinforcement. Provide precast units that have cast-in galvanized tie wire hooked for anchorage and blend with concrete surfaces after finishing is completed.

Provide reinforcement that is supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

- a. Provide supports for reinforcing bars that are sufficient in number and have sufficient strength to carry the reinforcement they support, and in accordance with ACI 301 and CRSI 10MSP. Do not use supports to support runways for concrete conveying equipment and similar construction loads.
- b. Equip supports on ground and similar surfaces with sand-plates.
- c. Support welded wire reinforcement as required for reinforcing bars.
- d. Secure reinforcements to supports by means of tie wire. Wire must be black, soft iron wire, not less than 16 gage.
- e. Reinforcement must be accurately placed, securely tied at intersections, and held in position during placing of concrete by spacers, chairs, or other approved supports. Point wire-tie ends away from the form. Unless otherwise indicated, numbers, type, and spacing of supports must conform to the Contract Documents.
- f. Bending of reinforcing bars partially embedded in concrete is permitted only as specified in the Contract Documents.

3.5.10 Spacing of Reinforcing Bars

- a. Spacing must be as indicated in the Contract Documents.
- b. Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If any reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement is subject to preapproval by the Contracting Officer.

3.5.11 Concrete Protection for Reinforcement

Additional concrete protection must be in accordance with the Contract Documents.

3.5.12 Welding

Welding must be in accordance with AWS D1.4.

3.6 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

In accordance with ASTM C94, ACI 301, ACI 302.1R and ACI 304R, except as modified herein. Batching equipment must be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

3.6.1 Measuring

Make measurements at intervals as specified in paragraphs SAMPLING and TESTING.

3.6.2 Mixing

- a. Mix concrete in accordance with ASTM C94, ACI 301 and ACI 304R.
- b. 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.
- c. 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 submitted water-cementitious material ratio are not exceeded and the required concrete strength is still met. When additional water is added, an additional 30 revolutions of the mixer at mixing speed is required.
- d. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch. Do not reconstitute concrete that has begun to solidify.
- e. When fibers are used, add fibers together with the aggregates and never as the first component in the mixer. Fibers must be dispensed into the mixing system using appropriate dispensing equipment and procedure as recommended by the manufacturer.

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 in accordance with ACI 301 Section 5.

3.7.1 Footing Placement

Concrete for footings may be placed in excavations without forms upon inspection and approval by the Contracting Officer. Excavation width must be a minimum of 4 inches greater than indicated.

3.7.2 Pumping

ACI 304R and ACI 304.2R. Pumping must not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment must not exceed 2 inches at discharge/placement. Do not convey concrete through pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of coarse aggregate to 33 percent of the diameter of the pipe. Limit maximum size of well-rounded aggregate to 40 percent of the pipe diameter. Take samples for testing at both the point of delivery to the pump and at the discharge end.

3.7.2.1 Pumping Lightweight Concrete

In accordance with ACI 213R unless otherwise specified. Presoak or presaturate aggregates. Cement content must be minimum of 564 pounds per cubic yard and be sufficient to accommodate a 4 to 6 inch slump. Make field trial run in accordance with ACI 213R.

3.7.3 Cold Weather

Cold weather concrete must meet the requirements of ACI 306.1 unless otherwise specified. 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.

3.7.4 Hot Weather

Hot weather concrete must meet the requirements of ACI 301 unless otherwise specified. Maintain required concrete temperature using Figure 4.2 in ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

3.7.5 Bonding

Surfaces of set concrete at joints, must be roughened and cleaned of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, nor damaged concrete at the surface.

Obtain bonding of fresh concrete that has set as follows:

- a. 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.
- b. 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.
- c. Provide cement grout that consists of equal parts of portland cement and fine aggregate by weight with not more than 6 gallons of water per sack of cement. Apply cement grout with a stiff broom or brush to a minimum thickness of 1/16 inch. Deposit fresh concrete before cement grout has attained its initial set.

3.8 WASTE MANAGEMENT

Provide as specified in the Waste Management Plan and as follows.

3.8.1 Mixing Equipment

Before concrete pours, designate on-site area to be paved later in project for cleaning out concrete mixing trucks. Minimize water used to wash equipment.

3.8.2 Hardened, Cured Waste Concrete

Crush and reuse hardened, cured waste concrete as fill or as a base course for pavement.

3.8.3 Reinforcing Steel

Collect reinforcing steel and place in designated area for recycling.

3.9 SURFACE FINISHES EXCEPT FLOOR, SLAB, AND PAVEMENT FINISHES

3.9.1 Defects

Repair surface defects in accordance with ACI 301 Section 5.

3.9.2 Not Against Forms (Top of Walls)

Surfaces not otherwise specified must be finished with wood floats to even surfaces. Finish must match adjacent finishes.

3.9.3 Formed Surfaces

3.9.3.1 Tolerances

Tolerances in accordance with ACI 117 and as indicated.

3.9.3.2 As-Cast Rough Form

Provide for surfaces not exposed to public view a surface finish SF-1.0. Patch holes and defects in accordance with ACI 301.

3.9.3.3 Standard Smooth Finish

Provide for surfaces exposed to public view a surface finish SF-3.0. Patch holes and defects in accordance with ACI 301.

3.10 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

In accordance with ACI 301 and ACI 302.1R, unless otherwise specified. Slope floors uniformly to drains where drains are provided. Where straightedge measurements are specified, Contractor must provide straightedge.

3.10.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater.

3.10.1.1 Scratched

Use for surfaces intended to receive bonded applied cementitious applications. Finish concrete in accordance with ACI 301 Section 5 for a scratched finish.

3.10.1.2 Floated

Use for exterior slabs where not otherwise specified. Finish concrete in accordance with ACI 301 Section 5 for a floated finish.

3.10.1.3 Steel Troweled

Use for floors intended as walking surfaces and for reception of floor coverings. Finish concrete in accordance with ACI 301 Section 5 for a steel troweled finish.

3.10.1.4 Nonslip Finish

Use on surfaces of exterior platforms, steps, and landings; and on exterior and interior pedestrian ramps. Finish concrete in accordance with ACI 301 Section 5 for a dry-shake finish. After the selected material has been embedded by the two floatings, complete the operation with a broomed finish.

3.10.1.5 Broomed

Use on surfaces of exterior walks, platforms, patios, and ramps, unless otherwise indicated. Finish concrete in accordance with ACI 301 Section 5 for a broomed finish.

3.10.1.6 Pavement

Screed the concrete with a template advanced with a combined longitudinal and crosswise motion. Maintain a slight surplus of concrete ahead of the template. After screeding, float the concrete longitudinally. Use a straightedge to check slope and flatness; correct and refloat as necessary. Obtain final finish by belting. Lay belt flat on the concrete surface and advance with a sawing motion; continue until a uniform but gritty nonslip surface is obtained. Round edges and joints with an edger having a radius of 1/8 inch.

3.10.2 Flat Floor Finishes

ACI 302.1R. Construct in accordance with one of the methods recommended in Table 7.15.3, "Typical Composite Ff/FL Values for Various Construction Methods." ACI 117 for tolerance tested by ASTM E1155.

a. Specified Conventional Value:

Slab-on-grade and slab on steel deck: Floor Flatness (Ff) 25, 15 minimum

Slab-on-grade: Floor Levelness (FL) 20, 12 minimum. At force plates, provide tolerance of +/- 1/8" at top edge and bottom of slab recess per manufacturer requirements.

3.10.2.1 Measurement of Floor Tolerances

Test slab within 24 hours of the final troweling. Provide tests to Contracting Officer within 12 hours after collecting the data. Floor flatness inspector is required to provide a tolerance report which must include:

- a. Key plan showing location of data collected.
- b. Results required by ASTM E1155.

3.10.2.2 Remedies for Out of Tolerance Work

Contractor is required to repair and retest any floors not meeting specified tolerances. Prior to repair, Contractor must submit and receive approval for the proposed repair, including product data from any materials proposed. Repairs must not result in damage to structural integrity of the floor. For floors exposed to public view, repairs must prevent any uneven or unusual coloring of the surface.

3.10.3 Concrete Walks

Provide 4 inches thick minimum. Provide contraction joints spaced every 5 linear feet unless otherwise indicated. Cut contraction joints 1 inch deep, or one fourth the slab thickness whichever is deeper, with a jointing tool after the surface has been finished. Provide 0.5 inch thick transverse expansion joints at changes in direction where sidewalk abuts curb, steps, rigid pavement, or other similar structures; space expansion

joints every 50 feet maximum. Give walks a broomed finish. Unless indicated otherwise, provide a transverse slope of 1/48. Limit variation in cross section to 1/4 inch in 5 feet.

3.10.4 Pits and Trenches

Place bottoms and walls monolithically or provide waterstops and keys.

3.10.5 Curbs and Gutters

Provide contraction joints spaced every 10 feet maximum unless otherwise indicated. Cut contraction joints 3/4 inch deep with a jointing tool after the surface has been finished. Provide expansion joints 1/2 inch thick and spaced every 100 feet maximum unless otherwise indicated. Perform pavement finish.

3.10.6 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.

3.11 JOINTS

3.11.1 Construction Joints

Make and locate joints not indicated so as not to impair strength and appearance of the structure, as approved. Joints must be perpendicular to main reinforcement. Reinforcement must be continued and developed across construction joints. Locate construction joints as follows:

3.11.1.1 Maximum Allowable Construction Joint Spacing

- a. In walls at not more than 60 feet in any horizontal direction, provided the maximum control joint spacing does not exceed 24 feet.
- b. In slabs on ground, so as to divide slab into areas not in excess of 1,200 square feet.

3.11.1.2 Construction Joints for Constructability Purposes

- a. In walls, at top of footing; at top of slabs on ground; at top and bottom of door and window openings or where required to conform to architectural details; and at underside of deepest beam or girder framing into wall.
- b. In columns or piers, at top of footing; at top of slabs on ground; and at underside of deepest beam or girder framing into column or pier.
- c. Near midpoint of spans for supported slabs, beams, and girders unless a beam intersects a girder at the center, in which case construction joints in girder must offset a distance equal to twice the width of the beam. Make transfer of shear through construction joint by use of inclined reinforcement.

Provide keyways at least 1-1/2-inches deep in construction joints in walls and slabs and between walls and footings; approved bulkheads may be used for slabs.

3.11.2 Isolation Joints in Slabs on Ground

- a. Provide joints at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.
- b. Fill joints with premolded joint filler strips 1/2 inch thick, extending full slab depth. Install filler strips at proper level below finish floor elevation with a slightly tapered, dress-and-oiled wood strip temporarily secured to top of filler strip to form a groove not less than 3/4 inch in depth where joint is sealed with sealing compound and not less than 1/4 inch in depth where joint sealing is not required. Remove wood strip after concrete has set. Contractor must clean groove of foreign matter and loose particles after surface has dried.

3.11.3 Contraction Joints in Slabs on Ground

- a. Provide joints to form panels as indicated.
- b. Under and on exact line of each control joint, cut 50 percent of welded wire reinforcement before placing concrete.
- c. Sawcut contraction joints into slab on ground in accordance with ACI 301 Section 5.

3.11.4 Sealing Joints in Slabs on Ground

- a. Contraction and control joints which are to receive finish flooring material must be sealed with joint sealing compound after concrete curing period. Slightly underfill groove with joint sealing compound to prevent extrusion of compound. Remove excess material as soon after sealing as possible.
- b. Sealed groove must be left ready to receive filling material that is provided as part of finish floor covering work.

3.12 CURING AND PROTECTION

Curing and protection in accordance with ACI 301 Section 5, unless otherwise specified. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by blasting, pile driving, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer, hardener, or epoxy coating. Allow curing compound/sealer installations to cure prior to the installation of materials that adsorb VOCs.

3.12.1 Curing Periods

ACI 301 Section 5, except 10 days for retaining walls, pavement or chimneys. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing are subject to approval by the Contracting Officer.

3.12.2 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.

3.12.3 Curing Unformed Surfaces

- a. Accomplish initial curing of unformed surfaces, such as monolithic slabs, floor topping, and other flat surfaces, by membrane curing.
- b. Accomplish final curing of concrete surfaces to receive liquid floor hardener of finish flooring by moisture-retaining cover curing.

3.12.4 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.

3.12.5 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.

3.12.6 Protection After Curing

Protect finished concrete surfaces from damage by construction operations.

3.13 FIELD QUALITY CONTROL

3.13.1 Sampling

ASTM C172. Collect samples of fresh concrete to perform tests specified. ASTM C31 for making test specimens.

3.13.2 Testing

3.13.2.1 Slump Tests

ASTM C143. Take concrete samples during concrete placement/discharge. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cementitious material ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 20 cubic yards (maximum) of concrete.

3.13.2.2 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.

3.13.2.3 Compressive Strength Tests

ASTM C39. Make six 4 inch by 8 inch test cylinders for each set of tests in accordance with ASTM C31, ASTM C172 and applicable requirements of ACI 305R and ACI 306R. Take precautions to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and hold two cylinder in reserve. Take samples for strength tests of each mix design of concrete placed each day not less than once a day, nor less than once for each 100 cubic yards of concrete for the first 500 cubic yards, then every 500 cubic yards thereafter, nor less than once for each 5400 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result must be the average of two cylinders from the same concrete sample tested at 28 days. Concrete compressive tests must meet the requirements of this section, the Contract Document, and ACI 301. Retest locations represented by erratic core strengths. Where retest does not meet concrete compressive strength requirements submit a mitigation or remediation plan for review and approval by the contracting officer. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

3.13.2.4 Air Content

ASTM C173 or ASTM C231 for normal weight concrete and ASTM C173 for lightweight concrete. Test air-entrained concrete for air content at the same frequency as specified for slump tests.

3.13.2.5 Unit Weight of Structural Concrete

ASTM C567. Determine unit weight of lightweight concrete. Perform test for every 20 cubic yards maximum.

3.13.2.6 Strength of Concrete Structure

The strength of the concrete structure will be considered to be deficient if any of the following conditions are identified:

- a. Failure to meet compressive strength tests as evaluated.
- b. Reinforcement not conforming to requirements specified.
- c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.
- d. Concrete curing and protection of concrete against extremes of temperature during curing, not conforming to requirements specified.
- e. Concrete subjected to damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration.
- f. Poor workmanship likely to result in deficient strength.

Where the strength of the concrete structure is considered deficient submit a mitigation or remediation plan for review and approval by the contracting officer.

3.13.2.7 Non-Conforming Materials

Factors that indicate that there are non-conforming materials include (but not limited to) excessive compressive strength, inadequate compressive strength, excessive slump, excessive voids and honeycombing, concrete delivery records that indicate excessive time between mixing and placement, or excessive water was added to the mixture during delivery and placement. Any of these indicators alone are sufficient reason for the Contracting Officer to request additional sampling and testing.

Investigations into non-conforming materials must be conducted at the Contractor's expense. The Contractor must be responsible for the investigation and must make written recommendations to adequately mitigate or remediate the non-conforming material. The Contracting Officer may accept, accept with reduced payment, require mitigation, or require removal and replacement of non-conforming material at no additional cost to the Government.

3.13.2.8 Testing Concrete Structure for Strength

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

- a. Take at least three representative cores from each member or area of concrete-in-place that is considered potentially deficient. Location of cores will be determined by the Contracting Officer.
- b. Test cores after moisture conditioning in accordance with ASTM C42 if concrete they represent is more than superficially wet under service.
- c. Air dry cores, (60 to 80 degrees F with relative humidity less than 60 percent) for 7 days before test and test dry if concrete they represent is dry under service conditions.

- d. Strength of cores from each member or area are considered satisfactory if their average is equal to or greater than 85 percent of the 28-day design compressive strength of the class of concrete.
- e. 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.

3.14 REPAIR, REHABILITATION AND REMOVAL

Before the Contracting Officer accepts the structure the Contractor must inspect the structure for cracks, damage and substandard concrete placements that may adversely affect the service life of the structure. A report documenting these defects must be prepared which includes recommendations for repair, removal or remediation must be submitted to the Contracting Officer for approval before any corrective work is accomplished.

3.14.1 Repair of Weak Surfaces

Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. Concrete surfaces with weak surfaces less than 1/4 inch thick must be diamond ground to remove the weak surface. Surfaces containing weak surfaces greater than 1/4 inch thick must be removed and replaced or mitigated in a manner acceptable to the Contracting Officer.

3.14.2 Failure of Quality Assurance Test Results

Proposed mitigation efforts by the Contractor must be approved by the Contracting Officer prior to proceeding.

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SECTION 03 35 43

POLISHED CONCRETE FINISHING

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 D4263	(1983; R 2012 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM F710	(2017) Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

1.2 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

Section includes polished concrete finishing, including staining.

- a. Concrete for polished concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing, and curing is specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

1.3.1 Related Requirements

- a. Section 03 30 00 CAST-IN-PLACE CONCRETE for concrete not designated as polished concrete.
- b. Section 09 93 23 INTERIOR STAINS AND TRANSPARENT FINISHES for sealed concrete SC2 and SC3.

1.4 DEFINITIONS

Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

1.5 PREINSTALLATION MEETINGS

Preinstallation Conference: Conduct conference at Project site.

- a. Before submitting design mixtures, review concrete design mixture and

examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:

- (1) Contractor's superintendent.
 - (2) Independent testing agency responsible for concrete design mixtures.
 - (3) Ready-mix concrete manufacturer.
 - (4) Cast-in-place concrete subcontractor.
 - (5) Polished concrete finishing Subcontractor.
- b. Review cold- and hot-weather concreting procedures, curing procedures, construction joints, concrete repair procedures, concrete finishing, and protection of polished concrete.

1.6 ACTION SUBMITTALS

- a. Product Data: For each type of product.
- b. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.
- c. Samples for Initial Selection: For each type of product requiring color selection.
- d. Samples for Verification: For each type of exposed color.

1.7 INFORMATIONAL SUBMITTALS

- a. Qualification Data: For Installer.
- b. Material Certificates: For each of the following, signed by manufacturers:
 - (1) Repair materials.
 - (2) Stain materials.
 - (3) Liquid floor treatments.

1.8 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Polishing Schedule

SD-03 Product Data

For each type of product

SD-04 Samples

Color Selection

Exposed color

Field Sample Panels

Mockups

SD-07 Certificates

Qualification Data Installer

Repair materials

Stain materials

Liquid floor treatments

1.9 QUALITY ASSURANCE

- a. Field Sample Panels: After approval of verification sample and before casting concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 48 by 48 inches minimum, to demonstrate the expected range of finish, color, and appearance variations.
 - (1) Locate panels as indicated or, if not indicated, as directed by Architect.
 - (2) Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
 - (3) Demolish and remove field sample panels when directed.
- b. Mockups: Before casting concrete, build mockups to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - (1) Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
 - (2) Demonstrate curing, finishing, and protecting of polished concrete.
 - (3) Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 FIELD CONDITIONS

Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 PRODUCTS

2.1 STAIN MATERIALS, SC2 AND SC3

- a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable performance product by alternate industry manufacturer.
- b. Penetrating Stain: Water-based, acrylic latex, penetrating stain with colorfast pigments.

PART 3 EXECUTION

3.1 GENERAL

Install in accordance with manufacturer's instructions for all floor products being utilized.

3.2 STAINING

Newly placed concrete shall be at least 14 days old before staining.

Prepare surfaces according to manufacturer's written instructions and as follows:

- a. Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.
 - (1) Do not use acidic solutions to clean surfaces.
- b. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by acid etching or grinding, sanding, or abrasive blasting as recommended by stain manufacturer. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
- c. Apply acidic solution to dampened concrete surfaces, scrubbing with uncolored, acid-resistant nylon-bristle brushes until bubbling stops and concrete surface has texture of 120-grit sandpaper. Do not allow solution to dry on concrete surfaces. Rinse until water is clear. Control, collect, and legally dispose of runoff.
- d. Neutralize concrete surfaces and rinse until water is clear. Test surface for residue with clean white cloth. Test surface according to ASTM F710 to ensure pH is between 7 and 8.

Allow concrete surface to dry before applying stain. Verify readiness of concrete to receive stain according to ASTM D4263 by tightly taping 18-by-18-inch, 4-mil thick polyethylene sheet to a representative area of concrete surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.

Penetrating Stain: Apply penetrating stain to concrete surfaces according to manufacturer's written instructions and as follows:

- a. Apply first coat of stain to dry, clean surfaces by low-pressure pump-up sprayer.
- b. Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
- c. Lightly buff surfaces with dry pad or rags to remove excess residue. Do not rinse.
- d. Apply 2 coats of specified concrete sealer per manufacturers instructions. Protect finished floors from damage during construction.

-- End of Section --

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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 SP-66 (2004) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M (2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A167 (2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A185/A185M (2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

ASTM A615/A615M (2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM A641/A641M (2009a; R 2014) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

ASTM A653/A653M (2018) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A951/A951M (2011) Standard Specification for Steel Wire for Masonry Joint Reinforcement

ASTM A996/A996M (2016) Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

ASTM A1008/A1008M (2016) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM B370	(2012) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM C67/C67M	(2018) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C90	(2016) Standard Specification for Loadbearing Concrete Masonry Units
ASTM C129	(2017) Standard Specification for Nonloadbearing Concrete Masonry Units
ASTM C207	(2018) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C216	(2017) Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C270	(2014a2019) Standard Specification for Mortar for Unit Masonry
ASTM C476	(2018) Standard Specification for Grout for Masonry
ASTM C494/C494M	(2017) Standard Specification for Chemical Admixtures for Concrete
ASTM C641	(2017) Standard Test Method for Iron Staining Materials in Lightweight Concrete Aggregates
ASTM C780	(2017) Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C979/C979M	(2016) Standard Specification for Pigments for Integrally Colored Concrete
ASTM C1019	(2018) Standard Test Method for Sampling and Testing Grout
ASTM C1384	(2012a) Standard Specification for Admixtures for Masonry Mortars
ASTM C1611/C1611M	(2014) Standard Test Method for Slump Flow of Self-Consolidating Concrete
ASTM D2000	(2012; R 2017) Standard Classification System for Rubber Products in Automotive Applications

ASTM D2287 (2012) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

ASTM E514/E514M (2014a) Standard Test Method for Water Penetration and Leakage Through Masonry

THE MASONRY SOCIETY (TMS)

TMS MSJC (2016) Masonry Standard Joint Committee's (MSJC) Book - Building Code Requirements and Specification for Masonry Structures, Containing TMS 402/ACI 530/ASCE 5, TMS 602/ACI 530.1/ASCE 6, and Companion Commentaries

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Cut CMU Drawings; G

Reinforcement Detail Drawings; G

SD-03 Product Data

Hot Weather Procedures; G

Cold Weather Procedures; G

Clay or Shale Brick; G

Cementitious Materials; G

Recycled Content of Steel Reinforcement, Concrete Masonry Units; S

Environmental Product Declaration for Concrete Masonry Units, Steel Reinforcement; S

SD-04 Samples

Mock-Up Panel; G

Clay or Shale Brick; G

Concrete Masonry Units (CMU); G

Admixtures for Masonry Mortar; G

Anchors, Ties, and Bar Positioners; G

Joint Reinforcement; G

Clay Masonry Expansion-Joint Materials; G

SD-05 Design Data

Masonry Compressive Strength; G

Bracing Calculations; G

SD-06 Test Reports

Efflorescence Test

Field Testing of Mortar

Field Testing of Grout

Single-Wythe Masonry Wall Water Penetration Test

SD-07 Certificates

Special Masonry Inspector Qualifications

Clay or Shale Brick

Concrete Masonry Units (CMU)

Precast Concrete Units

Cementitious Materials

Admixtures for Masonry Mortar

Admixtures for Grout

Anchors, Ties, and Bar Positioners

Joint Reinforcement

Insulation

SD-10 Operation and Maintenance Data

Take-Back Program

1.3 QUALITY ASSURANCE

1.3.1 Masonry Mock-Up Panels

1.3.1.1 Mock-Up Panel Location

After material samples are approved and prior to starting masonry work, construct a mock-up panel for each type and color of masonry required. At least 48 hours prior to constructing the panel or panels, submit written notification to the Contracting Officer. Do not build-in mock-up panels as part of the structure; locate mock-up panels where directed. Construct portable mock-up panels or locate in an area where they will not be disrupted during construction.

1.3.1.2 Mock-Up Panel Configuration

Construct mock-up panels L-shaped or otherwise configured to represent all of the wall elements. Construct panels of the size necessary to demonstrate the acceptable level of workmanship for each type of masonry represented on the project. Provide a straight panel or a leg of an L-shaped panel of minimum size 8 feet long by 4 feet high.

1.3.1.3 Mock-Up Panel Composition

Show full color range, texture, and bond pattern of the masonry work. Demonstrate 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 during the construction of the panels. Also include installation or application procedures for anchors, wall ties, CMU control joints, brick expansion joints, insulation, flashing, brick soldier, row lock courses and weeps. Include a masonry bonded corner a bond beam corner and installation of electrical boxes and conduit. When the panel represents reinforced masonry, include 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. Provide required reinforcing around this opening as well as at wall corners and control joints.

1.3.1.4 Mock-Up Panel Construction Method

Where anchored veneer walls or cavity walls are required, demonstrate and receive approval for the method of construction; i.e., either bring up the two wythes together or separately, with the insulation and appropriate ties placed within the specified tolerances across the cavity. Demonstrate provisions 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. When water-repellent is specified to be applied to the masonry, apply the approved product to the mock-up panel. Construct panels on a properly designed concrete foundation.

1.3.1.5 Mock-Up Panel Purpose

The completed panels is used as the standard of workmanship for the type of masonry represented. Do not commence masonry work until the mock-up panel for that type of masonry construction has been completed and approved. Protect panels from the weather and construction operations until the masonry work has been completed and approved. Perform cleaning procedures on the mockup and obtain approval of the Contracting Officer prior to cleaning the building. After completion of the work, completely remove the mock-up panels, including all foundation concrete, from the construction site.

1.3.2 Special Masonry Inspector Qualifications

Refer to Section 01 45 35 SPECIAL INSPECTIONS for qualifications and responsibilities of the masonry special inspector.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver, store, handle, and protect material 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.

1.4.1 Masonry Units

Cover and protect masonry units from precipitation. Conform to handling and storage requirements of TMS MSJC.

- a. Pack prefaced concrete masonry units in the manufacturer's standard paper cartons, trays, or shrink wrapped pallets with a divider between each unit. Do not stack pallets. Do not remove units from cartons until cartons are placed on scaffolds or in the location where units are to be laid.

1.4.2 Reinforcement, Anchors, and Ties

Store steel reinforcing bars, coated anchors, ties, and joint reinforcement above the ground. Maintain steel reinforcing bars and uncoated ties free of loose mill scale and loose rust.

1.4.3 Cementitious Materials, Sand and Aggregates

Deliver cementitious and other packaged materials in unopened containers, plainly marked and labeled with manufacturers' names and brands. Store cementitious material in dry, weathertight enclosures or completely cover. Handle cementitious materials 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 and segregation.

1.5 PROJECT/SITE CONDITIONS

Conform to TMS MSJC for hot and cold weather masonry erection.

1.5.1 Hot Weather Procedures

When ambient air temperature exceeds 100 degrees F, or exceeds 90 degrees F and the wind velocity is greater than 8 mph, comply with TMS MSJC Article 1.8 D for: preparation prior to conducting masonry work; construction while masonry work is in progress; and protection for newly completed masonry.

1.5.2 Cold Weather Procedures

When ambient temperature is below 40 degrees F, comply with TMS MSJC Article 1.8 C for: preparation prior to conducting masonry work; construction while masonry work is in progress; and protection for newly completed masonry.

1.6 SUSTAINABLE DESIGN REQUIREMENTS

Provide Recycled Content of Steel Reinforcement, Concrete Masonry Units and Environmental Product Declaration for Concrete Masonry Units, Steel Reinforcement.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Design - Specified Compressive Strength of Masonry

The specified compressive strength of masonry, $f'm$, is 2,000 psi.

2.1.2 Performance - Verify Masonry Compressive Strength

Verify specified compressive strength of masonry using the "Unit Strength Method" of TMS MSJC. Submit calculations and certifications of unit and mortar strength.

Verify specified compressive strength of masonry using the "Prism Test Method" of TMS MSJC when the "Unit Strength Method" cannot be used. Submit test results.

2.2 MANUFACTURED UNITS

2.2.1 General Requirements

Do not change the source of materials, which will affect the appearance of the finished work, after the work has started except with Contracting Officer's approval. Submit test reports from an approved independent laboratory. Certify test reports on a previously tested material as the same materials as that proposed for use in this project. Submit certificates of compliance stating that the materials meet the specified requirements.

2.2.2 Clay or Shale Brick

2.2.2.1 General

2.2.2.1.1 Sample Submittal

Submit brick samples as specified, showing the color range and texture of clay or shale brick. Limit units used on the project to those that conform to the approved sample. 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.

2.2.2.1.2 Uniformity

Manufacture bricks at one time and from the same run. Deliver clay or shale brick units factory-blended to provide a uniform appearance and color range in the completed wall.

2.2.2.1.3 Efflorescence Test

Test clay brick that will be exposed to weathering for efflorescence in accordance with ASTM C67/C67M. Schedule tests far enough in advance of starting masonry work to permit retesting if necessary. Units meeting the definition of "effloresced" are subject to rejection.

2.2.2.2 Solid Clay or Shale Brick

Provide solid clay or shale brick that conforms to ASTM C216, Type FBX. Where brick cores, recesses, or deformation would be exposed to view,

provide 100 percent solid units. Provide brick with texture and color tange to match the brick indicated.

Provide brick with specified sizes.

- a. Modular size, 3-5/8 inches thick, 2-1/4 inches high, and 7-5/8 inches long.

2.2.3 Concrete Units

2.2.3.1 Aggregates

Test lightweight aggregates, and blends of lightweight and heavier aggregates in proportions used in producing the units, for stain-producing iron compounds in accordance with ASTM C641, visual classification method. Do not incorporate aggregates for which the iron stain deposited on the filter paper exceeds the "light stain" classification.

2.2.3.2 Concrete Masonry Units (CMU)

2.2.3.2.1 Size

Provide units with specified dimension of 7 5/8" and 11 5/8" inches wide, 7 5/8" inches high, and 15 5/8" inches long.

2.2.3.2.2 Surfaces

Provide units with exposed surfaces that are smooth and of uniform texture.

2.2.3.2.3 Weather Exposure

Provide concrete masonry units with water-repellant admixture added during manufacture where units will be exposed to weather.

2.2.3.2.4 Unit Types

- a. Hollow Load-Bearing Units: ASTM C90, lightweight. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls.
- b. Hollow Non-Load-Bearing Units: ASTM C129, lightweight. Load-bearing units may be provided in lieu of non-load-bearing units.

2.2.3.2.5 Jamb Units

Provide jamb units of the shapes and sizes to conform with wall units.

Provide sash jamb units with a 3/4 by 3/4 inch groove near the center at end of each unit.

2.2.4 Precast Concrete Units

2.2.4.1 General

- a. Provide precast concrete trim, copings, splashblocks and sills that are factory-made units in a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, provide precast concrete with minimum 4,000 psi compressive strength, conforming to Section 03 30 00 CAST-IN-PLACE CONCRETE using 1/2 inch to No. 4

nominal-size coarse aggregate, and with reinforcement required for handling of the units. Maintain minimum clearance of 3/4 inch between reinforcement and faces of units.

- b. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 120 psi for at least 5 hours, either damp-cure for 24 hours or steam-cure and then age under cover for 28 days or longer. In precast concrete members weighing over 80 pounds provide built-in loops of galvanized wire or other approved provisions for lifting and anchoring.
- c. Fabricate units with beds and joints at right angles to the face, with sharp true arises and with drip grooves on the underside where units overhang walls. Form exposed-to-view surfaces free of surface voids, spalls, cracks, and chipped or broken edges and with uniform appearance and color. Unless otherwise specified, provide units with a smooth dense finish.
- d. Prior to installation, wet and inspect each unit for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.
- e. Submit specified factory certificates.
- f. Provide architectural cast stone masonry trim, copings, heads, and sills that are manufactured in a plant by a producer regularly engaged in producing cast stone. Provide cast stone units that comply with ASTM C1364. Submit test reports and three exemplars of the same cast stone product installed in similar projects in similar climatic conditions.

2.2.4.2 Precast Concrete Sills and Copings

Cast sills and copings washes. For windows having mullions, cast sills in sections with head joints at mullions and a 1/4 inch allowance for mortar joints. Roughen the ends of sills, except a 3/4 inch wide margin at exposed surfaces, for bond. Provide rounded nosings on treads of door sills.

2.3 EQUIPMENT

2.3.1 Vibrators

Maintain at least one spare vibrator on site at all times.

2.3.2 Grout Pumps

Pumping through aluminum tubes is not permitted.

2.4 MATERIALS

2.4.1 Mortar Materials

2.4.1.1 Cementitious Materials

Provide cementitious materials that conform to those permitted by ASTM C270.

2.4.1.2 Hydrated Lime and Alternates

Provide lime that conforms to one of the materials permitted by ASTM C207 for use in combination with portland cement, hydraulic cement, and blended hydraulic cement. Do not use lime in combination with masonry cement or mortar cement.

2.4.1.3 Colored Mortar

Use mortar pigment that conforms to ASTM C979/C979M. Add pigment to mortar to produce a uniform color matching as indicated on Drawings. Furnish pigments in accurately pre-measured and packaged units that can be added to a measured amount of cementitious materials or supply pigments via preblended cementitious materials or dry mortar mix.

- a. In masonry cement or mortar cement, do not exceed 5 percent of cement weight for mineral oxide pigment; do not exceed 1 percent of cement weight for carbon black pigment.
- b. In cement-lime mortar mix, do not exceed 10 percent of cementitious materials' weight for mineral oxide pigment; do not exceed 2 percent of cementitious materials' weight for carbon black pigment.

2.4.1.4 Admixtures for Masonry Mortar

In cold weather, use a non-chloride based accelerating admixture that conforms to ASTM C1384, unless Type III portland cement is used in the mortar.

In showers and kitchens, use mortar that contains a water-repellent admixture that conforms to ASTM C1384. Provide a water-repellent admixture, conforming to ASTM C1384 and of the same brand and manufacturer as the block's integral water-repellent, in the mortar used to place concrete masonry units that have an integral water-repellent admixture.

2.4.1.5 Aggregate and Water

Provide aggregate (sand) and water that conform to materials permitted by ASTM C270.

2.4.2 Grout and Ready-Mix Grout Materials

2.4.2.1 Cementitious Materials for Grout

Provide cementitious materials that conform to those permitted by ASTM C476.

2.4.2.2 Admixtures for Grout

Water-reducing admixtures that conform to ASTM C494/C494M Type F or G and viscosity-modifying admixtures that conform to ASTM C494/C494M Type S are permitted for use in grout. Other admixtures require approval by the Contracting Officer.

In cold weather, a non-chloride based accelerating admixture may be used subject to approval by the Contracting Officer; use accelerating admixture that is non-corrosive and conforms to ASTM C494/C494M, Type C.

2.4.2.3 Aggregate and Water

Provide fine and coarse aggregates and water that conform to materials permitted by ASTM C476.

2.5 MORTAR AND GROUT MIXES

2.5.1 Mortar Mix

- a. Provide mortar Type S and M unless specified otherwise herein. Do not use masonry cement in the mortar. Do not use air-entrainment in the mortar.
- b. Use ASTM C270 Type S and M cement-lime mortar or mortar cement mortar for seismic-force-resisting elements indicated.
- c. Provide mortar that conforms to ASTM C270. Use Type M mortar for foundation walls and in piers.
- d. Provide Type S mortar for non-load-bearing, non-shear-wall interior masonry.
- e. For field-batched mortar, measure component materials by volume. Use measuring boxes for materials that do not come in packages, such as sand, for consistent batching. Mix cementitious materials and aggregates between 3 and 5 minutes in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency. Do not hand mix mortar unless approved by the Contracting Officer. Maintain workability of mortar by remixing or retempering. Discard mortar that has begun to stiffen or is not used within 2-1/2 hours after initial mixing.
- f. For preblended mortar, follow manufacturer's mixing instructions.

2.5.2 Grout and Ready Mix Grout Mix

Use grout that conforms to ASTM C476. Use conventional grout with a slump between 8 and 11 inches. Use self-consolidating grout with slump flow of 24 to 30 inches and a visual stability index (VSI) not greater than 1. Provide minimum grout strength of 2000 psi in 28 days, as tested in accordance with ASTM C1019. 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 grout meets the specified requirements. Use ready-mixed grout that conforms to ASTM C476.

2.6 ACCESSORIES

2.6.1 Grout Barriers

Grout barriers for vertical cores that consist of fine mesh wire, fiberglass, or expanded metal.

2.6.2 Anchors, Ties, and Bar Positioners

2.6.2.1 General

- a. Fabricate anchors and ties without drips or crimps. Size anchors and ties to provide a minimum of 5/8 inch mortar cover from each face of masonry.

- b. Fabricate steel wire anchors and ties shall from wire conforming to ASTM A1064/A1064M and hot-dip galvanize in accordance with ASTM A153/A153M.
- c. Fabricate joint reinforcement in conformance with ASTM A951/A951M. Hot dip galvanize joint reinforcement in exterior walls and in interior walls exposed to moist environment in conformance with ASTM A153/A153M. Galvanize joint reinforcement in other interior walls in conformance with ASTM A641/A641M; coordinate with paragraph JOINT REINFORCEMENT below.
- d. Fabricate sheet metal anchors and ties in conformance with ASTM A1008/A1008M. Hot dip galvanize sheet metal anchors and ties in exterior walls and in interior walls exposed to moist environment in compliance with ASTM A153/A153M Class B. Galvanize sheet metal anchors and ties in other interior walls in compliance with ASTM A653/A653M, Coating Designation G60.
- e. Submit two anchors, ties and bar positioners of each type used, as samples.

2.6.2.2 Wire Mesh Anchors

Provide wire mesh anchors of 1/4 inch mesh galvanized hardware cloth, conforming to ASTM A185/A185M, with length not less than 12 inches, at intersections of interior non-bearing masonry walls.

2.6.2.3 Wall Ties for Multi-Wythe Masonry Construction

Provide rectangular-shaped wall ties, fabricated of hot-dipped galvanized W1.7 diameter steel wire. Provide rectangular wall ties no less than 4 inches wide.

Provide adjustable type wall ties, if approved for use, that consist of two essentially U-shaped elements fabricated of minimum W2.8 diameter steel wire or pintle type ties that are inserted to eyes of horizontal joint reinforcement, hot-dip galvanized. Provide adjustable ties with double pintle legs and allows a maximum offset of 1-1/4 inch between each element of the tie and maximum distance between connecting parts no more than 1/16 inch. Form the pintle and eye elements shall be formed so that both can be in the same plane. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT.

2.6.2.4 Dovetail Anchors

Provide dovetail anchors of 3/16 inch diameter steel wire, triangular shaped, and attached to a 12 gauge or heavier steel dovetail section. Use these anchors to connect the exterior masonry wythe as it passes over the face of concrete columns, beams, or walls. Fill cells immediately above and below these anchors unless solid units are used. Furnish dovetail slots, which are specified to be installed by others, in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

2.6.2.5 Adjustable Anchors

2.6.2.5.1 Anchorage of Veneer to Light Gauge Steel or Concrete Backing

Use one of the following types of adjustable anchors to connect veneer to

light gauge steel or concrete backing:

- a. sheet metal at least 7/8 inch wide, 0.06 inch thick, and with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch or bent, notched or punched to provide equivalent performance;
- b. wire anchors of minimum size W1.7 with ends bent to form a minimum 2 inches extension and without drips;
- c. or wire pintle anchors used in conjunction with joint reinforcement.

Do not exceed 1/16 inch clearance between connecting parts of the tie. Assemble adjustable anchors to prevent disengagement. Provide pintle anchors with one or more pintle legs of wire size W2.8 and an offset not exceeding 1-1/4 inch.

2.6.2.6 Veneer Anchor Screws

Provide screws for attachment of veneer anchors to cold-formed steel framing members of size as required by design to provide the needed pullout load capacity but not less than No. 12. Provide length of screws such that the screws penetrate the holding member by not less than 5/8 inch.

2.6.2.7 Bar Positioners

Factory-fabricate bar positioners, used to prevent displacement of reinforcing bars during the course of construction, from 9 gauge steel wire or equivalent, and hot-dip galvanized. Bar positioners must be suitable for intended use and be corrosion resistant steel. Bar positioners not fully contained within the wythe must be hot-dip galvanized.

2.6.3 Joint Reinforcement

Factory fabricate joint reinforcement in conformance with ASTM A951/A951M, welded construction. Provide ladder type joint reinforcement, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units and with all wires a minimum of 9 gauge. Size joint reinforcement to provide a minimum of 5/8 inch cover from each face. Space crosswires not more than 16 inches. Provide joint reinforcement for straight runs in flat sections not less than 10 feet long. Provide joint reinforcement 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.

2.6.4 Reinforcing Steel Bars

Reinforcing steel bars and rods shall conform to ASTM A615/A615M or ASTM A996/A996M, Grade 60. Provide reinforcing bars that contain a minimum of 90 percent recycled content.

2.6.5 Concrete Masonry Control Joint Keys

Provide control joint keys of a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D2000 M2AA-805 with a minimum durometer hardness of 80 or polyvinyl

chloride conforming to ASTM D2287 Type PVC 654-4 with a minimum durometer hardness of 85. Form the control joint key 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, to fit neatly, but without forcing, in masonry unit jamb sash grooves.

2.6.6 Clay Masonry Expansion-Joint Materials

Provide backer rod and sealant, adequate to accommodate joint compression and extension equal to 50 percent of the width of the joint. Provide the backer rod of compressible rod stock of closed cell polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Provide sealant in conformance with Section 07 92 00 JOINT SEALANTS.

Submit one piece of each type of material used.

2.6.7 Through Wall Flashing and Weeps

2.6.7.1 General

Provide coated copper, copper or stainless steel sheet, self-adhesive rubberized sheet, or reinforced membrane sheet flashing.

2.6.7.2 Coated-Copper Flashing

Provide 7 ounce, electrolytic copper sheet, uniformly coated on both sides with acidproof, alkaliproof, asphalt impregnated kraft paper or polyethylene sheets.

2.6.7.3 Copper or Stainless Steel Flashing

Provide copper sheet, complying with ASTM B370, minimum 16 ounce weight; or stainless steel, ASTM A167, Type 304 or 316, 0.015 inch thick, No. 2D finish. Where indicated, provide with factory-fabricated deformations that mechanically bond flashing against horizontal movement in all directions, where deformations consist of dimples, diagonal corrugations, or a combination of dimples and transverse corrugations.

2.6.7.4 Rubberized Flashing

Provide self-adhesive rubberized asphalt sheet flashing consisting of 32-mil thick pliable and highly adhesive rubberized asphalt compound bonded completely and integrally to 8-mil thick, high density, cross-laminated polyethylene film to produce an overall thickness of 40 mils. Provide rubberized, asphalt-based mastic and surface conditioner that are each approved by flashing manufacturer for use with flashing material.

2.6.7.5 Weep Ventilators

Provide weep ventilators that are prefabricated from stainless steel or plastic. Provide inserts with grill or louver-type openings designed to allow the passage of moisture from cavities and to prevent the entrance of insects, and with a rectangular closure strip to prevent mortar droppings from clogging the opening. Provide ventilators with compressible flanges to fit in a standard 3/8 inch wide mortar joint and with height equal to the nominal height of the unit.

2.6.7.6 Single-Wythe Exterior Wall CMU Flashing System

In single-wythe exterior CMU walls, provide a system of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. For exterior CMU walls, provide a flashing/weep system in open cores that do not receive grout. Cell flashing pans are to have integral weep spouts built into mortar bed joints that extend into the cell to prevent clogging with mortar.

2.6.7.7 Metal Drip Edge

Provide stainless steel drip edge, 15-mil thick, hemmed edges, with down-turned drip at the outside edge and upturned dam at the inside edge for use with membrane flashings.

2.6.8 RIGID BOARD-TYPE INSULATION

Provide rigid board-type insulation as specified in Section 07 21 13 BOARD AND BLOCK INSULATION.

PART 3 EXECUTION

3.1 EXAMINATION

Prior to start of work, verify the applicable conditions as set forth in TMS MSJC, inspection.

3.2 PREPARATION

3.2.1 Stains

Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

3.2.2 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.

3.2.3 Concrete Surfaces

Where masonry is to be placed, clean concrete 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.

3.2.4 Shelf Angles

Adjust shelf angles as required to keep the masonry level and at the proper elevation.

3.2.5 Bracing

Provide bracing and scaffolding necessary for masonry work. Design bracing to resist wind pressure as required by OSHA and local codes and submit bracing calculations, sealed by a registered professional

engineer. Do not remove bracing in less than 10 days.

3.3 ERECTION

3.3.1 General

- a. Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching. Lay masonry units in running bond pattern. Lay facing courses level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances is plus or minus 1/2 inch. Adjust each unit to its final position while mortar is still soft and has plastic consistency.
- b. Remove and clean units that have been disturbed after the mortar has stiffened, and relay with fresh mortar. Keep air spaces, cavities, chases, expansion joints, and spaces to be grouted free from mortar and other debris. Select units to be used in exposed masonry surfaces from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work.
- c. When necessary to temporarily discontinue the work, step (rack) back the masonry for joining when work resumes. Tothing may be used only when specifically approved by the Contracting Officer. Before resuming work, remove loose mortar and thoroughly clean the exposed joint. Cover the top of walls subjected to rain or snow with nonstaining waterproof covering or membrane when work is not in process. Extend the covering a minimum of 610 mm 2 feet down on each side of the wall and hold securely in place.
- d. Ensure that units being laid and surfaces to receive units are free of water film and frost. Lay solid units in a nonfurrowed full bed of mortar. Bevel mortar for veneer wythes and slope down toward the cavity side. Shove units into place so that the vertical joints are tight. Completely fill vertical joints between solid units with mortar, except where indicated at control, expansion, and isolation joints. Place hollow units so that mortar extends to the depth of the face shell at heads and beds, unless otherwise indicated. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Provide means to prevent mortar from dropping into the space below or clean grout spaces prior to grouting.
- e. In multi-wythe construction with collar joints no more than 3/4 inch wide, bring up the inner wythe not more than 16 inches ahead of the outer wythe. Fill collar joints with mortar during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by back-buttering each unit as it is laid.

3.3.1.1 Jointing

Tool mortar joints when the mortar is thumbprint hard. Tool horizontal joints after tooling vertical joints. Brush mortar joints to remove loose and excess mortar.

3.3.1.1.1 Tooled Joints

Tool mortar joints in exposed exterior and interior masonry surfaces concave, using a jointer that is slightly larger than the joint width so that complete contact is made along the edges of the unit. Perform

tooling so that the mortar is compressed and the joint surface is sealed. Use a jointer of sufficient length to obtain a straight and true mortar joint. No exterior joints are to be left un-tooled.

3.3.1.1.2 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.

3.3.1.1.3 Joint Widths

- a. Construct brick masonry with mortar joint widths equal to the difference between the specified and nominal dimensions of the unit, within tolerances permitted by TMS MSJC.
- b. Provide 3/8 inch wide mortar joints in concrete masonry, except for prefaced concrete masonry units.
- c. Provide 3/8 inch wide mortar joints on unfaced side of prefaced concrete masonry units and not less than 3/16 inch nor more than 1/4 inch wide on prefaced side.
- d. Maintain mortar joint widths within tolerances permitted by TMS MSJC

3.3.1.2 Cutting and Fitting

Use full units of the proper size wherever possible, in lieu of cut units. Locate cut units where they would have the least impact on the architectural aesthetic goals of the facility. Perform cutting and fitting, including that required to accommodate the work of others, by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Before being placed in the work, dry wet-cut units to the same surface-dry appearance as uncut units being laid in the wall. Provide cut edges that are clean, true and sharp.

- a. Carefully make openings in the masonry 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. Provide reinforced masonry lintels above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.
- b. Do not reduce masonry units in size by more than one-third in height and one-half in length. Do not locate cut products at ends of walls, corners, and other openings.

3.3.1.3 Unfinished Work

Rack back unfinished work for joining with new work. Tothing may be resorted to only when specifically approved by the Contracting Officer. Remove loose mortar and thoroughly clean the exposed joints before laying new work.

3.3.1.4 Clay Masonry Expansion Joints

Provide clay masonry expansion joints as indicated. Construct by filling with a compressible foam pad. Ensure that no mortar or other

noncompressible materials are within the joint. Install backer rod and sealant in accordance with Section 07 92 00 JOINT SEALANTS.

3.3.1.5 Control Joints

Provide control joints in concrete masonry as indicated. Construct by raking out mortar within the head joint in accordance with the details shown on the Drawings. Form a continuous vertical joint at control joint locations, including through bond beams, by utilizing half blocks in alternating courses on each side of the joint. Interrupt the control joint key in courses containing continuous bond beam reinforcement. Interrupt the horizontal reinforcement and grout in bond beams at the control joint except in bond beams at the floor and roof diaphragms.

Where mortar was placed in the joint, rake both faces of the control joints to a depth of 3/4 inch. Install backer rod and sealant on both faces in accordance with Section 07 92 00 JOINT SEALANTS.

3.3.1.6 Decorative Architectural Units

Place decorative masonry units with the patterned face shell properly aligned in the completed wall.

3.3.2 Clay or Shale Brick Masonry

3.3.2.1 Brick Placement

Blend all brick at the jobsite from several cubes to produce a uniform appearance when installed. An observable "banding" or "layering" of colors or textures caused by improperly mixed brick is unacceptable. 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. Do not lay brick that is cored, recessed, or has other deformations in a manner that allows those deformations to be exposed to view; lay 100 percent solid units in these areas. Completely fill head and bed joints of solid units with mortar. Lay hollow units with mortar joints as specified for concrete masonry units.

Place exterior face of salvaged bricks towards the exterior.

3.3.2.2 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/C67M. Ensure that each unit is nearly saturated when wetted 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.

3.3.2.3 Partitions

- a. Construct partitions continuous from floor to underside of floor or roof deck where shown. Fill openings in firewalls around joists and other structural members as indicated or approved. Where suspended

ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 4 inches above the ceiling level. Construct an isolation joint in the intersection between partitions and structural or exterior walls.

- b. Tie interior partitions having 4 inch nominal thickness units to intersecting partitions of 4 inch units, 5 inches into partitions of 6 inch units, and 7 inches into partitions of 8 inch or thicker units. Cells within vertical plane of ties shall be filled solid with grout for full height of partition or solid masonry units may be used. Tie interior partitions over 4 inches thick together with joint reinforcement. Provide joint reinforcement with prefabricated pieces at corners and intersections of partitions.
- c. Double-Faced Bases or Partitions: Construct double-faced clay unit bases and partitions of two-unit construction. Bond units by overlapping from opposite faces of the wall, 2 inches for 6 inch thick partitions and 4 inches for 8 inch thick or greater. A single wythe prefaced concrete masonry base or partition may be made with double faced units.

3.3.3 Anchored Veneer Construction

- a. Construct exterior masonry wythes to the thickness indicated on the drawings. Provide a minimum two inch air space behind the masonry veneer. Provide means to ensure that the cavity space and flashings are kept clean of mortar droppings and other loose debris. Maintain chases and raked-out joints free from mortar and debris.
- b. Place masonry in running bond pattern.
- c. For veneer over stud framing, do not install veneer until the exterior sheathing, moisture barrier, veneer anchors and flashing have been installed on the backing. Take extreme care to avoid damage to the moisture barrier and flashing during construction of the masonry veneer. Repair or replace portions of the moisture barrier and flashing that are damaged prior to completion of the veneer. Provide a continuous cavity as indicated.
- d. For veneer with a masonry backup wythe, 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, install through-wall flashings with the exterior wythe, securing the top edge of the flashing with a termination bar and sealant, or protect flashings that are installed with the interior wythe from damage until they are fully enclosed in the wall.
- e. Provide anchors (ties) to connect the veneer to its backing in sufficient quantity to comply with the following requirements: maximum wall area per anchor {tie) of 1.77 ft^2 , and maximum vertical spacing of 16 inches, and maximum horizontal spacing of 16 inches. Provide additional anchors around openings larger than 16 inch in either direction. Space anchors around perimeter of opening at a maximum of 24 inches on center. Place anchors within 12 inches of openings. Anchors with drips are not permitted.
- f. With solid units, embed anchors in mortar joint and extend into the veneer a minimum of 1-1/2 inch, with at least 5/8 inch mortar cover to the outside face.

- g. With hollow units, embed anchors in mortar or grout and extend into the veneer a minimum of 1-1/2 inch, with at least 5/8 inch mortar or grout cover to outside face.

3.3.4 Reinforced, Single Wythe Concrete Masonry Units Walls

3.3.4.1 Concrete Masonry Unit Placement

- a. Fully bed units used to form piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout in mortar under both face shells and webs. Provide mortar beds under both face shells for other units. Mortar head joints for a distance in from the face of the unit not less than the thickness of the face shell.
- b. Solidly grout foundation walls below grade.
- c. Stiffen double walls 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 each wall within the double wall. Adequately reinforce walls and partitions for support of wall-hung plumbing fixtures when chair carriers are not specified.
- d. Submit drawings showing elevations of walls exposed to view and indicating the location of all cut CMU products.

3.3.4.2 Preparation for Reinforcement

Lay units in such a manner as to preserve the unobstructed vertical continuity of cores to be grouted. Remove mortar protrusions extending 1/2 inch or more into cells before placing grout. Position reinforcing bars accurately as indicated before placing grout. Where vertical reinforcement occurs, fill cores solid with grout in accordance with paragraph PLACING GROUT in this Section.

3.3.5 Cavity Walls (Multi-Wythe Noncomposite Walls)

Provide a continuous cavity as indicated. Bevel mortar beds away from cavity to prevent projection into cavity when bricks are shoved in place. Keep cavities clear and clean of mortar droppings. At the bottom of cavity walls, in the course immediately above the through-wall flashing, temporarily omit one brick every 4 feet. Clean mortar droppings and debris out of the cavity through the temporary openings at least once each day masonry is laid, and more often when required to keep the cavities clean. Fill in the openings with bricks and mortar after the wall is complete and the cavity has been inspected and found clean.

Securely tie the two wythes together with horizontal joint reinforcement, or provide ties to connect the masonry wythes in sufficient quantity to comply with the following requirements: maximum wall area per tie of 1.77 ft², and maximum vertical spacing of 16 inches, and maximum horizontal spacing of 16 inches. Provide additional ties around openings larger than 16 inches in either direction. Space ties around perimeter of opening at a maximum of 3 feet on center. Place ties within 12 inches of openings. Ties with drips are not permitted.

3.3.6 ANCHORAGE

3.3.6.1 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.

3.3.6.2 Anchorage to Structural Steel

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 16 inches on centers vertically, and if applicable, not over 24 inches on centers horizontally.

3.3.6.3 Anchorage at Intersecting Walls

Provide wire mesh anchors at maximum 16 inches spacing at intersections of interior non-bearing masonry walls.

Anchor structural masonry walls as indicated on drawings, unless the drawings indicate a movement joint at the intersection.

3.3.7 Lintels

3.3.7.1 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. Extend lintel reinforcement beyond each side of masonry opening 40 bar diameters or 24 inches, whichever is greater. Support reinforcing bars in place prior to grouting and locate 1/2 inch above the bottom inside surface of the lintel unit.

3.3.7.2 Precast Concrete and Steel Lintels

Provide precast concrete and steel lintels as shown on the Drawings. Set lintels in a full bed of mortar with faces plumb and true. Provide steel and precast lintels with a minimum bearing length of 8 inches unless otherwise indicated. In partially grouted masonry, provide fully grouted units under the full lintel bearing length, unless otherwise indicated.

3.3.8 Sills and Copings

Set sills and copings in a full bed of mortar with faces plumb and true. Slope sills and copings to drain water. Mechanically anchor copings and sills longer than 4 feet as indicated.

3.4 INSTALLATION

3.4.1 Bar Reinforcement Installation

3.4.1.1 Preparation

Submit detail drawings showing bar splice locations. Identify bent bars on a bending diagram and reference and locate such bars on the drawings. Show wall dimensions, bar clearances, and wall openings. Utilize bending details that conform to the requirements of ACI SP-66. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are

shown. If, during construction, additional masonry openings are required, resubmit the approved shop drawings with the additional openings shown along with the proposed changes. Clearly highlight location of these additional openings. Provide wall elevation drawings with minimum scale of 1/4 inch per foot. 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.

Clean reinforcement of loose, flaky rust, scale, grease, mortar, grout, and other coatings that might destroy or reduce its bond prior to placing grout. Do not use bars with kinks or bends not shown on the approved shop drawings. Place reinforcement prior to grouting. Unless otherwise indicated, extend vertical wall reinforcement to within 2 inches of tops of walls.

3.4.1.2 Positioning Bars

- a. Accurately place vertical bars 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. Provide minimum clearance between parallel bars of 1/2 inch between the bars and masonry units for coarse grout and a minimum clearance of 1/4 inch between the bars and masonry units for fine grout. Provide minimum clearance between parallel bars of 1 inch or one diameter of the reinforcement, whichever is greater. Vertical reinforcement 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 or by other means to prevent displacement beyond permitted tolerances. As masonry work progresses, secure vertical reinforcement to prevent displacement beyond allowable tolerances.
- b. Wire column and pilaster lateral ties in position around the vertical reinforcing bars. Place lateral ties in contact with the vertical reinforcement and do not place in horizontal mortar bed joints.
- c. Position horizontal reinforcing bars as indicated. Stagger splices in adjacent horizontal bars, unless otherwise indicated.
- d. Form splices by lapping bars as indicated. Do not cut, bend or eliminate reinforcing bars. Foundation dowel bars may be field-bent when permitted by TMS MSJC.

3.4.1.3 Splices of Bar Reinforcement

Lap splice reinforcing bars as indicated. When used, provide welded or mechanical connections that develop at least 125 percent of the specified yield strength of the reinforcement.

3.4.2 Placing Grout

3.4.2.1 General

Fill cells containing reinforcing bars with grout. Solidly 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. Solidly grout cells under lintel bearings on each side of openings for full height of openings. Solidly grout walls below grade, lintels, and bond beams. Units other than open end units may require

grouting each course to preclude voids in the units.

Discard site-mixed grout that is not placed within 1-1/2 hours after water is first added to the batch or when the specified slump is not met without adding water after initial mixing. Discard ready-mixed grout that does not meet the specified slump without adding water other than water that was added at the time of initial discharge. Allow sufficient time between grout lifts to preclude displacement or cracking of face shells of masonry units. Provide a grout shear key between lifts when grouting is delayed and the lower lift loses plasticity. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, tear down the wall and rebuild.

3.4.2.2 Vertical Grout Barriers for Multi-Wythe Composite Walls

In multi-wythe composite walls, provide grout barriers in the collar joint not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

3.4.2.3 Horizontal Grout Barriers

Embed horizontal grout barriers in mortar below cells of hollow units receiving grout.

3.4.2.4 Grout Holes and Cleanouts

3.4.2.4.1 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 hollow unit masonry is indicated. Form such openings not 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.

3.4.2.4.2 Cleanouts for Hollow Unit Masonry Construction

For hollow masonry units, provide cleanout holes at the bottom of every grout pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet 4 inches. 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. Provide cleanouts not less than 3 by 3 inch by cutting openings in one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Do not cleanout holes 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.

3.4.2.4.3 Cleanouts for Multi-Wythe Composite Masonry Construction

Provide cleanouts for construction of walls that incorporate a grout filled cavity between solid masonry wythes, provide cleanouts at the

bottom of every pour by omitting every other masonry unit from one wythe. Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Do not plug cleanout holes 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.

3.4.2.5 Grout Placement

A grout pour is the total height of masonry to be grouted prior to erection of additional masonry. A grout lift is an increment of grout placement within a grout pour. A grout pour is filled by one or more lifts of grout.

- a. Lay masonry to the top of a pour permitted by TMS MSJC Table 7, based on the size of the grout space and the type of grout. Prior to grouting, remove masonry protrusions that extend 1/2 inch or more into cells or spaces to be grouted. Provide grout holes and cleanouts in accordance with paragraph GROUT HOLES AND CLEANOUTS above when the grout pour height exceeds 5 feet 4 inches. Hold reinforcement, bolts, and embedded connections rigidly in position before grouting is started. Do not prewet concrete masonry units.
- b. Place grout using a hand bucket, concrete hopper, or grout pump to fill the grout space without segregation of aggregate. Operate grout pumps to produce a continuous stream of grout without air pockets, segregation, or contamination.
- c. If the masonry has cured at least 4 hours, grout slump is maintained between 10 to 11 inches, and no intermediate reinforced bond beams are placed between the top and bottom of the pour height, place conventional grout in lifts not exceeding 12 feet 8 inches. For the same curing and slump conditions but with intermediate bond beams, limit conventional grout lift to the bottom of the lowest bond beam that is more than 5 feet 4 inches above the bottom of the lift, but do not exceed 12 feet 8 inches. If masonry has not cured at least 4 hours or grout slump is not maintained between 10 to 11 inches, place conventional grout in lifts not exceeding 5 feet 4 inches.
- d. Consolidate conventional grout lift and reconsolidate after initial settlement before placing next lift. For grout pours that are 12 inches or less in height, consolidate and reconsolidate grout by mechanical vibration or puddling. For grout pours that are greater than 12 inches in height, consolidate and reconsolidate grout by mechanical vibration. 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. If previous lift is not permitted to set, dip vibrator into previous lift. Do not insert vibrators into lower lifts that are in a semi-solidified state. If lower lift sets prior to placement of subsequent lift, form a grout key by terminating grout a minimum of 1-1/2 inch below a mortar joint. Vibrate each vertical cell containing reinforcement in partially grouted masonry. Do not form grout keys within beams.
- e. If the masonry has cured 4 hours, place self-consolidating grout (SCG) in lifts not exceeding the pour height. If masonry has not cured for at least 4 hours, place SCG in lifts not exceeding 5 feet 4 inches. Do not mechanically consolidate self-consolidating grout. Place

self-consolidating grout in accordance with manufacturer's recommendations.

- f. Upon completion of each day's grouting, remove waste materials and debris from the equipment, and dispose of outside the masonry.

3.4.3 Joint Reinforcement Installation

Install joint reinforcement at 16 inches on center unless otherwise indicated. Lap joint reinforcement not less than 6 inches. Install prefabricated sections at corners and wall intersections. Place the longitudinal wires of joint reinforcement in mortar beds to provide not less than 5/8 inch cover to either face of the unit.

3.4.4 Bond Beams

Reinforce and grout bond beams as indicated and as described in paragraphs above. Install grout barriers under bond beam units to retain the grout as required, unless wall is fully grouted or solid bottom units are used. For high lift grouting in partially grouted masonry, provide grout retaining material on the top of bond beams to prevent upward flow of grout. Ensure that reinforcement is continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated.

3.4.5 Flashing and Weeps

- a. Install through-wall flashing at obstructions in the cavity and where indicated on Drawings. Ensure continuity of the flashing at laps and inside and outside corners by splicing in a manner approved by the flashing manufacturer. Ensure that the top edge of the flashing is sealed by turning the flashing 1/2 inch into the mortar bed joint of backup masonry or lapping a minimum of 6 inches under the weather resistive barrier. Terminate the horizontal leg of the flashing by extending the sheet metal 1/2 inch beyond the outside face of masonry and turning downward with a hemmed drip. Provide sealant below the drip edge of through-wall flashing.
- b. Wherever through-wall flashing occurs, provide weep holes to drain flashing to exterior at acceptable locations as indicated. Provide weeps of weep ventilators. Locate weeps not more than 24 inches on centers in mortar joints of the exterior wythe directly on the horizontal leg of through-wall flashing over foundations, bond beams, and any other horizontal interruptions of the cavity. Place weep holes perfectly horizontal or slightly canted downward to encourage water drainage outward and not inward. Other methods may be used for providing weeps when spacing is reduced to 16 inches on center and approved by the Contracting Officer. Maintain weeps free of mortar and other obstructions.

3.5 APPLICATION

3.5.1 Insulation

Insulate cavity walls (multi-wythe noncomposite masonry walls), where shown, by installing board-type insulation on the cavity side of the inner wythe. Apply board type insulation directly to the masonry or thru-wall flashing with adhesive. Neatly fit insulation between obstructions without impaling insulation on ties or anchors. Apply insulation in

parallel courses with vertical joints breaking midway over the course below and in moderate contact with adjoining units without forcing. Cut to fit neatly against adjoining surfaces.

3.5.2 Interface with Other Products

3.5.2.1 Built-In 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, unless otherwise indicated.

3.5.2.2 Door and Window Frame Joints

On the exposed interior and exterior sides of exterior frames, rake joints between frames and abutting masonry walls to a depth of 3/8 inch.

3.5.2.3 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. Provide bedding mortar and non-shrink grout as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.5.3 Tolerances

Lay masonry plumb, true to line, with courses level within the tolerances of TMS MSJC, Article 3.3 F.

3.6 FIELD QUALITY CONTROL

3.6.1 Tests

3.6.1.1 Field Testing of Mortar

Perform mortar testing at the following frequency: Three times per day. For each required mortar test, provide a minimum of three mortar samples. Perform initial mortar testing prior to construction for comparison purposes during construction.

Prepare and test mortar samples for mortar aggregate ratio in accordance with ASTM C780 Appendix A4. Prepare and test mortar compressive strength specimens in accordance with ASTM C780 Appendix A6.

3.6.1.2 Field Testing of Grout

- a. Perform grout testing at the following frequency: Three times per day. For each required grout property to be evaluated, provide a minimum of three specimens.
- b. Sample and test conventional and self-consolidating grout for compressive strength and temperature in accordance with ASTM C1019.
- c. Evaluate slump in conventional grout in accordance with ASTM C1019.

- d. Evaluate slump flow and visual stability index of self-consolidating grout in accordance with ASTM C1611/C1611M.

3.6.1.3 Clay Brick Efflorescence Test

Test clay brick that will be exposed to weathering for efflorescence in accordance with ASTM C67/C67M. Schedule tests far enough in advance of starting masonry work to permit retesting if necessary. Units meeting the definition of "effloresced" are subject to rejection.

3.6.1.4 Single-Wythe Masonry Wall Water Penetration Test

Prior to start of field construction of the single-wythe concrete masonry wall, perform masonry wall water penetration test on mock-up wall assemblies consisting of the identical design, materials, mix, and construction methods as the actual wall construction and in accordance with ASTM E514/E514M. Prepare a minimum of three specimens and cure for minimum 28 days prior to testing. Construct panels by the same methods, processes, and applications to be used on the project's construction site. Spray test for 6 hours on each specimen. If water is visible on back of test panels during the test and areas of dampness on the backside of the test panels do not exceed 25 percent of the wall area, the panels will be considered to have passed. Dampness is defined as any area of surface darkening or discoloration due to moisture penetration or accumulation below the observed surface.

Construct additional test panels for each failed test performed until three test panels pass the test. Factors that can affect test performance include materials, mixing, and quality of application and workmanship. Materials, mixing, and methods adjustments may be necessary in order to provide construction that passes the water penetration test. Document and record the test specimen construction materials and application and provide written test report in accordance with ASTM E514/E514M, supplemented by a detailed discussion of the specifics of test panel construction, application methods and processes used, quality of construction, and any variances or deviations that may have occurred between test panels during test panel construction. For failed test panels, identify in the supplemental report the variances, deficiencies or flaws that contributed to test panel failure and itemize the precautions to be taken in field construction of the masonry wall to prevent similar deficiencies and assure the wall construction replicates test panel conditions that pass the water penetration test. Submit the complete, certified test report, including supplemental report, to the Contracting Officer prior to start of single-wythe concrete masonry wall construction. Significant changes to materials, proportions, or construction techniques from those used in the passing water penetration test are grounds for performing new tests, at the discretion of the Contracting Officer.

3.6.2 Special Inspection

Perform special inspections and testing in accordance with Section 01 45 35 SPECIAL INSPECTIONS.

3.7 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, completely remove mortar and grout daubs and splashings from masonry-unit surfaces that will be exposed or painted. Before completion of the work, rake out defects in joints of masonry to be exposed or

painted, fill with mortar, and tool to match existing joints. Immediately after grout work is completed, remove scum and stains that have percolated through the masonry work using a low pressure stream of water and a stiff bristled brush. Do not clean masonry surfaces, other than removing excess surface mortar, until mortar in joints has hardened. Leave masonry surfaces clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Do not use metal tools and metal brushes for cleaning.

3.7.1 Dry-Brushing Concrete Masonry

Dry brush exposed concrete masonry surfaces at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.7.2 Clay Brick Surfaces

Clean exposed clay brick masonry surfaces to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. Perform cleaning in accordance with the approved cleaning procedure demonstrated on the mockup.

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. Water-soak exposed masonry surfaces and then clean with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay brick manufacturer and manufacturer of the cleaning product. Apply the solution with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Use proprietary cleaning agents in conformance with the cleaning product manufacturer's printed recommendations. Remove efflorescence in conformance with the brick manufacturer's recommendations.

3.8 CLOSE-OUT TAKE-BACK PROGRAM

Collect information from manufacturer for take-back program options. Set aside masonry units, full and partial to be returned to manufacturer for recycling into new product. When such a service is not available, seek local recyclers to reclaim the materials. Submit documentation that includes contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and/or reuse.

3.9 PROTECTION

Protect facing materials against staining. Cover top of walls with nonstaining waterproof covering or membrane to protect from moisture intrusion when work is not in progress. Continue covering the top of the unfinished walls until the wall is waterproofed with a complete roof or parapet system. Extend covering a minimum of 2 feet down on each side of the wall and hold securely in place. Before starting or resuming work, clean top surface of masonry in place of loose mortar and foreign material.

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STRUCTURAL WELDING
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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 360 (2010) Specification for Structural Steel Buildings

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189 (2016) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-105-2006)

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (2012) Standard Symbols for Welding, Brazing and Nondestructive Examination

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

AWS D1.3/D1.3M (2018) Structural Welding Code - Sheet Steel

AWS D1.4/D1.4M (2011) Structural Welding Code - Reinforcing Steel

AWS D14.4/D14.4M (2012) Specification for Welded Joints for Machinery and Equipment

AWS QC1 (2016) Specification for AWS Certification of Welding Inspectors

AWS Z49.1 (2012) Safety in Welding and Cutting and Allied Processes

ASTM INTERNATIONAL (ASTM)

ASTM E165/E165M (2018) Standard Practice for Liquid Penetrant Examination for General Industry

ASTM E709 (2015) Standard Guide for Magnetic Particle Examination

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Welding Quality Assurance Plan; G

SD-03 Product Data

Welding Procedure Qualifications; G

Welder, Welding Operator, and Tacker Qualification

Previous Qualifications

Pre-Qualified Procedures; G

Welding Electrodes and Rods

SD-06 Test Reports

Weld Inspection Log

SD-07 Certificates

Certified Welding Procedure Specifications (WPS)

Certified Brazing Procedure Specifications (BPS)

Certified Procedure Qualification Records (PQR)

Certified Welder Performance Qualifications (WPQ)

Certified Brazer Performance Qualifications (BPQ)

Certified Welding Inspector

Nondestructive Testing Personnel

1.3 QUALITY ASSURANCE

Except for pre-qualified (in accordance with AWS D1.1/D1.1M) and previously qualified procedures, each Contractor performing welding must record in detail and qualify the welding procedure specification for any welding procedure followed in the fabrication of weldments. Conform welding procedure qualifications to AWS D1.1/D1.1M and to the specifications in this section. Submit for approval copies of the welding procedure specification and the procedure qualification records for each type of welding being performed. Submission of the welder, welding operator, or tacker qualification test records is also required. Approval of any procedure, however, does not relieve the Contractor of the sole responsibility for producing a finished structure meeting all the

specified requirements. Submit this information on the forms in Annex M of AWS D1.1/D1.1M. Individually identify and clearly reference on the detail drawings and erection drawings all welding procedure specifications, or suitably key them to the contract drawings. In case of conflict between this specification and AWS D1.1/D1.1M, this specification governs.

1.3.1 General Requirements

Fabricate work in an AISC Certified Fabrication Plant, Category BU.

a. For Structural Projects, provide documentation of the following:

- (1) Component Thickness 1/8 inch and greater: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.1/D1.1M.
- (2) Component Thickness Less than 1/8 inch: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.3/D1.3M.
- (3) Reinforcing Steel: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.4/D1.4M.

b. For other applications, provide documentation of the following:

- (1) Submit one copy of the Certified Welding Procedure Specifications (WPS), Certified Brazing Procedure Specifications (BPS) and Certified Procedure Qualification Records (PQR) to the Contracting Officer for review.
- (2) Submit one copy of the Certified Welder Performance Qualifications (WPQ) and Certified Brazer Performance Qualifications (BPQ) to the Contracting Officer for review within fifteen calendar days prior to any employee welding on the project material.
- (3) Machinery: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D14.4/D14.4M.

1.3.2 Previous Qualifications

Welding procedures previously qualified by test in accordance with AWS D1.1/D1.1M, may be accepted for this contract without re-qualification, upon receipt of the test results, if the following conditions are met:

- a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.
- b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.
- c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.3.3 Pre-qualified Procedures

Welding procedures which are considered pre-qualified as specified in AWS D1.1/D1.1M will be accepted without further qualification. Submit for

approval a listing or an annotated drawing to indicate the joints not pre-qualified. Procedure qualification is mandatory for these joints.

1.3.4 Welder, Welding Operator, and Tacker Qualification

Each welder, welding operator, and tacker assigned to work on this contract must be qualified in accordance with the applicable requirements of AWS D1.1/D1.1M and as specified in this section. Welders, welding operators, and tackers who make acceptable procedure qualification test welds will be considered qualified for the welding procedure used within the applicable essential variables for welder qualification.

1.3.4.1 Previous Personnel Qualifications

At the discretion of the Contracting Officer, welders, welding operators, and tackers qualified by test within the previous 6 months may be accepted for this contract without re-qualification if all the following conditions are met:

- a. Copies of the welding procedure specifications, the procedure qualification test records, and the welder, welding operator, and tacker qualification test records are submitted and approved in accordance with the specified requirements for detail drawings.
- b. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.
- c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.3.4.2 Certificates

Before assigning any welder, welding operator, or tacker to work under this contract, submit the names and certification that each individual is qualified as specified. State in the certification the type of welding and positions for which the welder, welding operator, or tacker is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person certifying the qualification tests. Keep the certification current, on file, and furnish 3 copies.

1.3.4.3 Renewal of Qualification

Re-qualification of a welder or welding operator is required under any of the following conditions:

- a. It has been more than 6 months since the welder or welding operator has used the specific welding process for which he is qualified.
- b. There is specific reason to question the welder or welding operator's ability to make welds that meet the requirements of these specifications.
- c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract, and a qualification test has not been taken within the past 12 months. Submit as evidence of conformance all records showing periods of employment, name of employer where welder, or welding operator, was last employed, and the

process for which qualified.

- d. A tacker who passes the qualification test is considered eligible to perform tack welding indefinitely in the positions and with the processes for which he/she is qualified, unless there is some specific reason to question the tacker's ability or there has been a gap greater than 6 months since he/she last used the process. In such a case, the tacker is required to pass the prescribed tack welding test.

1.3.5 Inspector Qualification

Submit certificates indicating that certified welding inspectors meet the requirements of AWS QC1. Submit qualifications for nondestructive testing personnel in accordance with the requirements of ANSI/ASNT CP-189 for Levels I or II in the applicable nondestructive testing method. Level I inspectors must have direct supervision of a Level II inspector.

1.3.6 Symbols and Safety

Use symbols in accordance with AWS A2.4, unless otherwise indicated. Follow safe welding practices and safety precautions during welding in conformance with AWS Z49.1.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Conform the design of welded connections to AISC 360, unless otherwise indicated or specified. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved. Perform welding as specified in this section, except where additional requirements are shown on the drawings or are specified in other sections. Do not commence welding until welding procedures, inspectors, nondestructive testing personnel, welders, welding operators, and tackers have been qualified and the submittals approved by the Contracting Officer. Perform all testing at or near the work site. Maintain records of the test results obtained in welding procedure, welder, welding operator, and tacker performance qualifications.

2.1.1 Pre-erection Conference

Hold a pre-erection conference prior to the start of the field welding, to bring all affected parties together and to gain a naturally clear understanding of the project and the Welding Procedure Specifications (WPS) (submitted for all welding, including welding done using pre-qualified procedures). Mandatory attendance is required by all Contractor's welding production and inspection personnel and appropriate Government personnel. Include as items for discussion: responsibilities of various parties; welding procedures and processes to be followed; welding sequence (both within a joint and joint sequence within the building); inspection requirements and procedures, both visual and nondestructive testing; welding schedule; and other items deemed necessary by the attendees.

2.2 WELDING EQUIPMENT AND MATERIALS

Provide all welding equipment, welding electrodes and rods, welding wire, and fluxes capable of producing satisfactory welds when used by a qualified welder or welding operator. Use E70XX welding electrodes.

Provide welding equipment and materials that comply with the applicable requirements of AWS D1.1/D1.1M. Submit product data on welding electrodes and rods.

PART 3 EXECUTION

3.1 WELDING OPERATIONS

3.1.1 Requirements

Conform workmanship and techniques for welded construction to the requirements of AWS D1.1/D1.1M and AISC 360. When AWS D1.1/D1.1M and the AISC 360 specification conflict, the requirements of AWS D1.1/D1.1M govern.

3.1.2 Identification

Identify all welds in one of the following ways:

- a. Submit written records to indicate the location of welds made by each welder, welding operator, or tacker.
- b. Identify all work performed by each welder, welding operator, or tacker with an assigned number, letter, or symbol to identify welds made by that individual. The Contracting Officer may require welders, welding operators, and tackers to apply their symbol next to the weld by means of rubber stamp, felt-tipped marker with waterproof ink, or other methods that do not cause an indentation in the metal. Place the identification mark for seam welds adjacent to the weld at 3 foot intervals. Identification with die stamps or electric etchers is not allowed.

3.2 QUALITY CONTROL

Perform testing using an approved inspection or testing laboratory or technical consultant; or if approved, the Contractor's inspection and testing personnel may be used instead of the commercial inspection or testing laboratory or technical consultant. A Certified Welding Inspector must perform visual inspection on 100 percent of all welds. Document this inspection in the Visual Weld Inspection Log. Verify the welds conform to paragraph STANDARDS OF ACCEPTANCE. Conform procedures and techniques for inspection with applicable requirements of AWS D1.1/D1.1M, ASTM E165/E165M, and ASTM E709. Submit a Welding Quality Assurance Plan and records of tests and inspections.

3.3 STANDARDS OF ACCEPTANCE

Conform dimensional tolerances for welded construction, details of welds, and quality of welds with the applicable requirements of AWS D1.1/D1.1M and the contract drawings.

3.4 GOVERNMENT INSPECTION AND TESTING

In addition to the inspection and tests performed by the Contractor for quality control, the Government will perform inspection and testing for acceptance to the extent determined by the Contracting Officer. The work may be performed by the Government's own forces or under a separate contract for inspection and testing. The Government reserves the right to perform supplemental nondestructive and destructive tests to determine compliance with paragraph STANDARDS OF ACCEPTANCE.

3.5 CORRECTIONS AND REPAIRS

If inspection or testing indicates defects in the weld joints, repair defective welds using a qualified welder or welding operator as applicable. Conduct corrections in accordance with the requirements of AWS D1.1/D1.1M and the specifications. Repair all defects in accordance with the approved procedures. Repair defects discovered between passes before additional weld material is deposited. Wherever a defect is removed and repair by welding is not required, blend the affected area into the surrounding surface to eliminate sharp notches, crevices, or corners. After a defect is thought to have been removed, and before re-welding, examine the area by suitable methods to ensure that the defect has been eliminated. Repaired welds must meet the inspection requirements for the original welds.

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STRUCTURAL STEEL
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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 207	(2010) Certification Standard for Steel Fabrication and Erection, and Manufacturing of Metal Components
AISC 303	(2010) Code of Standard Practice for Steel Buildings and Bridges
AISC 303-10	(2010) Code of Standard Practice for Steel Buildings and Bridges
AISC 325	(2010) Steel Construction Manual
AISC 326	(2009) Detailing for Steel Construction
AISC 360	(2010) Specification for Structural Steel Buildings
AISC 420	(2010) Certification Standard for Shop Application of Complex Protective Coating Systems

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2012) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1	(2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel
AWS QC1	(2016) Specification for AWS Certification of Welding Inspectors

ASME INTERNATIONAL (ASME)

ASME B46.1	(2009) Surface Texture, Surface Roughness, Waviness and Lay
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ASTM INTERNATIONAL (ASTM)

ASTM A6	(2017a) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
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ASTM A36	(2014) Standard Specification for Carbon Structural Steel
ASTM A123	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A500	(2018) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A992	(2011; R 2015) Standard Specification for Structural Steel Shapes
ASTM B695	(2004; R 2016) Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM C827	(2016) Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
ASTM C1107	(2017) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM F436	(2016) Standard Specification for Hardened Steel Washers Inch and Metric Dimensions
ASTM F844	(2007a; R 2013) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F1136	(2011) Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners
ASTM F1554	(2018) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F2329	(2015) Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
ASTM F2833	(2011; R 2017) Standard Specification for Corrosion Protective Fastener Coatings with Zinc Rich Base Coat and Aluminum Organic/Inorganic Type

ASTM F3125 (2015a) Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1 (2016) Shop, Field, and Maintenance Coating of Metals

SSPC Paint 20 (2002; E 2004) Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic)

SSPC Paint 29 (2002; E 2004) Zinc Dust Sacrificial Primer, Performance-Based

SSPC SP 3 (1982; E 2004) Power Tool Cleaning

SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01 (2013; with Change 4, 2018) Structural Engineering

UFC 3-310-04 (2013; with Change 1, 2016) Seismic Design of Buildings

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

29 CFR Part 1926, Subpart R Steel Erection

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Erection and Erection Bracing Drawings; G

SD-02 Shop Drawings

Fabrication Drawings Including Details of Connections; G

SD-03 Product Data

Shop Primer

Welding Electrodes and Rods

Non-Shrink Grout

Recycled Content for Structural Steel; S

Recycled Content for Structural Steel Tubing; S

Environmental Product Declaration for Steel; S

SD-05 Design Data

Design Calculations for Steel Connections; G

SD-06 Test Reports

Bolts, Nuts, and Washers

SD-07 Certificates

Steel

Bolts, Nuts, and Washers

Galvanizing

AISC Structural Steel Fabricator Quality Certification

Welding Procedures and Qualifications

Welding Electrodes and Rods

Certified Welding Inspector

Welding Procedure Specifications (WPS)

1.3 AISC QUALITY CERTIFICATION

Work must be fabricated by an AISC Certified Structural Steel Fabricator, in accordance with AISC 207, Category BU. Submit AISC Structural Steel Fabricator quality certification.

1.4 QUALITY ASSURANCE

1.4.1 Preconstruction Submittals

1.4.1.1 Erection and Erection Bracing Drawings

Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing. The erection drawings must conform to AISC 303.

1.4.2 Fabrication Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 303, AISC 326 and AISC 325. Fabrication drawings must not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS A2.4 standard welding symbols. Clearly highlight any deviations from the details shown on the contract drawings highlighted on the fabrication drawings. Explain the reasons for any deviations from the contract drawings.

1.4.3 Delegated Connection Design

Design structural steel connection indicated in the contract documents per AISC 303, Option 3, using the connection loads indicated. Submit design calculations for steel connections signed and sealed by a registered professional engineer.

1.4.4 Certifications

1.4.4.1 Welding Procedures and Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests.

Conform to all requirements specified in AWS D1.1.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide the structural steel system, including shop primer galvanizing, complete and ready for use. Provide structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing in accordance with AISC 303, AISC 360, UFC 3-301-01 and UFC 3-310-04 except as modified in this contract.

2.2 STEEL

2.2.1 Structural Steel

Wide flange and WT shapes, ASTM A992. Angles, Channels and Plates, ASTM A36. Provide structural steel containing a minimum of 90 percent recycled content. Submit data identifying percentage of recycled content for structural steel. Provide Environmental Product Declaration for Steel.

2.2.2 Structural Steel Tubing

ASTM A500, Grade C. Provide structural steel tubing containing a minimum of 90 percent recycled content. Submit data identifying percentage of recycled content for structural steel tubing.

2.2.3 Architecturally Exposed Structural Steel (AESS)

Structural Steel conforming to one of the categories of Architecturally Exposed Structural Steel or AESS Refer to AISC 303-10 "Code of Standard Practice for Steel Buildings and Bridges". Structural Steel designated as "AESS Level 1" in the contract documents and conforming to AISC 303-10, Chapter 10 definition of AESS1. These are basic elements with workmanship requirements exceeding those in non AESS construction.

2.3 BOLTS, NUTS, AND WASHERS

Submit the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

2.3.1 High-Strength Bolts

High strength bolts and nuts must be shipped together in the same shipping container. Fasteners indicated to be galvanized shall be tested by the supplier to show that the galvanized nut with the supplied lubricant provided may be rotated from the snug tight condition well in excess of the rotation required for pretensioned installation without stripping. The supplier shall supply nuts that have been lubricated and tested with the supplied bolts.

2.3.1.1 Bolts

ASTM F3125, Grade A325M A325, Type 1 Heavy Hex Head Style, plain finish.

2.3.1.2 Nuts

ASTM A563, Grade and Style as specified in the applicable ASTM bolt standard.

2.3.1.3 Washers

ASTM F436, plain carbon steel.

2.3.2 Foundation Anchorage

2.3.2.1 Anchor Rods

ASTM F1554 Gr 36, Class 1A.

2.3.2.2 Anchor Nuts

ASTM A563, Grade A, hex style.

2.3.2.3 Anchor Washers

ASTM F844.

2.3.2.4 Anchor Plate Washers

ASTM A36.

2.4 STRUCTURAL STEEL ACCESSORIES

2.4.1 Welding Electrodes and Rods

AWS D1.1. Submit product data for welding electrodes and rods.

2.4.2 Non-Shrink Grout

ASTM C1107, with no ASTM C827 shrinkage. Submit product data for non-shrink grout.

2.4.3 Welded Shear Stud Connectors

AWS D1.1, Table 7.1, Type B.

2.5 GALVANIZING

ASTM F2329, ASTM F1136, ASTM F2833 or ASTM B695 for threaded parts or ASTM A123 for structural steel members, as applicable, unless specified otherwise galvanize after fabrication where practicable.

2.6 FABRICATION

Fabrication must be in accordance with the applicable provisions of AISC 325. Fabrication and assembly must be done in the shop to the greatest extent possible. Punch, subpunch and ream, or drill bolt holes perpendicular to the surface of the member.

Compression joints depending on contact bearing must have a surface roughness not in excess of 500 micro inch as determined by ASME B46.1, and ends must be square within the tolerances for milled ends specified in ASTM A6.

Shop splices of members between field splices will be permitted only where indicated on the Contract Drawings. Splices not indicated require the approval of the Contracting Officer.

For AESS, fabricate and assemble in the shop to the greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by the Architect. Detail AESS assemblies to minimize field handling and expedite erection. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures. Remove all backing and run out tabs. Grind all sharp edges smooth, including all sheared, punched or flame cut edges. Provide a continuous appearance to all welded joints including tack welds. Provide joint filler at intermittent welds. Remove all weld spatter, slivers and similar surface discontinuities. Seal weld open ends of round and rectangular hollow structural section with 3/8 inch closure plates. Provide venting as required for galvanized members.

2.6.1 Markings

Prior to erection, identify members by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections must be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate match markings in areas that will decrease member strength or cause stress concentrations.

2.6.2 Shop Primer

SSPC Paint 20 or SSPC Paint 29, (zinc rich primer). Shop prime structural steel, except as modified herein, in accordance with SSPC PA 1. Do not prime steel surfaces embedded in concrete, or surfaces within 0.5 inch of the toe of the welds prior to welding (except surfaces on which metal decking and shear studs are to be welded). If flash rusting occurs, re-clean the surface prior to application of primer. Apply primer in accordance with endorsement "SPE-P1" of AISC 420 or approved equal NACE or SSPC certification to a minimum dry film thickness of 2.0 mil. Submit shop primer product data.

Prior to assembly, prime surfaces which will be concealed or inaccessible after assembly. Do not apply primer in foggy or rainy weather; when the ambient temperature is below 45 degrees F or over 95 degrees F; or when the primer may be exposed to temperatures below 40 degrees F within 48

hours after application, unless approved otherwise by the Contracting Officer. Repair damaged primed surfaces with an additional coat of primer.

2.6.2.1 Cleaning

SSPC SP 6/NACE No.3, except steel exposed in spaces above ceilings, attic spaces, furred spaces, and chases that will be hidden to view in finished construction may be cleaned to SSPC SP 3 when recommended by the shop primer manufacturer. Maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

2.7 DRAINAGE HOLES

Drill adequate drainage holes to eliminate water traps. Hole diameter must be 1/2 inch and location indicated on the detail drawings. Hole size and locations must not affect the structural integrity.

PART 3 EXECUTION

3.1 ERECTION

- a. Erection of structural steel, except as indicated in item b and c. below, must be in accordance with the applicable provisions of AISC 325, AISC 303 and 29 CFR Part 1926, Subpart R.
- b. Employ special care to handle and erect AESS. Erect finish pieces using nylon straps or chains with softeners such that they are not damaged. Place weld tabs for temporary bracing and safety cabling at points concealed from view in the completed structure or where approved by the Architect during the pre-installation meeting. Methods of removing temporary erection devices and finishing the AESS members shall be approved by the Architect prior to erection. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures. Remove all backing and run out tabs. When temporary braces or fixtures are required to facilitate erection, care shall be taken to avoid any blemishes, holes or unsightly surfaces resulting from the use or removal of such temporary elements. Comply with AWS D1.1 at welded connections. Appearance and quality of welds shall be consistent. Employ methods that will maintain alignment of members without warp exceeding the tolerance of this section. Remove all weld spatter exposed to view.

After final positioning of steel members, provide full bearing under base plates and bearing plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions.

3.1.1 Delivery

Deliver AESS to Project site in such quantities and at such times to ensure continuity of installation. All tie downs on loads shall be nylon straps or shall use softeners when using chains or wire rope slings to avoid damage to edges and surfaces of members. The standard for acceptance of delivered and erected members shall be equivalent to the standard employed at fabrication.

3.1.2 Storage

Store the material out of contact with the ground in such manner and

location as to minimize deterioration.

3.1.3 Handling

Handle finish pieces using nylon type slings, or chains with softeners, or wire ropes with softeners such that they are not damaged. Conform to AISC 303-10 Sections 10.4, 10.5, and 10.6.

3.2 CONNECTIONS

Except as modified in this section, design connections indicated in accordance with AISC 360. Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Holes must not be cut or enlarged by burning. Bolts, nuts, and washers must be clean of dirt and rust, and lubricated immediately prior to installation.

3.2.1 Bolts

Tighten ASTM A325 bolts to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

3.3 GAS CUTTING

Use of gas-cutting torch in the field for correcting fabrication errors is not permitted on any major member in the structural framing. Use of a gas cutting torch will be permitted on minor members not under stress only after approval has been obtained from the Contracting Officer.

3.4 WELDING

Welding must be in accordance with AWS D1.1. Provide AWS D1.1 qualified welders, welding operators, and tackers.

Develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Submit for approval all WPS, whether prequalified or qualified by testing.

3.4.1 Removal of Temporary Welds, Run-Off Plates, and Backing Strips

Remove only from finished areas.

3.5 SHOP PRIMER REPAIR

Repair shop primer in accordance with the paint manufacturer's recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

3.5.1 Field Priming

Field prime steel exposed to the weather, or located in building areas without HVAC for control of relative humidity. After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat must be cleaned and primed with paint of the same quality as that used for the shop coat.

3.6 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing. Notify the Contracting Officer in writing of defective welds, bolts, nuts, and washers within 7 working days of the date of the inspection.

3.6.1 Welds

3.6.1.1 Visual Inspection

AWS D1.1. Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification inspections. A Certified Welding Inspector must perform visual inspection on 100 percent of all welds. Document this inspection in the Visual Weld Inspection Log. Submit certificates indicating that certified welding inspectors meet the requirements of AWS QC1.

3.6.2 Inspection and Testing of Steel Stud Welding

Perform verification inspection and testing of steel stud welding conforming to the requirements of AWS D1.1, Stud Welding Clause. The Contracting Officer will serve as the verification inspector. Bend test studs that do not show a full 360 degree weld flash or have been repaired by welding as required by AWS D1.1, Stud Welding Clause. Studs that crack under testing in the weld, base metal or shank will be rejected and replaced by the Contractor at no additional cost.

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SECTION 05 21 00

STEEL JOIST FRAMING

05/15

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SECTION 05 21 00

STEEL JOIST FRAMING
05/15

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016)
Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2014) Standard Specification for Carbon
Structural Steel

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2015) International Building Code

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1 (2016) Shop, Field, and Maintenance
Coating of Metals

SSPC Paint 15 (1999; E 2004) Steel Joist Shop Primer

SSPC SP 2 (1982; E 2000; E 2004) Hand Tool Cleaning

STEEL JOIST INSTITUTE (SJI)

SJI LOAD TABLES (2010; Errata 1 2011; Errata 2 2012) 42nd
Edition Catalog of Standard Specifications
Load Tables and Weight Tables for Steel
Joists and Joist Girders

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

29 CFR 1926 Safety and Health Regulations for
Construction

29 CFR 1926.757 Steel Erection; Open Web Steel Joists

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S"

are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Welder Qualification

SD-02 Shop Drawings

Steel Joist Framing; G

SD-03 Product Data

Recycled Content; S

SD-05 Design Data

Design Calculations; G

SD-06 Test Reports

Erection Inspection
Welding Inspections

SD-07 Certificates

Certification of Compliance

1.3 QUALITY ASSURANCE

Perform all work in compliance with the requirements set forth in 29 CFR 1926.

1.3.1 Drawing Requirements

Submit drawings of steel joist framing including fabrication, specifications for shop painting, and identification markings of joists. Show joist type and size, layout in plan, all applicable loads, deflection criteria, and erection details including methods of anchoring, framing at openings, type, size, and location and connections for and spacing of bridging, requirements for field welding, and details of accessories as applicable.

1.3.2 Certification of Compliance

Prior to construction commencement, submit certification for welder qualification, in compliance with AWS D1.1/D1.1M, welding operation, and tacker, stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. Submit certification of compliance for the following:

- a. 29 CFR 1926
- b. 29 CFR 1926.757
- c. Statement from steel joist manufacturer, that work was performed in accordance with approved construction documents and with SJI standard

specifications, in accordance with ICC IBC Section 1704.2.5.2.

1.4 DELIVERY, STORAGE, AND HANDLING

Handle, transport, and store joists in a manner to prevent damage affecting their structural integrity. Verify piece count of all joist products upon delivery and inspect all joists products for damage. Report any damage to the joist supplier. Store all items off the ground in a well drained location protected from the weather and easily accessible for inspection and handling. Store joists with top chord down and with joists in a vertical position. Store deep joists horizontally if they were shipped on their sides.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Designate steel joists on the drawings in accordance with the standard designations of the Steel Joist Institute. Joists of other standard designations or joists with properties other than those shown may be substituted for the joists designated provided the structural properties are equal to or greater than those of the joists shown and provided all other specified requirements are met.

2.2 STEEL JOISTS

Provide steel joists conforming to SJI LOAD TABLES. Design joists designated K, KCS, LH and DLH to support the loads given in the applicable standard load tables of SJI LOAD TABLES. Submit design calculations for net uplift loads, non-SJI standard details, and field splices. Include cover letter signed and sealed by the joist manufacturer's registered design professional.

2.2.1 Steel Joist Camber

Camber joists according to SJI LOAD TABLES.

2.3 RECYCLED CONTENT

Provide products with a total recycled content not less than 50 percent.

2.4 ACCESSORIES AND FITTINGS

2.4.1 Bridging

Provide bridging of material, size, and type required by SJI LOAD TABLES for type of joist, chord size, spacing and span. Furnish additional erection bridging if required for stability.

2.4.2 Bearing Plates

Fabricate steel bearing plats from ASTM A36/A36M steel of size and thickness indicated.

2.4.3 Ceiling Extensions

Furnish ceiling extensions, either bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise

indicated.

2.5 SHOP PAINTING

SSPC Paint 15. Shop prime joists, except as modified herein, in accordance with SSPC PA 1. Clean joists in accordance with SSPC SP 2 before priming. If flash rusting occurs, re-clean the surface prior to application of primer. For joists which require finish painting under Section 09 90 00 PAINTS AND COATINGS, the primer paint must be compatible with the finish paint.

PART 3 EXECUTION

3.1 ERECTION

Install joists in conformance with SJI LOAD TABLES for the joist series indicated, and the requirements of 29 CFR 1926 and 29 CFR 1926.757. Handle and set joists avoiding damage to the members. Place the "tag end" of joists as shown on the joists placement plans. Distribute temporary loads so that joist capacity is not exceeded. Remove damaged joists from the site, except when field repair is approved and such repairs are satisfactorily made in accordance with the manufacturer's recommendations. Do not repair, field modify, or alter any joists without specific written instructions from the Designer of Record and/or joist manufacturer.

Install and connect bridging concurrently with joist erection, before construction loads are applied. Do not apply loads to bridging. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams. Do not cut away vertical leg of bridging where bridging makes an elevation transition; weld a separate piece of bridging at the transition. Perform all welding in accordance with AWS D1.1/D1.1M.

3.2 BEARING PLATES

Provide bearing plates to accept full bearing after the supporting members have been plumbed and properly positioned, but prior to placing superimposed loads. The area under the plate must be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Provide bedding mortar and grout as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.3 PAINTING

3.3.1 Touch-Up Painting

After erection of joists, touch-up connections and areas of abraded shop coat with paint of the same type used for the shop coat.

3.4 VISUAL INSPECTIONS

Perform the following visual inspections:

- a. Verify that all joists are spaced properly.
- b. Verify that there is sufficient joist bearing on steel beams, and masonry.
- c. Verify all bridging lines are properly spaced and anchored.

- d. Verify that damage has not occurred to the joists during erection.
- e. Verify the joists are aligned vertically and there is no lateral sweep in the joists.
- f. Where concentrated loads are present on the joists verify that they are located in accordance with the joists placement plan.
- g. Verify welding of bridging and joist seats in accordance with AWS D1.1/D1.1M, Section 6. Perform erection inspection and field welding inspections with AWS certified welding inspectors.
- h. Verify proper bolting of diagonal bridging and joist seats where the bolts are snug-tight.

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STEEL DECKS
05/15

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI D100 (1991; R 2008) Cold-Formed Steel Design Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

AWS D1.3 (2018) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A36 (2014) Standard Specification for Carbon Structural Steel

ASTM A123 (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A653 (2018) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A780 (2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM A1008 (2016) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM D746 (2014) Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact

ASTM D1056 (2014) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber

ASTM D1149	(2007; R 2012) Standard Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials
SOCIETY FOR PROTECTIVE COATINGS (SSPC)	
SSPC Paint 20	(2002; E 2004) Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic)
STEEL DECK INSTITUTE (SDI)	
ANSI/SDI C	(2017) Standard for Composite Steel Floor Deck - Slabs
ANSI/SDI NC	(2017) Standard for Non-Composite Steel Floor Deck
ANSI/SDI QA/QC	(2017) Standard for Quality Control and Quality Assurance for Installation of Steel Deck
ANSI/SDI RD	(2017) Standard for Steel Roof Deck
SDI DDM04	(2015; Errata 1-3 2016; Add 1 2015; Add 2 20162006) Diaphragm Design Manual; 4th Edition
SDI DDP	(1987; R 2000) Deck Damage and Penetrations
SDI MOC3	(2016) Manual of Construction with Steel Deck (3rd Edition)

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

29 CFR 1926	Safety and Health Regulations for Construction
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings; G

SD-03 Product Data

Accessories

Deck Units

Galvanizing Repair Paint

Mechanical Fasteners

Touch-Up Paint

Welding Equipment

Welding Rods and Accessories

Recycled Content; S

SD-04 Samples

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SD-05 Design Data

Deck Units; G

SD-07 Certificates

Powder-Actuated Tool Operator

Welder Qualifications

Welding Procedures

Manufacturer's Certificate

Stud Manufacturer's Certification

Stud Manufacturer's Test Reports

1.3 QUALITY ASSURANCE

1.3.1 Deck Units

Furnish deck units and accessory products from a manufacturer regularly engaged in manufacture of steel decking. Provide manufacturer's certificates attesting that the decking material meets the specified requirements.

1.3.2 Certification of Powder-Actuated Tool Operator

Provide manufacturer's certificate attesting that the operators are authorized to use the low velocity powder-actuated tool.

1.3.3 Qualifications for Welding Work

Follow Welding Procedures of AWS D1.3 for sheet steel and AWS D1.1 for stud welding.

Submit qualified Welder Qualifications in accordance with AWS D1.3 for sheet steel and AWS D1.1 for stud welding, or under an equivalent approved qualification test. Perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails

to meet requirements, perform an immediate retest of two test welds until each test weld passes. Failure in the immediate retest will require the welder be retested after further practice or training, performing a complete set of test welds.

Submit manufacturer's catalog data for Welding Equipment and Welding Rods and Accessories.

1.3.4 Regulatory Requirements

1.3.5 Fabrication Drawings

Show type and location of units, location and sequence of connections, bearing on supports, methods of anchoring, attachment of accessories, adjusting plate details, cant strips, ridge and valley plates, metal closure strips, size and location of holes to be cut and reinforcement to be provided, the manufacturer's erection instructions and other pertinent details.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver deck units to the site in a dry and undamaged condition. Store and handle steel deck in a manner to protect it from corrosion, deformation, and other types of damage. Do not use decking for storage or as working platform until units have been fastened into position. Exercise care not to damage material or overload decking during construction. The maximum uniform distributed storage load must not exceed the design live load. Stack decking on platforms or pallets and cover with weathertight ventilated covering. Elevate one end during storage to provide drainage. Maintain deck finish at all times to prevent formation of rust. Repair deck finish using touch-up paint. Replace damaged material.

1.5 DESIGN REQUIREMENTS FOR ROOF DECKS

1.5.1 Properties of Sections

Properties of metal roof deck sections must comply with engineering design width as limited by the provisions of AISI D100.

1.5.2 Allowable Loads

Indicate total uniform dead and live load for detailing purposes.

PART 2 PRODUCTS

2.1 DECK UNITS

Submit manufacturer's design calculations, or applicable published literature for the structural properties of the proposed deck units.

Provide products with a totalrecycled content not less than 50 percent.

2.1.1 Roof Deck

Conform to ASTM A1008 for deck used in conjunction with insulation and built-up roofing. Fabricate roof deck units of the steel design thickness required by the design drawings and galvanized.

2.1.2 Composite Deck

Conform to ASTM A653 or ASTM A1008 for composite deck assembly. Fabricate deck used as the tension reinforcing in composite deck of the thickness indicated on the design drawings with integrally embossed or raised pattern ribs. Zinc-coat in conformance with ASTM A653, G60 coating class.

2.1.3 Length of Deck Units

Provide deck units of sufficient length to span three or more spacings where possible.

2.1.4 Touch-Up Paint

Provide a high zinc-dust content paint for regalvanizing welds in galvanized steel conforming to ASTM A780.

Provide touch-up paint for shop-painted units of the same type used for the shop painting, and touch-up paint for zinc-coated units of an approved galvanizing repair paint with a high-zinc dust content. Touch-up welds with paint conforming to SSPC Paint 20 in accordance with ASTM A780. Maintain finish of deck units and accessories by using touch-up paint whenever necessary to prevent the formation of rust.

2.2 ACCESSORIES

Provide accessories of same material as deck, unless specified otherwise. Provide manufacturer's standard type accessories, as specified.

2.2.1 Adjusting Plates

Provide adjusting plates, or segments of deck units, of same thickness and configuration as deck units in locations too narrow to accommodate full size units. Provide factory cut plates of predetermined size where possible.

2.2.2 End Closures

Fabricated of sheet metal by the deck manufacturer. Provide end closures minimum 0.0295 inch thick to close open ends at openings through deck.

2.2.3 Flexible Closure Strips for Roof Decks

Provide strips made of vulcanized, closed-cell, synthetic rubber material specified and premolded to the configuration required to provide tight-fitting closures at open ends and sides of steel roof decking.

Conforming to ASTM D1056, Grade 2A1, with the following additional properties:

Brittleness temperature of minus 40 degrees F when tested in accordance with ASTM D746.

Flammability resistance with a flame spread rating of less than 25 when tested in accordance with ASTM E84.

Resistance to ozone must be "no cracks" after exposure of a sample kept under a surface tensile strain of 25 percent to an ozone concentration of 100 parts per million of air by volume in air for 100

hours at 104 degrees F and tested in accordance with ASTM D1149.

Provide a elastomeric type adhesive as recommended by the manufacturer of the flexible closure strips.

2.2.4 Closure Plates for Composite Deck

Support and retain concrete at each floor level. Provide edge closures at all edges of the slab of sufficient strength and stiffness to support the wet concrete. Provide metal closures for all openings in composite steel deck 1/4 inch and over.

2.2.5 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.

Fabricate cover plates for abutting floor deck units from the specified structural-quality steel sheets not less than nominal 18 gage thick before galvanizing. Provide 6 inch wide cover plates and form to match the contour of the floor deck units.

2.2.6 Roof Sump Pans

Sump pans must be provided for roof drains and must be minimum 0.075 inch thick steel, flat type. Shape sump pans to meet roof slope by the supplier or by a sheet metal specialist. Provide bearing flanges of sump pans to overlap steel deck a minimum of 3 inch. Shape, size, and reinforce the opening in bottom of the sump pan to receive roof drain.

2.2.7 Column Closures

Sheet metal, minimum 0.0358 inch thick or metal rib lath.

2.2.8 Access Hole Covers

Sheet metal, minimum 0.0474 inch thick.

2.2.9 Hanger

Provide clips or loops for utility systems and suspended ceilings of one or more of the following types:

- a. Lip tabs or integral tabs where noncellular decking or flat plate of cellular section is 0.0474 inch thick or more, and a structural concrete fill is used over deck.
- b. Slots or holes punched in decking for installation of pigtails.
- c. Tabs driven from top side of decking and arranged so as not to pierce electrical cells.
- d. Decking manufacturer's standard as approved by the Contracting Officer.

2.2.10 Shear Connectors

Provide shear connectors in accordance with AWS D1.1 headed stud Type B.

Submit stud manufacturer's certification that the studs delivered conform to the material requirements. Submit stud manufacturer's test reports for the last completed in-plant quality control mechanical tests.

2.2.11 Cant Strips for Roof Decks

Fabricate cant strips from the specified commercial-quality steel sheets not less than nominal 0.0358 inch thick before galvanizing. Bend strips to form a 45-degree cant not less than 5 inch wide, with top and bottom flanges a minimum 3 inch wide. Length of strips 10 feet.

2.2.12 Ridge and Valley Plates for Roof Decks

Fabricate plates from the specified structural-quality steel sheets, not less than nominal 0.0358 inch thick 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.

2.2.13 Metal Closure Strips for Roof Decks

Fabricate strips from the specified commercial-quality steel sheets not less than nominal 0.0358 inch thick before galvanizing. Provide strips from the configuration required to provide tight-fitting closures at open ends and sides of steel roof decking.

2.2.14 Galvanized Steel Angles for Roof Decks

Provide hot-rolled carbon steel angles conforming to ASTM A36, and hot-dip galvanized in accordance with ASTM A123.

2.2.15 Mechanical Fasteners

Provide mechanical fasteners, such as powder actuated fasteners, pneumatically driven fasteners or self-drilling screws, for anchoring the deck to structural supports and adjoining units as indicated.

2.2.16 Miscellaneous Accessories

Furnish the manufacturer's standard accessories to complete the deck installation. Furnish metal accessories of the same material as the deck and with the minimum design thickness as follows: saddles, 0.0474 inch welding washers, 0.0598 inch other metal accessories, 0.0358 inch unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

Prior to installation of decking units and accessories, examine worksite to verify that as-built structure will permit installation of decking system without modification.

3.2 INSTALLATION

Install steel deck units in accordance with 29 CFR 1926, Subpart R - Steel Erection, ANSI/SDI QA/QC, SDI DDM04 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. Butted deck ends. Do not use unanchored deck units as a work or storage platform. Do not fill unanchored deck with concrete. Permanently anchor units placed by the end of each working day. Do not support suspended ceilings, light fixtures, ducts, utilities, or other loads by steel deck unless indicated. Distribute loads by appropriate means to prevent damage.

3.2.1 Attachment

Immediately after placement and alignment, and after correcting inaccuracies, permanently fasten steel deck units to structural supports and to adjacent deck units by welding with normal 5/8 inch diameter puddle welds, fastened with screws, powder-actuated fasteners, or pneumatically driven fasteners as indicated on the design drawings and in accordance with manufacturer's recommended procedure and ANSI/SDI C, ANSI/SDI NC or ANSI/SDI RD. Clamp or weight deck units to provide firm contact between deck units and structural supports while performing welding or fastening. Attachment of adjacent deck units by button-punching is prohibited.

3.2.1.1 Welding

Perform welding in accordance with AWS D1.3 using methods and electrodes recommended by the manufacturers of the base metal alloys being used. Ensure only operators previously qualified by tests prescribed in AWS D1.3 make welds. Immediately recertify, or replace qualified welders, that are producing unsatisfactory welding. Refer to the design drawings for location, size, and spacing of fastening. Do not use welding washers at the connections of the deck to supports. Do not use welding washers at sidelaps. Holes and similar defects will not be acceptable. Attach all partial or segments of deck units to structural supports in accordance with Section 2.5 of SDI DDM04. Attach shear connectors as shown and welded as per AWS D1.1 through the steel deck to the steel member. Immediately clean welds by chipping and wire brushing. Heavily coat welds, cut edges and damaged portions of coated finish with zinc-dust paint conforming to ASTM A780.

3.2.1.2 Mechanical Fastening

Anchor deck to structural supports and adjoining units with mechanical fasteners. Drive the powder-actuated fasteners with a low-velocity piston tool by an operator authorized by the manufacturer of the powder-actuated tool.

3.2.1.3 Sidelap Fastening

Lock sidelaps between adjacent floor deck units together by screws as indicated.

3.2.2 Openings

Cut or drill all holes and openings required and be coordinated with the drawings, specifications, and other trades. Frame and reinforce openings through the deck in conformance with SDI DDP. Reinforce holes and openings as indicated on the design drawings. Openings must not interfere with seismic members such as chords and drag struts.

3.2.3 Deck Damage

SDI MOC3, for repair of deck damage.

3.2.4 Touch-Up Paint

3.2.4.1 Roof Deck

After roof decking installation, wire brush, clean, and touchup paint the scarred areas on top and bottom surfaces of metal roof decking. The scarred areas include welds, weld scars, bruises, and rust spots. Touchup galvanized surfaces with galvanizing repair paint. Touchup painted surfaces with repair paint of painted surfaces.

3.2.4.2 Floor Deck

For floor decking installation, wire brush, clean, and touchup paint the scarred areas on the top and bottom surfaces of the metal floor decking and on the surface of supporting steel members. Include welds, weld scars, bruises, and rust spots for scarred areas. Touched up the galvanized surfaces with galvanizing repair paint. Touch up the painted surfaces with paint for the repair of painted surfaces.

3.2.5 Accessory Installation

3.2.5.1 Adjusting Plates

Provide in locations too narrow to accommodate full-size deck units and install as shown on shop drawings.

3.2.5.2 End Closures

Provide end closure to close open ends of cells at columns, walls, and openings in deck.

3.2.5.3 Closures Above Partitions

Provide for closing voids between cells over partitions that are perpendicular to direction of cells. Provide a one-piece closure strip for partitions 4 inch nominal or less in thickness and two-piece closure strips for wider partitions. Provide sheet metal closures above fire-rated partitions at both sides of partition with space between filled with fiberglass insulation. Provide flexible rubber closures above acoustic-rated partitions at both sides of partition with space between filled with blanket insulation.

3.2.5.4 Cover Plates

Where concrete leakage would be a problem, provide metal cover plates, or joint tape, at joints between decking sheets, cellular or noncellular, to be covered with concrete fill.

3.2.5.5 Column Closures

Provide for spaces between floor decking and columns which penetrate the deck. Field cut closure plate to fit column in the field and tack weld to decking and columns.

3.2.5.6 Access Hole Covers

Provide access whole covers to seal holes cut in decking to facilitate welding of the deck to structural supports.

3.2.5.7 Hangers

Provide as indicated to support suspended ceilings. Space devices as indicated.

3.2.6 Concrete Work

Prior to placement of concrete, inspect installed decking to ensure that there has been no permanent deflection or other damage to decking. Replace decking which has been damaged or permanently deflected as approved by the Contracting Officer. Place concrete on metal deck in accordance with Construction Practice of ANSI/SDI C or ANSI/SDI NC.

3.2.7 Preparation of Fire-Proofed Surfaces

Provide deck surfaces, both composite and noncomposite, which are to receive sprayed-on fireproofing, galvanized and free of all grease, mill oil, paraffin, dirt, salt, and other contaminants which impair adhesion of the fireproofing. Complete any required cleaning prior to steel deck installation using a cleaning method that is compatible with the sprayed-on fireproofing.

3.3 ROOF SUMP PANS

Place sump pans over openings in roof decking and fusion welded to top surface of roof decking. Do not exceed spacing of welds of 12 inch with not less than one weld at each corner. Field cut opening in the bottom of each roof sump pan to receive the roof drain as part of the work of this section.

3.4 CANT STRIPS FOR ROOF DECKS

Provide strips to be fusion welded to surface of roof decking, secured to wood nailers by galvanized screws or to steel framing by galvanized self-tapping screws or welds. Do not exceed spacing of welds and fasteners of 12 inch. Lap end joints a minimum 3 inch and secure with galvanized sheet metal screws spaced a maximum 4 inch on center.

3.5 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.

3.6 CLOSURE STRIPS FOR ROOF DECKS

Provide closure strips at open, uncovered ends and edges of the roof decking and in voids between roof decking and top of walls and partitions where indicated. Install closure strips in position in a manner to provide a weathertight installation.

3.7 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.

3.8 CLEANING AND PROTECTION FOR ROOF DECKS

Upon completion of the deck, sweep surfaces clean and prepare for installation of the roofing.

3.9 FIELD QUALITY CONTROL

3.9.1 Headed Stud Inspection

In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

- a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
- b. Conduct tests according to requirements in AWS D1.1 on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.9.2 Deck Weld Inspection

Visual inspect welds in accordance with AWS D1.3.

3.9.3 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 should not exceed manufacturing and construction tolerances of supporting members. When gap is more than the allowable, provide corrective measures or replacement. Reinspect decking after performing corrective measures or replacement.

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SECTION 05 40 00

COLD-FORMED METAL FRAMING

05/15

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SECTION 05 40 00

COLD-FORMED METAL FRAMING
05/15

PART 1 GENERAL

1.1 REFERENCES

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AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 318 (2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI S100 (2012) North American Specification for the Design of Cold-Formed Steel Structural Members

AISI S110 (2007; Suppl 1; Reaffirmed 2012) Standard for Seismic Design of Cold-Formed Steel Structural Systems - Special Bolted Moment Frames

AISI S200 (2007) North American Standard for Cold-Formed Steel Framing - General Provision

AISI S201 (2007) North American Standard for Cold-Formed Steel Framing - Product Data

AISI S202 (2011) Code of Standard Practice for Cold-formed Steel Structural Framing

AISI S211 (2007) North American Standard for Cold-Formed Steel Framing - Wall Stud Design

AISI S212 (2007) North American Standard for Cold-Formed Steel Framing - Header Design

AISI S213 (2007; Suppl 1 2009) North American Standard for Cold-Formed Steel Framing - Lateral Design

AISI S214 (2012) North American Standard for Cold-Formed Steel Framing - Truss Design

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016)
Structural Welding Code - Steel

AWS D1.3/D1.3M (2018) Structural Welding Code - Sheet
Steel

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2017) Standard Specification for Zinc
(Hot-Dip Galvanized) Coatings on Iron and
Steel Products

ASTM A153/A153M (2016) Standard Specification for Zinc
Coating (Hot-Dip) on Iron and Steel
Hardware

ASTM A307 (2014; E 2017) Standard Specification for
Carbon Steel Bolts, Studs, and Threaded
Rod 60 000 PSI Tensile Strength

ASTM A370 (2018) Standard Test Methods and
Definitions for Mechanical Testing of
Steel Products

ASTM A653/A653M (2018) Standard Specification for Steel
Sheet, Zinc-Coated (Galvanized) or
Zinc-Iron Alloy-Coated (Galvannealed) by
the Hot-Dip Process

ASTM A1003/A1003M (2015) Standard Specification for Steel
Sheet, Carbon, Metallic- and
Nonmetallic-Coated for Cold-Formed Framing
Members

ASTM C955 (2017) Standard Specification for
Cold-Formed Steel Structural Framing
Members

ASTM C1007 (2011a) Standard Specification for
Installation of Load Bearing (Transverse
and Axial) Steel Studs and Related
Accessories

ASTM C1513 (2013) Standard Specification for Steel
Tapping Screws for Cold-Formed Steel
Framing Connections

ASTM E119 (2018c; E 2018) Standard Test Methods for
Fire Tests of Building Construction and
Materials

ASTM E329 (2018) Standard Specification for Agencies
Engaged in Construction Inspection,
Testing, or Special Inspection

ASTM E488/E488M (2015) Standard Test Methods for Strength
of Anchors in Concrete and Masonry Elements

ASTM F1554	(2018) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F1941	(2010) Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))
ASTM F2329/F2329M	(2015) Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
INTERNATIONAL CODE COUNCIL (ICC)	
ICC IBC	(2015) International Building Code
U.S. DEPARTMENT OF DEFENSE (DOD)	
UFC 3-301-01	(2013; with Change 4, 2018) Structural Engineering

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29, SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Exterior metal framing; G

Roof trusses; G

SD-03 Product Data

Steel Studs, Joists, Tracks, Bracing, Bridging and Accessories

SD-05 Design Data

Metal Framing Calculations; G

SD-07 Certificates

Load-Bearing Cold-Formed Metal Framing

Welds

1.3 DELIVERY, STORAGE, AND HANDLING

Steel framing and related accessories shall be stored and handled in accordance with the AISI S202, "Code of Standard Practice for Cold-Formed

Steel Structural Framing".

1.4 LOAD-BEARING COLD-FORMED METAL FRAMING

Include top and bottom tracks, bracing, fastenings, and other accessories necessary for complete installation. Framing members shall have the structural properties indicated. Where physical structural properties are not indicated, they shall be as necessary to withstand all imposed loads. Design framing in accordance with AISI S100. Non-load-bearing metal framing, furring, and ceiling suspension systems are specified in Section 09 22 00 SUPPORTS FOR PLASTER AND GYPSUM BOARD. Metal suspension systems for acoustical ceilings are specified in Section 09 51 00 ACOUSTICAL CEILINGS.

Submit mill certificates or test reports from independent testing agency, qualified in accordance with ASTM E329, showing that the steel sheet used in the manufacture of each cold-formed component complies with the minimum yield strengths and uncoated steel thickness specified. Test reports shall be based on the results of three coupon tests in accordance with ASTM A370.

1.5 MAXIMUM DEFLECTION

Deflections of structural members shall not exceed the more restrictive of the limitations of ICC IBC and UFC 3-301-01.

1.6 QUALITY ASSURANCE

- a. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a registered professional engineer.
- b. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E329 for testing indicated.
- c. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- d. Welding Qualifications: Qualify procedures and personnel according to the following:
 - (1) AWS D1.1/D1.1M, "Structural Welding Code - Steel".
 - (2) AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel".
- e. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E119 by, and displaying a classification label from, a testing and inspecting agency acceptable to authorities having jurisdiction.
- f. AISI Specifications and Standards: Comply with:
 - (1) AISI S100, "North American Specification for the Design of Cold-Formed Steel Structural Members".

- (2) AISI S110, "Standard for Seismic Design of Cold-Formed Steel Structural Systems - Special Bolted Moment Frames".
- (3) AISI S200, "North American Standard for Cold-Formed Steel Framing - General Provision".
- (4) AISI S201, "North American Standard for Cold-Formed Steel Framing - Product Data".
- (5) AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing".
- (6) AISI S211, "North American Standard for Cold-Formed Steel Framing - Wall Stud Design".
- (7) AISI S212, "North American Standard for Cold-Formed Steel Framing - Header Design".
- (8) AISI S213, "North American Standard for Cold-Formed Steel Framing - Lateral Design".
- (9) AISI S214, "North American Standard for Cold-Formed Steel Framing - Truss Design".

1.6.1 Drawing Requirements

Submit exterior metal framing and roof trusses to show sizes, thicknesses, layout, material designations, methods of installation, and accessories including the following:

- a. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.
- b. Connection details showing fastener type, quantity, location, and other information to assure proper installation.
- c. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

Sign and seal fabrication drawings by a registered professional engineer.

1.6.2 Design Data Required

Submit metal framing calculations with design criteria and structural loading to verify sizes, thickness, and spacing of members and connections signed and sealed by a registered professional engineer. Show methods and practices used in installation.

PART 2 PRODUCTS

2.1 STEEL STUDS, JOISTS, TRACKS, BRACING, BRIDGING AND ACCESSORIES

Framing components shall comply with ASTM C955 and the following.

- a. Provide products with minimum 30 percent total recycled content.

- b. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - (1) Grade: As required by structural performance.
 - (2) Coating: G60 (Z180), A60 (ZF180), AZ50 (AZ150), or GF30 (ZGF90).
- c. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - (1) Minimum Base-Metal Thickness: 0.0329 inch.
 - (2) Flange Width: As required by structural performance and architectural design.
- d. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 - (1) Minimum Base-Metal Thickness: 0.0329 inch.
 - (2) Flange Width: As required by structural performance and architectural design.
- e. Roof Truss Members: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - (1) Minimum Base-Metal Thickness: 0.0428 inch.
 - (2) Flange Width: As required by structural performance and architectural design.

2.1.1 Studs and Joists of 54 mils (0.054 Inch) and Heavier

Galvanized steel, ASTM A653/A653M and ASTM A1003/A1003M, SS Grade 50, G60.

2.1.2 Studs and Joists of 43 mils (0.043 Inch) and Lighter

Studs and Joists of 43 mils (0.043 Inch) and Lighter, Track, and Accessories (All thicknesses): Galvanized steel, ASTM A653/A653M and ASTM A1003/A1003M, SS, Grade 33 33,000 psi G60.

2.1.3 Sizes, Thickness, Section Modulus, and Other Structural Properties

Size and thickness as required unless noted otherwise.

2.2 MARKINGS

Studs and track shall have product markings stamped on the web of the section. The markings shall be repeated throughout the length of the member at a maximum spacing of 4 feet on center and shall be legible and easily read. The product marking shall include the following:

- a. An ICC number.
- b. Manufacturer's identification.
- c. Minimum delivered uncoated steel thickness.

- d. Protective coating designator.
- e. Minimum yield strength.

2.3 CONNECTIONS

2.3.1 Steel-To-Concrete Connections

- a. Anchor Rods: ASTM F1554, Grade 36; galvanized per ASTM A153/A153M.
- b. Post-Installed Concrete Anchors: Adhesive or expansion anchors fabricated from corrosion-resistant materials with allowable load capacities in accordance with ICC-ES AC193 and ACI 318 greater than or equal to the design load as determined by testing per ASTM E488/E488M conducted by a qualified testing agency.
- c. Power-Actuated Fasteners: Fabricated from corrosion-resistant materials with allowable load capacities in accordance with ICC-ES AC 70 greater than or equal to the design load as determined by testing per ASTM E1190 conducted by a qualified testing agency.

2.3.2 Steel-To-Steel Connections

- a. Screws: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping steel screws of the type and size indicated. Provide low-profile head beneath sheathing and manufacturer's standard elsewhere. Electroplated to a minimum of 5 micron zinc coating per ASTM F1941 or hot-dipped galvanized per ASTM A123/A123M or ASTM A153/A153M.
- b. Bolts: ASTM A307 coated by hot-dip process per ASTM F2329/F2329M or zinc-coated by mechanical-deposition process per ASTM B695, Class 55.
- c. Welding Electrodes: Comply with AWS standards.

2.4 PLASTIC GROMMETS

Supply plastic grommets for stud webs as recommended by stud manufacturer, to protect electrical wires and plumbing piping. Prevent metal-to-metal contact between wiring/piping and studs.

2.5 SEALER GASKET

Closed-cell neoprene foam, 1/4-inch thick, selected from manufacturer's standard widths to match width of bottom track on concrete slab or foundation.

PART 3 EXECUTION

3.1 TRUSS FABRICATION

- a. Fabricate cold-formed steel trusses and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
- b. Truss must be fabricated either on site or off site prior to erection.
- c. Fabricate trusses using jigs or templates.

- d. Splices can only occur at joints.
- e. Cut truss members by sawing or shearing: do not torch cut.
- f. Fasten cold-formed steel truss members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator.
- g. Fasten other materials to cold-formed steel trusses by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- h. Reinforce, stiffen, and brace trusses to withstand handling, delivery, and erection stresses. Lift fabricated trusses to prevent damage or permanent distortion.

3.2 FASTENING

Fasten framing members together by welding or by using self-drilling, self-tapping screws. Electrodes and screw connections shall be as required and indicated in the design calculations.

3.2.1 Welds

All welding shall be performed in accordance with AWS D1.3/D1.3M, as modified by AISI S100. All welders, welding operations, and welding procedures shall be qualified according to AWS D1.3/D1.3M. Submit certified copies of welder qualifications test records showing qualification in accordance with AWS D1.3/D1.3M. All welds shall be cleaned and coated with rust inhibitive galvanizing paint. Do not field weld materials lighter than 43 mils.

3.2.2 Screws

Screws shall be of the self-drilling self-tapping type, size, and location as required unless noted otherwise. Screw penetration through joined materials shall not be less than three exposed threads. Minimum spacings and edge distances for screws shall be as specified in AISI S100. Screws covered by sheathing materials shall have low profile heads.

3.2.3 Anchors

Anchors shall be of the type, size, and location as required unless noted otherwise.

3.2.4 Powder-Actuated Fasteners

Powder-actuated fasteners shall be of the type, size, and location as required unless noted otherwise.

3.3 INSTALLATION

Install cold-formed framing in accordance with ASTM C1007 and AISI S200.

Install cold-formed steel framing according to AISI S202 and to manufacturer's written instructions unless more stringent requirements are indicated.

3.3.1 Tracks

Provide accurately aligned runners at top and bottom of studs. Install sealer gasket under bottom of track on concrete slab or foundation. Anchor tracks as indicated in design calculations. Butt weld joints in tracks or splice with stud inserts. Fasteners shall be at least 3 inches from the edge of concrete slabs.

3.3.2 Studs

Cut studs square and set with firm bearing against webs of top and bottom tracks. Position studs vertically in tracks and space as indicated in design. Do not splice studs. Provide at least two studs at jambs of doors and other openings 2 feet wide or larger. Provide jack studs over openings, as necessary, to maintain indicated stud spacing. Provide tripled studs at corners, positioned to receive interior and exterior finishes. Fasten studs to top and bottom tracks by welding or screwing both flanges to the tracks. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all openings that are larger than the stud spacing in a wall. In curtain wall construction, provide for vertical movement where studs connect to the structural frame. Provide horizontal bracing in accordance with the design calculations and AISI S100. Bracing shall be not less than the following:

<u>LOAD</u>	<u>HEIGHT</u>	<u>BRACING</u>
Wind load only	Up to 10 feet	One row at mid-height
	Over 10 feet	Rows 5'-0" o.c. maximum
Axial load	Up to 10 feet	Two rows at 1/3 points
	Over 10 feet	Rows 3'-4" o.c. maximum

3.3.3 Joists and Trusses

- a. Provide a stud directly under each joist or truss. The maximum spacing of studs as indicated shall be maintained.
- b. Install, bridge, and brace cold-formed steel trusses according to AISI S200, AISI S214, AISI's "Code of Standard Practice for Cold-Formed Steel Structural Framing," and manufacturer's written instructions unless more stringent requirements are indicated.
- c. Install temporary bracing and supports. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- d. Do not alter, cut, or remove framing members or connections of trusses.

3.3.4 Erection Tolerances

- a. Framing members which will be covered by finishes such as wallboard,

plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:

- (1) Layout of walls and partitions: 1/4 inch from intended position;
- (2) Plates and runners: 1/4 inch in 8 feet from a straight line;
- (3) Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and
- (4) Face of framing members: 1/4 inch in 8 feet from a true plane.

b. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive shall be within the following limits:

- (1) Layout of walls and partitions: 1/4 inch from intended position;
- (2) Plates and runners: 1/8 inch in 8 feet from a straight line;
- (3) Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and
- (4) Face of framing members: 1/8 inch in 8 feet from a true plane.

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SECTION 05 50 13

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SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS
05/17

PART 1 GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System
for Aluminum Finishes

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303 (2010) Code of Standard Practice for Steel
Buildings and Bridges

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSE/SAFE A10.3 (2013) Operations - Safety Requirements
for Powder Actuated Fastening Systems

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016)
Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts
and Screws (Inch Series)

ASME B18.2.2 (2015) Nuts for General Applications:
Machine Screw Nuts, Hex, Square, Hex
Flange, and Coupling Nuts (Inch Series)

ASME B18.21.1 (2009; R 2016) Washers: Helical
Spring-Lock, Tooth Lock, and Plain Washers
(Inch Series)

ASME B18.21.2M (1999; R 2014) Lock Washers (Metric Series)

ASME B18.22M (1981; R 2017) Metric Plain Washers

ASME B18.6.2 (1998; R 2010) Slotted Head Cap Screws,
Square Head Set Screws, and Slotted
Headless Set Screws: Inch Series

ASME B18.6.3 (2013; R 2017) Machine Screws, Tapping
Screws, and Machine Drive Screws (Inch
Series)

ASTM INTERNATIONAL (ASTM)

ASTM A108	(2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A29/A29M	(2016) Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought
ASTM A307	(2014; E 2017) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel
ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A500/A500M	(2018) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A53/A53M	(2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A653/A653M	(2018) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A924/A924M	(2018) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B108/B108M	(2015) Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B209M	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

ASTM B221	(2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B221M	(2013) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B26/B26M	(2014; E 2015) Standard Specification for Aluminum-Alloy Sand Castings
ASTM C1513	(2013) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
ASTM D1187/D1187M	(1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM E488/E488M	(2015) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
ASTM F1554	(2018) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

MASTER PAINTERS INSTITUTE (MPI)

MPI 79	(2012) Primer, Alkyd, Anti-Corrosive for Metal
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SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3	(1982; E 2004) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Expansion Joint Covers, Installation Drawings; G

Bollards/Pipe Guards; G

Embedded Angles and Plates, Installation Drawings; G

SD-03 Product Data

Recycled Content of Steel Products; S

SD-04 Samples

Expansion Joint Covers

SD-07 Certificates

Certificates of Compliance; G

1.3 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

1.5 MISCELLANEOUS REQUIREMENTS

1.5.1 Fabrication Drawings

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in AISC 303.

1.5.2 Installation Drawings

Submit templates, erection, and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation in relation to the building construction.

PART 2 PRODUCTS

2.1 RECYCLED CONTENT OF STEEL PRODUCTS

Provide products with recycled content and provide certificates of compliance in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

2.2 MATERIALS

Provide exposed fastenings of compatible materials (avoid contact of dissimilar metals). Coordinate color and finish with the material to which fastenings are applied.

2.2.1 Structural Carbon Steel

Provide in accordance with ASTM A36/A36M.

2.2.2 Structural Tubing

Provide in accordance with ASTM A500/A500M.

2.2.3 Steel Pipe

Provide in accordance with ASTM A53/A53M, Type E or S, Grade B.

2.2.4 Fittings for Steel Pipe

Provide standard malleable iron fittings in accordance with ASTM A47/A47M.

2.2.5 Anchor Bolts

Provide in accordance with ASTM F1554. Where exposed, provide anchor bolts of the same material, color, and finish as the metal to which they are applied.

2.2.5.1 Expansion Anchors and Adhesive Anchors

Provide diameter minimum embedment as required. Design values listed are as tested in accordance with ASTM E488/E488M.

2.2.5.2 Lag Screws and Bolts

Provide in accordance with ASME B18.2.1, type and grade best suited for the purpose.

2.2.5.3 Toggle Bolts

Provide in accordance with ASME B18.2.1.

2.2.5.4 Bolts, Nuts, Studs and Rivets

Provide in accordance with ASME B18.2.2 or ASTM A307.

2.2.5.5 Powder Actuated Fasteners

Follow safety provisions in accordance with ASSE/SAFE A10.3.

2.2.5.6 Screws

Provide in accordance with ASME B18.2.1, ASME B18.6.2, ASME B18.6.3 and ASTM C1513.

2.2.5.7 Washers

Provide plain washers in accordance with ASME B18.22M, ASME B18.21.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers in accordance with ASME B18.21.2M, ASME B18.21.1.

2.2.5.8 Welded Headed Shear Studs

Provide in accordance with ASTM A108 or ASTM A29/A29M-12.

2.2.6 Aluminum Alloy Products

Provide in accordance with ASTM B209M, ASTM B209 for sheet plate, ASTM B221M, ASTM B221M, ASTM B221 for extrusions and ASTM B26/B26M or ASTM B108/B108M for castings. Provide aluminum extrusions at least 1/8 inch thick and aluminum plate or sheet at least 0.050 inch thick.

2.3 FABRICATION FINISHES

2.3.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Provide galvanizing in accordance with ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, Z275 G90.

2.3.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.3.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint in accordance with 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, with a torch, surfaces to which stick or paste material will be applied. Heat to a temperature sufficient to melt the metals in the stick or paste. Spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.3.4 Shop Cleaning and Painting

2.3.4.1 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 must be free of dirt and grease prior to embed. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints. Shop coat these surfaces with rust prevention.

2.3.4.2 Pretreatment, Priming and Painting

Apply pre-treatment, 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.

2.3.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.3.6 Aluminum Surfaces

2.3.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2.3.6.2 Aluminum Finishes

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA DAF45. Unless otherwise specified, provide all other aluminum items with a anodized finish. Provide a coating thickness not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations. Provide in accordance with AA DAF45. Provide a polished satin finish on items to be anodized.

2.4 EXPANSION JOINT COVERS

Provide expansion joint covers constructed of extruded aluminum with anodized satin aluminum finish for walls and ceilings and standard mill finish for floor covers and exterior covers. Furnish plates, backup angles, expansion filler strips and anchors as indicated. Provide a fire-rating for expansion joints as indicated on drawings.

2.5 BOLLARDS/PIPE GUARDS

Provide galvanized prime coated extra strong weight steel pipe in accordance with ASTM A53/A53M. Provide size as indicated on the drawings. Anchor posts in concrete and fill solidly with concrete with minimum compressive strength of 2500 psi.

2.6 MISCELLANEOUS PLATES AND SHAPES

Provide items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings and frames. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as indicated and as required to support wall loads over openings. Provide with connections and fasteners. Construct to have at least 8 in bearing on masonry at each end.

Provide angles and plates in accordance with ASTM A36/A36M, for embedment as indicated. Galvanize embedded items exposed to the elements in accordance with ASTM A123/A123M.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated in accordance with manufacturer's instructions. Verify all field dimensions prior to fabrication. Include materials and parts necessary to complete each assembly, whether indicated or not. Miss-alignment and miss-sizing of holes for fasteners is cause for rejection. Conceal fastenings where practicable. Joints exposed to weather must be watertight.

3.2 WORKMANSHIP

Provide miscellaneous metalwork that is true and accurate in shape, size, and profile. Make angles and lines continuous and straight. Make curves consistent, smooth and unfaceted. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections. Unless otherwise indicated and approved, provide a smooth finish on exposed surfaces. Provide countersunk rivets

where exposed. Provide coped and mitered corner joints aligned flush and without gaps.

3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage as necessary, whether indicated or not, for fastening miscellaneous metal items securely in place. Include slotted inserts, expansion shields, powder-driven fasteners, toggle bolts (when approved for concrete), through bolts for masonry, headed shear studs, machine and carriage bolts for steel, through bolts, lag bolts, and screws for wood. Do not use wood plugs. Provide non-ferrous attachments for non-ferrous metal. Provide exposed fastenings of compatible materials (avoid contact of dissimilar metals), that generally match in color and finish the surfaces to which they are applied. Conceal fastenings where practicable. Provide all fasteners flush with the surfaces they fasten, unless indicated otherwise.

3.4 BUILT-IN WORK

Where necessary and not otherwise indicated, form built-in metal work for anchorage with concrete or masonry. Provide built-in 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. Provide welded headed shear studs in accordance with AWS D1.1/D1.1M, Clause 7, except as otherwise specified. Provide in accordance with the safety requirements of EM 385-1-1.

3.6 DISSIMILAR METALS

Where dissimilar metals are in contact, protect surfaces with a coating in accordance with 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 in accordance with ASTM D1187/D1187M, asphalt-base emulsion. Clean surfaces with metal shavings from installation at the end of each work day.

3.7 PREPARATION

3.8 INSTALLATION OF BOLLARDS/PIPE GUARDS

Set bollards/pipe guards vertically in concrete piers. Fill hollow cores with concrete having a compressive strength of 3000 psi.

3.9 INSTALLATION MISCELLANEOUS PLATES AND SHAPES

Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as indicated and as required to support wall loads over openings. Provide with connections and fasteners. Construct to have at least 8 inches bearing on masonry at each end.

-- End of Section --

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SECTION 05 51 00

METAL STAIRS

02/17

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 - 2.2.2.1 General
 - 2.2.2.2 Stair Framing
 - 2.2.2.3 Riser, Subtread, and Subplatform Metal Pans
 - 2.2.3 Protective Coating
- 2.3 COMPONENTS
 - 2.3.1 Masonry Anchorage Devices
- 2.4 MATERIALS
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PART 3 EXECUTION

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SECTION 05 51 00

METAL STAIRS
02/17

PART 1 GENERAL

Section 05 05 23.16 STRUCTURAL WELDING applies to work specified in this section.

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 314 (1990; R 2013) Standard Specification for
Steel Anchor Bolts

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISC/AISI 121 (2004) Standard Definitions for Use in the
Design of Steel Structures

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016)
Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2014) Standard Specification for Carbon
Structural Steel

ASTM A53/A53M (2018) Standard Specification for Pipe,
Steel, Black and Hot-Dipped, Zinc-Coated,
Welded and Seamless

ASTM A283/A283M (2013) Standard Specification for Low and
Intermediate Tensile Strength Carbon Steel
Plates

ASTM A325 (2014) Standard Specification for
Structural Bolts, Steel, Heat Treated,
120/105 ksi Minimum Tensile Strength

ASTM A449 (2014) Standard Specification for Hex Cap
Screws, Bolts, and Studs, Steel, Heat
Treated, 120/105/90 ksi Minimum Tensile
Strength, General Use

ASTM A500/A500M (2018) Standard Specification for
Cold-Formed Welded and Seamless Carbon
Steel Structural Tubing in Rounds and

Shapes

ASTM A1011/A1011M	(2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM C514	(2004; R 2014) Standard Specification for Nails for the Application of Gypsum Board
ASTM C636/C636M	(2013) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM E488/E488M	(2015) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Steel Shapes, Plates, Bars, and Strips; G
Metal Stair System; G

SD-03 Product Data

Structural-Steel Plates, Shapes, and Bars; G
Structural-Steel Tubing; G
Masonry Anchorage Devices; G
Protective Coating; G
Steel Pan Stairs; G
Recycled Content of Steel Products; S

SD-08 Manufacturer's Instructions

Structural-Steel Plates, Shapes, and Bars; G
Structural-Steel Tubing; G
Protective Coating; G
Masonry Anchorage Devices; G

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Submit complete and detailed fabrication drawings for all iron and steel hardware, and for all steel shapes, plates, bars, and strips used in accordance with the design specifications referenced in this section.

2.2 FABRICATION

Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, before cleaning and treating surfaces and applying surface finishes, including zinc coatings.

2.2.1 General Fabrication

Prepare and submit metal stair system shop drawings with detailed plans and elevations at scales not less than 1 inch to 1 foot and with details of sections and connections at scales not less than 3 inches to 1 foot. Also detail the placement drawings, diagrams, and templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchorage devices.

Use materials of size and thicknesses indicated or, if not indicated, of the size and thickness necessary to produce a finished product that is strong enough and durable enough for its intended use. Work the materials to the dimensions indicated on approved detail drawings, using proven methods of fabrication and support. Use the type of materials indicated or specified for the various components of work.

Form exposed work true to line and level, with accurate angles and surfaces and with straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch, and bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Continuously weld corners and seams in accordance with the recommendations of AWS D1.1/D1.1M. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use Phillips flat-head (countersunk) screws or bolts.

Provide and coordinate anchorage of the type indicated for the supporting structure. Fabricate anchoring devices, and space them as indicated and as necessary to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified as fabricated from cold-finished or cold-rolled stock.

2.2.2 Steel Pan Stairs

2.2.2.1 General

Joining pieces by welding. Fabricate units so that bolts and other fastenings do not appear on finished surfaces. Make joints true and tight, and connections between parts lighttight. Grind continuous welds smooth where exposed.

Construct metal stair units to sizes and arrangements indicated to support a minimum live load of 100 pounds per square foot. Provide framing, hangers, columns, struts, clips, brackets, bearing plates, and other components as required for the support of stairs and platforms.

2.2.2.2 Stair Framing

Fabricate stringers of structural-steel channels, or plates, or a combination thereof as indicated. Provide closures for exposed ends of strings.

Construct platforms of structural-steel channel headers and miscellaneous framing members as indicated. Bolt headers to stringers and newels, and bolt framing members to stringers and headers.

2.2.2.3 Riser, Subtread, and Subplatform Metal Pans

Form metal pans of 0.1084-inch (12-gage) structural-steel sheets, conforming to ASTM A1011/A1011M, Grade 36. Shape the pans to the configuration indicated.

Construct risers and subtread metal pans with steel angle supporting brackets, of the size indicated, welded to stringers. Secure metal pans to brackets with rivets or welds. Secure subplatform metal pans to platform frames with welds.

2.2.3 Protective Coating

Shop-prime steelwork as indicated in accordance with AISC/AISI 121 except surfaces of steel encased in concrete; welded surfaces; high-strength, bolt-connected surfaces; and surfaces of crane rails.

2.3 COMPONENTS

2.3.1 Masonry Anchorage Devices

Provide masonry anchorage devices consisting of expansion shields complying with AASHTO M 314, ASTM E488/E488M and ASTM C514 as follows:

- a. Lead expansion shields for machine screws and bolts 1/4 inch and smaller; head-out embedded-nut type, single unit class, Group I, Type 1, Class 1.
- b. Lead expansion shields for machine screws and bolts larger than 1/4 inch in size; head-out embedded-nut type, multiple unit class, Group I, Type 1, Class 2.
- c. Bolt anchor expansion shields for lag bolts; zinc-alloy, long-shield anchors class, Group II, Type 1, Class 1.

- d. Bolt anchor expansion shields for bolts; closed-end bottom-bearing class, Group II, Type 2, Class 1.

Use toggle bolts of the tumble-wing type, conforming to ASTM A325, ASTM A449, and ASTM C636/C636M, type, class, and style as required.

2.4 MATERIALS

Provide recycled content of steel products.

2.4.1 Structural-Steel Plates, Shapes and Bars

Structural-size shapes and plates, conforming to ASTM A36/A36M, unless otherwise noted, except bent or cold-formed plates.

Steel plates - bent or cold-formed, conforming to ASTM A283/A283M, Grade C.

Steel bars and bar-size shapes, conforming to ASTM A36/A36M, unless otherwise noted for steel bars and bar-size shapes. Provide steel with recycled content.

2.4.2 Structural-Steel Tubing

Provide the following:

- a. Structural steel tubing, hot-formed, welded or seamless, conforming to ASTM A500/A500M, Grade B, unless otherwise noted. Provide steel with recycled content.

2.4.3 Steel Pipe

Provide the following:

- a. Steel pipe conforming to ASTM A53/A53M, type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40). Provide steel with recycled content.

PART 3 EXECUTION

3.1 PREPARATION

Clean surfaces thoroughly before installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. Examine materials upon arrival at site. Notify the carrier and manufacturer of any damage.

Protect installed products until completion of project. Touch up, repair or replace, damaged products before substantial completion

3.2 INSTALLATION

Install in accordance with the manufacturer's instructions and approved submittals. Install in proper relationship with adjacent construction.

Install items at locations indicated, according to the manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Ensure that exposed fastenings are compatible with generally match the color and finish of, and harmonize with the material to which they are applied. Include materials and parts

necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners is cause for rejection. Conceal fastenings where practicable. Select thickness of metal and details of assembly and supports that adequately strengthen and stiffen the construction. Form joints exposed to the weather to exclude water.

3.2.1 Field Preparation

Remove rust-preventive coating just before field erection, using a remover approved by the coating manufacturer. Provide surfaces, when assembled, free of rust, grease, dirt and other foreign matter.

3.2.2 Field Welding

Comply with AWS D1.1/D1.1M in executing manual shielded-metal arc welding, (for appearance and quality of new welds) and in correcting existing welding.

-- End of Section --

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DIVISION 05 - METALS

SECTION 05 51 33

METAL LADDERS

02/16

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- 3.1 GENERAL INSTALLATION REQUIREMENTS
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 - 3.5.2 Field Preparation
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SECTION 05 51 33

METAL LADDERS
02/16

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN LADDER INSTITUTE (ALI)

ALI A14.3 (2008) Standard for Fixed Ladders and Safety Requirements

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A36/A36M (2014) Standard Specification for Carbon Structural Steel

ASTM A47/A47M (1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings

ASTM A500/A500M (2018) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A53/A53M (2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A653/A653M (2018) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A780/A780M (2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM A924/A924M (2018) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM D1187/D1187M (1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal

MASTER PAINTERS INSTITUTE (MPI)

MPI 79 (2012) Primer, Alkyd, Anti-Corrosive for Metal

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3 (1982; E 2004) Power Tool Cleaning

SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning

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

29 CFR 1910.23 (Nov 2016) Ladders

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Ladders, Installation Drawings

SD-03 Product Data

Ladders

SD-07 Certificates

Fabricator Certification for Ladder Assembly

1.3 CERTIFICATES

Provide fabricator certification for ladder assembly stating that the ladder and associated components have been fabricated according to the requirements of 29 CFR 1910.23.

1.4 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.

1.5 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Structural Carbon Steel

ASTM A36/A36M.

2.1.2 Structural Tubing

ASTM A500/A500M.

2.1.3 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B.

2.1.4 Fittings for Steel Pipe

Standard malleable iron fittings ASTM A47/A47M.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, G90, as applicable.

2.2.2 Galvanize

Anchor bolts, 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.

2.2.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions.

2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.3 LADDERS

Fabricate vertical ladders conforming to 29 CFR 1910.23 and Section 5 of ALI A14.3. Ladders shall be capable of supporting their maximum intended load. Use 2 1/2 by 3/8 inch steel flats for stringers and 3/4 inch diameter steel rods for rungs. Ladder rungs, step and cleats must be spaced not less than 10 inches and not more than 16 inches wide (measured before installation of ladder safety system), spaced no more than 14 inches apart, plus welded or shouldered and headed into stringers. Install ladders so that the maximum perpendicular distance from the centerline of the steps or rungs, or grab bars, or both, to the nearest permanent object in the back of the ladder or to the finished wall surface will not be less than 7 inches, except for the elevator pit ladders, which have a minimum perpendicular distance of 4.5 inches. Provide heavy clip angles riveted or bolted to the stringer and drilled for not less than two 1/2 inch diameter expansion bolts as indicated. Provide intermediate clip angles not over 48 inches on centers. The top rung of the ladder must be level with the top of the access level, parapet or landing served by the ladder except for hatches or wells. Extend the side rails of through or side step ladders 42 inches above the access level. Provide ladder access protective swing gates at the top of access/egress level. The drawings must indicate ladder locations and details of critical dimensions and materials.

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. Provide Exposed fastenings of compatible materials, generally matching 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 will be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports must provide strength and stiffness. Formed joints exposed to the weather to exclude water. Items listed below require additional procedures.

3.2 WORKMANSHIP

Metalwork must be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching must produce clean true lines and surfaces. Continuously weld along the entire area of contact. Do not tack weld exposed connections of work in place. Grid smooth exposed welds. Provide smooth finish on exposed surfaces of work in place, unless otherwise approved. Where tight fits are required, mill

joints. Cope or miter corner joints, well formed, and in true alignment. 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 metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion anchors, and powder-actuated fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine bolts, carriage bolts and powder-actuated threaded studs 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 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.

3.5 FINISHES

3.5.1 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.

3.5.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matter.

3.5.3 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

3.6 LADDERS

Secure to the adjacent construction with the clip angles attached to the stringer. Secure to masonry or concrete with not less than two 1/2 inch diameter expansion bolts. Ends of ladders must not rest upon floor.

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SECTION 05 52 00

METAL RAILINGS

02/18

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PART 3 EXECUTION

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SECTION 05 52 00

METAL RAILINGS
02/18

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 314 (1990; R 2013) Standard Specification for
Steel Anchor Bolts

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016)
Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A108 (2013) Standard Specification for Steel
Bar, Carbon and Alloy, Cold-Finished

ASTM A153/A153M (2016) Standard Specification for Zinc
Coating (Hot-Dip) on Iron and Steel
Hardware

ASTM A283/A283M (2013) Standard Specification for Low and
Intermediate Tensile Strength Carbon Steel
Plates

ASTM A307 (2014; E 2017) Standard Specification for
Carbon Steel Bolts, Studs, and Threaded
Rod 60 000 PSI Tensile Strength

ASTM A36/A36M (2014) Standard Specification for Carbon
Structural Steel

ASTM A449 (2014) Standard Specification for Hex Cap
Screws, Bolts, and Studs, Steel, Heat
Treated, 120/105/90 ksi Minimum Tensile
Strength, General Use

ASTM A53/A53M (2018) Standard Specification for Pipe,
Steel, Black and Hot-Dipped, Zinc-Coated,
Welded and Seamless

ASTM C514 (2004; R 2014) Standard Specification for
Nails for the Application of Gypsum Board

ASTM C636/C636M (2013) Standard Practice for Installation

of Metal Ceiling Suspension Systems for
Acoustical Tile and Lay-In Panels

ASTM E488/E488M (2015) Standard Test Methods for Strength
of Anchors in Concrete and Masonry Elements

ASTM F3125/F3125M (2015a) Standard Specification for High
Strength Structural Bolts, Steel and Alloy
Steel, Heat Treated, 120 ksi (830 MPa) and
150 ksi (1040 MPa) Minimum Tensile
Strength, Inch and Metric Dimensions

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 521 (2001; R 2012) Pipe Railing Systems Manual

1.2 ADMINISTRATIVE REQUIREMENTS

1.2.1 Preinstallation Meetings

Within 30 days of contract award, submit fabrication drawings to the
Contracting Officer for the following items:

- a. Iron and steel hardware
- b. Steel shapes, plates, bars and strips
- c. Steel railings and handrails
- d. Anchorage and fastening systems

Submit manufacturer's catalog data, including two copies of manufacturers
specifications, load tables, dimension diagrams, and anchor details for
the following items:

- a. Structural-steel plates, shapes, and bars
- b. Structural-steel tubing
- c. Cold-finished steel bars
- d. Hot-rolled carbon steel bars
- e. Cold-drawn steel tubing
- f. Concrete inserts
- g. Masonry anchorage devices
- h. Protective coating
- i. Steel railings and handrails
- j. Anchorage and fastening systems

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation;
submittals not having a "G" designation are for information only. When

used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings; G

Iron and Steel Hardware; G

Structural Steel Plates, Shapes And Bars; G

SD-03 Product Data

Masonry Anchorage Devices; G

Protective Coating; G

Steel Railings and Handrails; G

Anchorage and Fastening Systems; G

SD-07 Certificates

Welding Procedures; G

Welder Qualification; G

SD-08 Manufacturer's Instructions

Installation Instructions

1.4 QUALITY CONTROL

1.4.1 Welding Procedures

Submit results of welding procedures testing in accordance with AWS D1.1/D1.1M made in the presence of the Contracting Officer and by an approved testing laboratory at the Contractor's expense.

1.4.2 Welder Qualification

Submit certified welder qualification by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. In addition, perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, conduct an immediate retest of two test welds and ensure that each test weld passes. Failure in the immediate retest will require that the welder be retested after further practice or training and make a complete set of test welds.

PART 2 PRODUCTS

2.1 FABRICATION

Preassemble items in the shop to the greatest extent possible.
Disassemble units only to the extent necessary for shipping and handling.

Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, before cleaning, treating, and applying surface finishes, including zinc coatings.

Provide railing and handrail detail plans and elevations at not less than 1 inch to 1 foot. Provide details of sections and connections at not less than 3 inches to 1 foot. Also detail setting drawings, diagrams, templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchors.

Use materials of size and thicknesses indicated or, if not indicated, of the size and thickness necessary to produce adequate strength and durability in the finished product for its intended use. Work the materials to the dimensions indicated on approved detail drawings, using proven details of fabrication and support. Use the type of materials indicated or specified for the various components of work.

Form exposed work true to line and level, with accurate angles and surfaces and straight sharp edges. Ensure that all exposed edges are eased to a radius of approximately 1/32 inch. Bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Weld corners and seams continuously and in accordance with the recommendations of AWS D1.1/D1.1M. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form the exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use countersunk Phillips flathead screws or bolts.

Provide anchorage of the type indicated and coordinated with the supporting structure. Fabricate anchoring devices and space as indicated and as required to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified to be fabricated from cold-finished or cold-rolled stock.

2.1.1 Steel Handrails

Fabricate joint posts, rail, and corners by one of the following methods:

- a. Flush-type rail fittings of commercial standard, welded and ground smooth, with railing splice locks secured with 3/8 inch hexagonal-recessed-head setscrews.
- b. Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove-welding joints, and grinding smooth. Butt railing splices and reinforce them by a tight-fitting interior sleeve not less than 6 inches long.
- c. Railings may be bent at corners in lieu of jointing, provided that

bends are made in suitable jigs and the pipe is not crushed.

2.1.2 Protective Coating

Shop-prime the steelwork as indicated in accordance with Section 09 90 00 PAINTS AND COATINGS except the following:

- a. steel surfaces encased in concrete
- b. steel surfaces for welding
- c. high-strength bolt-connected contact surfaces

2.2 COMPONENTS

2.2.1 Structural Steel Plates, Shapes And Bars

Provide structural-size shapes and plates, except plates to be bent or cold-formed, conforming to ASTM A36/A36M, unless otherwise noted.

Provide steel plates, to be bent or cold-formed, conforming to ASTM A283/A283M, Grade C.

Provide steel bars and bar-size shapes conforming to ASTM A36/A36M, unless otherwise noted.

2.2.2 Cold-Finished Steel Bars

Provide cold-finished steel bars conforming to ASTM A108, grade as selected by the fabricator.

2.2.3 Steel Pipe

Provide pipe conforming to ASTM A53/A53M, type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40).

2.2.4 Masonry Anchorage Devices

Provide masonry anchorage devices consisting of expansion shields complying with AASHTO M 314, ASTM E488/E488M and ASTM C514 as follows:

Provide lead expansion shields for machine screws and bolts 1/4 inch and smaller; head-out embedded nut type, single-unit class, Group I, Type 1, Class 1.

Provide lead expansion shields for machine screws and bolts larger than 1/4 inch in size; head-out embedded nut type, multiple-unit class, Group I, Type 1, Class 2.

Provide bolt anchor expansion shields for lag bolts; zinc-alloy, long-shield anchor class, Group II, Type 1, Class 1.

Provide bolt anchor expansion shields for bolts; closed-end bottom-bearing class, Group II, Type 2, Class 1.

Provide tumble-wing-type toggle bolts conforming to ASTM F3125/F3125M, ASTM A449 and ASTM C636/C636M, type, class, and style as required.

2.2.5 Fasteners

Provide galvanized zinc-coated fasteners in accordance with ASTM A153/A153M used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.

Provide standard hexagon-head bolts, conforming to ASTM A307, Grade A.

2.2.6 Steel Railings And Handrails

Design handrails to resist a concentrated load of 200 lb in any direction at any point of the top of the rail or 50 lb per foot applied horizontally to the top of the rail, whichever is more severe. NAAMM AMP 521, provide the same size rail and post. Provide pipe collars of the same material and finish as the handrail and posts.

2.2.6.1 Steel Handrails

Provide steel handrails, including inserts in concrete, steel pipe conforming to ASTM A53/A53M. Provide steel railings of 1 1/2 inch nominal size, shop-painted.

Provide kickplates between railing posts where indicated, and consisting of 1/8 inch steel flat bars not less than 6 inches high. Secure kickplates as indicated.

Galvanize exterior railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components.

PART 3 EXECUTION

3.1 PREPARATION

Adjust stair railings and handrails before securing in place in order to ensure proper matching at butting joints and correct alignment throughout their length. Space posts not more than 8 feet on center. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

- a. Anchor posts to steel with oval steel flanges, angle type or floor type as required by conditions, welded to posts and bolted to the steel supporting members.
- b. Anchor rail ends into masonry with round steel flanges welded to rail ends and anchored into the wall construction with lead expansion shields and bolts.

Secure handrails to walls by means of wall brackets and wall return fitting at handrail ends. Provide brackets of malleable iron castings, with not less than 3 inch projection from the finished wall surface to the center of the pipe, drilled to receive one 3/8 inch bolt. Locate brackets not more than 60 inches on center. Provide wall return fittings of cast iron castings, flush type, with the same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to building construction as follows:

- a. For concrete and solid masonry anchorage, use bolt anchor expansion shields and lag bolts.

- b. For hollow masonry and stud partition anchorage, use toggle bolts having square heads.

Install toe boards and brackets where indicated. Make splices, where required, at expansion joints. Install removable sections as indicated.

3.2 INSTALLATION

Submit manufacturer's installation instructions for the following products to be used in the fabrication of steel stair railing and hand rail work:

- a. Masonry anchorage devices
- b. Steel railings and handrails
- c. Anchorage and fastening systems

Provide complete, detailed fabrication and installation drawings for all iron and steel hardware, and for all steel shapes, plates, bars, and strips used in accordance with the design specifications cited in this section.

3.2.1 Steel Handrail

Install handrail by means of base plates bolted to stringers or structural-steel frame work. Secure rail ends by steel pipe flanges anchored by expansion shields and bolts or by 1/4 inch lag bolts to studs or solid backing.

3.2.2 Touchup Painting

Immediately after installation, clean field welds, bolted connections, abraded areas of the shop paint, and exposed areas painted with the paint used for shop painting. Apply paint by brush or spray to provide a minimum dry-film thickness of 2 mils.

3.3 FIELD QUALITY CONTROL

3.3.1 Field Welding

Ensure that procedures of manual shielded metal arc welding, appearance and quality of welds made, and methods used in correcting welding work comply with AWS D1.1/D1.1M.

-- End of Section --

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PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

ALSC PS 20 (2015) American Softwood Lumber Standard

AMERICAN WOOD COUNCIL (AWC)

AWC NDS (2015) National Design Specification (NDS) for Wood Construction

AWC WFCM (2012) Wood Frame Construction Manual for One- and Two-Family Dwellings

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA M2 (2016) Standard for the Inspection of Preservative Treated Wood Products for Industrial Use

AWPA M6 (2013) Brands Used on Preservative Treated Materials

AWPA P18 (2014) Nonpressure Preservatives

AWPA P49 (2015) Standard for Fire Retardant FR-1

AWPA P5 (2015) Standard for Waterborne Preservatives

AWPA T1 (2017) Use Category System: Processing and Treatment Standard

AWPA U1 (2019) Use Category System: User Specification for Treated Wood

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA L870 (2010) Voluntary Product Standard, PS 1-09, Structural Plywood

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

ASME B18.2.2 (2015) Nuts for General Applications:
Machine Screw Nuts, Hex, Square, Hex
Flange, and Coupling Nuts (Inch Series)

ASME B18.5.2.1M (2006; R 2011) Metric Round Head Short
Square Neck Bolts

ASME B18.5.2.2M (1982; R 2010) Metric Round Head Square
Neck Bolts

ASME B18.6.1 (2016) Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M (2016) Standard Specification for Zinc
Coating (Hot-Dip) on Iron and Steel
Hardware

ASTM A307 (2014; E 2017) Standard Specification for
Carbon Steel Bolts, Studs, and Threaded
Rod 60 000 PSI Tensile Strength

ASTM D2898 (2010; R 2017) Standard Practice for
Accelerated Weathering of
Fire-Retardant-Treated Wood for Fire
Testing

ASTM F1667 (2017) Standard Specification for Driven
Fasteners: Nails, Spikes, and Staples

ASTM F547 (2017) Standard Terminology of Nails for
Use with Wood and Wood-Base Materials

CALIFORNIA AIR RESOURCES BOARD (CARB)

CARB 93120 (2007) Airborne Toxic Control Measure
(ATCM) to Reduce Formaldehyde Emissions
from Composite Wood Products

FM GLOBAL (FM)

FM 4435 (2013) Roof Perimeter Flashing

U.S. DEPARTMENT OF COMMERCE (DOC)

DOC/NIST PS58 (1973) Basic Hardboard (ANSI A135.4)

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1923 (Rev A; Notice 3) Shield, Expansion (Lag,
Machine and Externally Threaded Wedge Bolt
Anchors)

CID A-A-1924 (Rev A; Notice 3) Shield, Expansion (Self
Drilling Tubular Expansion Shell Bolt
Anchors)

CID A-A-1925 (Rev A; Notice 3) Shield Expansion (Nail
Anchors)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fire-retardant Treatment

Adhesives

SD-06 Test Reports

Preservative-treated Lumber and Plywood

SD-07 Certificates

Certificates of Grade

Preservative Treatment

Indoor Air Quality

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. Do not use materials that have visible moisture or biological growth. 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 must be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Surfaces that are to be exposed to view must 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 must 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 must not bear grademarks or other types of identifying marks.

1.4.3 Preservative-Treated Lumber and Plywood

The Contractor is responsible for the quality of treated wood products. Each treated piece must be inspected in accordance with AWPA M2 and permanently marked or branded, by the producer, in accordance with AWPA M6. The Contractor must 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.

1.4.4 Fire-Retardant Treated Lumber

Mark each piece in accordance with AWPA M6, except pieces that are to be natural or transparent finished. In addition, exterior fire-retardant lumber must be distinguished by a permanent penetrating blue stain. Labels of a nationally recognized independent testing agency will be accepted as evidence of conformance to the fire-retardant requirements of AWPA M6.

1.4.5 Hardboard, Gypsum Board, and Fiberboard

Mark each sheet or bundle to identify the standard under which the material is produced and the producer.

1.5 SIZES AND SURFACING

ALSC PS 20 for dressed sizes of yard and structural lumber, Quality M2. Lumber must be surfaced four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes must 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 must be as follows at the time of delivery to the job site:

- a. Framing lumber and board, 19 percent maximum
- b. Materials other than lumber; moisture content must 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-treated wood products must 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 must not exceed the limits

of the U.S. EPA's Toxic Characteristic Leaching Procedure (TCLP), and must 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. In accordance with AWPA U1 provide non-copper preservative treatment such as EL2, PTI or SBX, DOT for products in direct contact with sheet metal.

- 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 must be air or kiln dried after treatment. Specific treatments must 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. Plastic lumber must not be preservative treated. The following items must be preservative treated:
 - (1) Wood framing, woodwork, and plywood up to and including the subflooring at the first-floor level of structures having crawl spaces when the bottoms of such items are 24 inches or less from the earth underneath.
 - (2) Wood members that are in contact with water.
 - (3) Exterior wood steps, platforms, and railings; and all wood framing of open, roofed structures.
 - (4) Wood sills, soles, plates, furring, and sleepers that are less than 24 inches from the ground, furring and nailers that are set into or in contact with concrete or masonry.
 - (5) Nailers, edge strips, crickets, curbs, and cants for roof decks.

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 FIRE-RETARDANT TREATMENT

Fire-retardant treated wood must be pressure treated with fire retardants conforming to AWPA P49. Fire retardant treatment of wood products must conform to the requirements of AWPA U1, Commodity Specification H and AWPA T1, Section H. Treatment and performance inspection must be by an independent and qualified testing agency that establishes performance ratings. Each piece or bundle of treated material must bear identification of the testing agency to indicate performance in accordance with such rating. Treated materials to be exposed to rain wetting must be subjected to an accelerated weathering technique in accordance with ASTM D2898 prior to being tested. Such items which will not be inside a building, and such items which will be exposed to heat or high humidity, must receive exterior fire-retardant treatment. Fire-retardant-treated wood products must be free of halogens, sulfates, ammonium phosphate, and

formaldehyde.

1.9 QUALITY ASSURANCE

1.9.1 Humidity Requirements

Sequence work to minimize use of temporary HVAC to dry out building and control humidity.

1.10 ENVIRONMENTAL REQUIREMENTS

During and immediately after installation of treated wood, engineered wood products, and laminated wood products at interior spaces, provide temporary ventilation.

1.11 CERTIFICATIONS

1.11.1 Certified Wood Grades

Provide certificates of grade from the grading agency on graded but unmarked lumber or plywood attesting that materials meet the grade requirements specified herein.

1.11.2 Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.

1.11.2.1 Composite Wood, Wood Structural Panel and Agrifiber Products

For purposes of this specification, composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), wheatboard, strawboard, panel substrates, and door cores. Products must contain no added urea-formaldehyde resins. Provide products certified to meet emissions requirements of either CARB 93120. Provide current product certification documentation from certification body.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

For products in this section, where applicable and to extent allowed by performance criteria, provide and document the following:

2.1.1 Recycled Content for Wood Products

Recycled content is identified for some products in this section; provide documentation in accordance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph RECYCLED CONTENT. Other products listed in this section may be available with recycled content; identify those products that meet project requirements for recycled content, and provide documentation in accordance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph RECYCLED CONTENT.

2.1.2 Reduce Volatile Organic Compounds (VOC) (Low-Emitting Materials) for Products

Reduced VOC content is identified for some products in this section; provide documentation in accordance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph REDUCE VOLATILE ORGANIC COMPOUNDS (VOC) (LOW-EMITTING MATERIALS). Other products listed in this section may be available with

reduced VOC content; identify those products that meet project requirements for reduced VOC content, and provide documentation in accordance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph REDUCE VOLATILE ORGANIC COMPOUNDS (VOC) (LOW-EMITTING MATERIALS).

2.2 MATERIALS

2.3 OTHER MATERIALS

2.3.1 Hardboard Underlayment

DOC/NIST PS58, service class, sanded on one side, 1/4 inch thick 4 feet wide.

2.3.2 Miscellaneous Wood Members

2.3.2.1 Nonstress Graded Members

Members must include bridging, corner bracing, furring, grounds, and nailing strips. Members must be in accordance with TABLE I for the species used. Sizes must be as follows unless otherwise shown:

Member	Size inch
Bridging	1 x 3 or 1 x 4 for use between members 2 x 12 and smaller; 2 x 4 for use between members larger than 2 x 12.
Corner bracing	1 x 4.
Furring	1 x 2
Grounds	Plaster thickness by 38.
Nailing strips	1 x 3 or 1 x 4 when used as shingle base or interior finish, otherwise 2 inch stock.

2.3.2.2 Blocking

Blocking must be standard or number 2 grade.

2.3.3 Adhesives

Comply with applicable regulations regarding toxic and hazardous materials and as specified.

2.4 ROUGH HARDWARE

Unless otherwise indicated or specified, rough hardware must be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials UST 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 must 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 must 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. In general, 8-penny or larger nails must be used for nailing through 1 inch thick lumber and for toe nailing 2 inch thick lumber; 16-penny or larger nails must be used for nailing through 2 inch thick lumber. Nails used with treated lumber and sheathing must be hot-dipped galvanized in accordance with ASTM A153/A153M. Nailing must be in accordance with the recommended nailing schedule contained in AWC WFCM. Where detailed nailing requirements are not specified, nail size and spacing must be sufficient to develop an adequate strength for the connection. The connection's strength must be verified against the nail capacity tables in AWC NDS. Reasonable judgment backed by experience must 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 must be used.

2.4.7 Wire Nails

ASTM F1667.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

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.

3.2 MISCELLANEOUS

3.2.1 Wood Roof Nailers, Edge Strips, Crickets, Curbs, and Cants

Provide sizes and configurations indicated or specified and anchored securely to continuous construction.

3.2.1.1 Roof Edge Strips and Nailers

Provide at perimeter of roof, around openings through roof, and where roofs abut walls, curbs, and other vertical surfaces. Except where indicated otherwise, nailers must be 6 inches wide and the same thickness as the insulation. Anchor nailers securely to underlying construction. Anchor perimeter nailers in accordance with FM 4435.

3.2.1.2 Crickets, Cants, and Curbs

Provide wood saddles or crickets, cant strips, curbs for scuttles and ventilators, and wood nailers bolted to tops of concrete or masonry curbs as indicated, specified, or necessary and of lumber.

3.2.2 Wood Blocking

Provide proper sizes and shapes at proper locations for the installation and attachment of wood and other finish materials, fixtures, equipment, and items indicated or specified.

3.2.3 Wood Furring

Provide where shown and as necessary for facing materials specified. Except as shown otherwise, furring strips must be nominal one by 3, continuous, and spaced 16 inches o.c. Erect furring vertically or horizontally as necessary. Nail furring strips to masonry. Do not use wood plugs. Provide furring strips around openings, behind bases, and at angles and corners. Furring must be plumb, rigid, and level and must be shimmed as necessary to provide a true, even plane with surfaces suitable to receive the finish required. Form furring for offsets and breaks in walls or ceilings on 1 by 4 wood strips spaced 16 inches o.c.

3.2.4 Temporary Closures

Provide with hinged doors and padlocks and install during construction at exterior doorways and other ground level openings that are not otherwise closed. Cover windows and other unprotected openings with polyethylene or other approved material, stretched on wood frames. Provide dustproof barrier partitions to isolate areas as directed.

3.2.5 Temporary Centering, Bracing, and Shoring

Provide for the support and protection of masonry work during construction as specified in Section 04 20 00 UNIT MASONRY.

3.3 WASTE MANAGEMENT OF WOOD PRODUCTS

In accordance with the Waste Management Plan and as specified. Clearly separate damaged wood and other scrap lumber for acceptable alternative uses on site, including bracing, blocking, cripples, ties, and shims.

Separate composite wood from other wood types and recycle or reuse. Fold up metal banding, flatten, and recycle.

Separate treated, stained, painted, and contaminated wood and place in designated area for hazardous materials. Dispose of according to local regulations. Do not leave any wood, shavings, sawdust, or other wood waste buried in fill or on the ground. Prevent sawdust and wood shavings

from entering the storm drainage system. Do not burn scrap lumber that has been pressure treated, or lumber that is less than one year old.

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- 3.3 MOULDING AND INTERIOR TRIM

-- End of Section Table of Contents --

SECTION 06 20 00

FINISH CARPENTRY
08/16

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

ALSC PS 20 (2015) American Softwood Lumber Standard

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

ASME B18.2.2 (2015) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B18.6.1 (2016) Wood Screws (Inch Series)

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA U1 (2019) Use Category System: User Specification for Treated Wood

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA L870 (2010) Voluntary Product Standard, PS 1-09, Structural Plywood

ASTM INTERNATIONAL (ASTM)

ASTM F547 (2017) Standard Terminology of Nails for Use with Wood and Wood-Base Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.9 (2015) Cabinet Hardware

CALIFORNIA AIR RESOURCES BOARD (CARB)

CARB 93120 (2007) Airborne Toxic Control Measure (ATCM) to Reduce Formaldehyde Emissions from Composite Wood Products

FOREST STEWARDSHIP COUNCIL (FSC)

FSC STD 01 001 (2015) Principles and Criteria for Forest Stewardship

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules (2015) Rules for the Measurement &
Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules (2013) 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 PINE INSPECTION BUREAU (SPIB)

SPIB 1003 (2014) Standard Grading Rules for Southern
Pine Lumber

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

40 CFR 770 Formaldehyde Standards for Composite Wood
Products

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17 (2015) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5 (2017) Western Lumber Grading Rules

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

WDMA I.S.4 (2015A) Preservative Treatment for Millwork

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings Indicating All Wood Assemblies; G

SD-03 Product Data

Wood Products; G

Treated Wood Products; G

Hardware and Accessories; G

SD-04 Samples

Samples; G

SD-07 Certificates

Certificates of Grade; G
Certified Sustainably Harvested Wood; S
Indoor Air Quality; S

1.3 DETAIL DRAWINGS

Submit detail drawings indicating all wood assemblies proposed for use in the project. Indicate materials, species, grade, density, grain, finish details of construction, location of use in the project, finishes, types, method and arrangement of fasteners, and installation details. This includes all fabricated assemblies.

1.4 PRODUCT DATA

Submit Manufacturers printed data including proposed species, grade, density grain, and finish as applicable; sufficient to demonstrate compliance with this specification for each type of wood product specified. For treated wood products also provide documentation of environmentally safe preservatives for each type of wood product specified.

Provide Manufacturers printed data for hardware and all wood accessories including but not limited to edge banding, adhesives, and sealers.

1.5 SAMPLES

Samples indicating proposed species, grade, density grain, and finish for each type of wood product specified. Provide samples of sufficient size to show pattern and color ranges of proposed products.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver wood products to the jobsite in an undamaged condition. Stack materials to ensure ventilation and drainage. Protect against dampness before and after delivery. Store materials under cover in a well ventilated enclosure and protect against extreme changes in temperature and humidity. Keep materials wrapped and separated from off-gassing materials (such as drying paints and adhesives). Do not use materials that have visible moisture or biological growth. Do not store products in building until wet trade materials are dry and humidity of the space is within wood manufacturer's tolerance limits for storage.

1.7 QUALITY ASSURANCE

1.7.1 Certifications

1.7.1.1 Certified Wood Grades

Provide certificates of grade from the grading agency on graded but unmarked lumber or plywood attesting that materials meet the grade requirements specified herein.

1.7.1.2 Certified Sustainably Harvested Wood

For species available as certified as sustainably harvested by FSC STD 01 001, provide in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

1.7.1.3 Indoor Air Quality Certifications

1.7.1.3.1 Composite Wood, Wood Structural Panel and Agrifiber Products

For purposes of this specification, composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), wheatboard, strawboard, panel substrates, and door cores. Products must contain no added urea-formaldehyde resins or comply with emissions requirements in Section 01 33 29 SUSTAINABILITY REPORTING. Provide products certified to meet requirements of both 40 CFR 770 and CARB 93120. Provide products certified to meet emissions requirements of either (limit requirements for either office or classroom spaces regardless of space type). Provide current product certification documentation from certification body.

1.7.2 Lumber

Identify each piece or each bundle of lumber, millwork, and trim by the grade mark of a recognized association or independent inspection agency certified by the Board of Review of the ALSC to grade the species.

1.7.3 Plywood

Provide each sheet of plywood with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. Marks must identify plywood by species group or span rating, exposure durability classification, grade, and compliance with APA L870.

1.7.4 Non-Pressure Treated Woodwork and Millwork

Mark, stamp, or label to indicate compliance with WDMA I.S.4.

PART 2 PRODUCTS

2.1 WOOD PRODUCTS

2.1.1 Sizes and Patterns of Wood Products

Provide yard and board lumber sizes in accordance with ALSC PS 20. Provide shaped lumber and millwork in the patterns indicated and in standard patterns of the association covering the species. Size references, unless otherwise specified, are nominal sizes. Provide actual sizes within manufacturing tolerances allowed by the applicable standard.

2.1.2 Species and Grades

Provide in accordance with AWWA U1 Use Category System Tables unless otherwise specified herein.

2.1.3 Trim, Finish, and Frames

Provide species and grades listed in the table below for wood materials that must be painted. For materials that must be stained, have a natural,

or a transparent finish, provide materials one grade higher than those listed in the table below.

TABLE OF GRADES FOR WOOD TO RECEIVE PAINT FINISH		
Grading Rules	Species	Exterior and Interior Trim, Finish, and Frames
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,) White Woods, (Western Woods,) Western Cedars, Western Hemlock	All Species: C & BTR. Select (Choice & BTR Idaho White Pine) or Superior Finish. Western Red Cedar may be graded C & BTR. Select or A & BTR in accordance with Special Western Red Cedar Rules.
WCLIB 17 standard grading rules	Douglas Fir-Larch, Hem-Fir, Mountain Hemlock, Sitka Spruce, Western Cedars, Western Hemlock	All Species: C & BTR VG, except A for Western Red Cedar
SPIB 1003 standard grading rules	Southern Pine	C & BTR
NHLA Rules	Cypress	C-Select
NELMA Grading Rules standard grading rules **	Balsam Fir, Eastern Hemlock-Tamarack, Eastern Spruce, Eastern White Pine, Northern Pine, Northern Pine, Northern White Cedar	All Species: C-Select except C & BTR for Eastern White Pine and Norway Pine
RIS Grade Use standard specifications	Redwood	Clear, Clear All Heart
NHLA Rules	Cypress	B Finish
	Red Gum, Soft Elm, Birch	Select or BTR (for interior use only)

Note: **

<http://www.nelma.org/library/2013-standard-grading-rules-for-northeastern-lumber/>

2.2 COUNTERTOPS

2.2.1 Solid Surface

For solid surface countertops refer to Section 06 61 16, SOLID POLYMER (SOLID SURFACING) FABRICATIONS.

2.3 MOISTURE CONTENT OF WOOD PRODUCTS

Air dry or kiln dry lumber. Kiln dry treated lumber after treatment. Maximum moisture content of wood products at time of delivery to the jobsite, and when installed, must be as follows:

- a. Interior Finish Lumber, Trim, and Millwork: 1-1/4 Inches Nominal or Less in Thickness: 6 percent on 85 percent of the pieces and 8 percent on remainder.

2.4 PRESERVATIVE TREATMENT OF WOOD PRODUCTS

2.4.1 Non-Pressure Treatment

Treat woodwork and millwork, such as cabinets, in accordance with WDMA I.S.4, with either 2 percent copper naphthenate, 3 percent zinc naphthenate, or 1.8 percent copper-8-quinolinolate. Provide a liberal brush coat of preservative treatment to field cuts and holes.

2.5 HARDWARE AND ACCESSORIES

Provide sizes, types, and spacings of hardware and accessories as recommended in writing by the wood product manufacturer, except as otherwise specified.

2.5.1 Wood Screws

ASME B18.6.1.

2.5.2 Bolts, Nuts, Lag Screws, and Studs

ASME B18.2.1 and ASME B18.2.2.

2.5.3 Nails

Use nails of a size and type best suited for each application and in accordance with ASTM F547. Use hot-dipped galvanized or aluminum nails for exterior applications. For siding, provide nails of sufficient length to extend 1-1/2 inches into supports, including wood sheathing over framing. Where nailing is impractical, provide screws of a size and type best suited for each application.

2.5.4 Adjustable Shelf Standards

ANSI/BHMA A156.9, Recessed (mortised) metal standards, BHMA No. B04071. Provide closed type support clips, BHMA No. B04081.

2.6 FABRICATION

2.6.1 Quality Standards (QS)

2.6.1.1 Grades

The terms "Premium," "Custom," and "Economy" refer to the quality grades defined in NAAWS 3.1. Provide items not otherwise specified in a specific grade as "Custom" grade.

2.6.1.2 Adhesives

Select adhesives for durability and permanent bonding. Address factors such as materials that must be bonded, expansion and contraction, bond strength, fire rating, moisture resistance, and manufacturer's recommendations.

2.6.2 Cabinets

Cabinets to receive paint finish. Fabricate cabinets with solid ends and frame fronts, or with frames all around. Provide frames of solid hardwood not less than 3/4 by 1-1/2 inches. Provide ends, bottoms, backs, partitions, and doors as hardwood plywood. Mortise and tenon, dovetail, or dowel and glue joints to produce a rigid unit. Cover exposed edges of plywood with hardwood strips. Provide cabinet doors, frames, and solid exposed ends 3/4 inch thick minimum. Provide cabinet bottoms, partitions, and framed ends to be 1/2 inch minimum. Provide shelves to be 5/8 inch thick minimum. Provide cabinet backs 1/4 inch thick minimum.

2.6.2.1 Cabinet Hardware

ANSI/BHMA A156.9. Provide cabinet hardware including two self, closing hinges for each door, two side mounted metal drawer slides for each drawer, and pulls for all doors and drawers as follows. Provide hardware exposed to view as bright chromium plated. Comply with the following requirements for all cabinet hardware:

- a. Provide frameless concealed European style, back mounted hinges with 165 degree opening and a self closing feature when at less than 90 degrees open.
- b. Provide drawer slides having a static rating capacity of 100 lbs.. Slides to have a self closing/stay closed action, zinc or epoxy coated steel finish, ball bearing rollers, and positive stop with lift out design.
- c. Provide drawer pulls as wire type pulls with center-to-center dimension of not less than 3-1/2 inches and a cross sectional diameter of 5/16 inch. Provide handle projections not less than 1-5/16 inches.
- d. Provide heavy duty magnetic drawer catches.

2.6.2.2 Finish

Provide a primer finish on wood surfaces after fabrication. Provide two coats of urethane paint and two coats of polyurethane.

2.6.3 Interior Trim with Transparent Finish (Display Cabinets)

2.6.3.1 AWI Quality Grade

Custom grade.

2.6.3.2 Construction

Provide design details, as indicated on the drawings.

2.6.3.3 Exposed Parts

Red Oake species, rift cut.

2.6.3.4 Finish

Provide a clear factory finish on wood surfaces after fabrication. Provide fabricator's standard natural finish equivalent to one coat of sealer, one coat of varnish on all surfaces and a second coat of varnish on surfaces exposed to view. Sand lightly and wipe clean between coats.

PART 3 EXECUTION

Do not install building construction materials that show visual evidence of biological growth.

3.1 FINISH WORK

Apply primer to finish work before installing. Where practicable, shop assemble and finish millwork items. Construct joints tight and in a manner to conceal shrinkage but to avoid cupping, twisting and warping after installation. Miter trim and mouldings at exterior angles; cope at interior angles and at returns. Provide millwork and trim in maximum practical lengths. Fasten finish work with finish nails. Provide blind nailing where practicable. Set face nails for putty stopping.

3.1.1 Interior Finish Work

After installation, sand exposed surfaces smooth.

3.2 MISCELLANEOUS

3.2.1 Cabinets

Provide cabinets level, plumb, true, and tight to adjacent walls. Secure cabinets to walls with concealed toggle bolts. Secure top to cabinet with concealed screws. Make cutouts for fixtures from templates supplied by fixture manufacturer. Locate cutouts for pipes so that edges of holes are covered by escutcheons after installation.

3.3 MOULDING AND INTERIOR TRIM

Install mouldings and interior trim straight, plumb, level and with closely fitted joints. Provide exposed surfaces machine sanded at the shop. Cope returns and interior angles at moulded items and miter

external corners. Shoulder intersections of flatwork to ease any inherent changes in plane. Blind nail to the extent practicable. Set and stop face nailing with a nonstaining putty to match the applied finish. Use screws for attachment to metal; set and stop screws in accordance with the same quality requirements for nails.

-- End of Section --

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DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

SECTION 06 61 16

SOLID SURFACING FABRICATIONS

08/10

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- 1.3 SUSTAINABILITY REPORTING
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SECTION 06 61 16

SOLID SURFACING FABRICATIONS
08/10

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM D2583	(2013a) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D570	(1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D696	(2016) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G21	(2015) Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

CSA GROUP (CSA)

CSA B45.5-11/IAPMO Z124	(2011; Update 1 2012) Plastic Plumbing Fixtures - First Edition
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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates
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NSF INTERNATIONAL (NSF)

NSF/ANSI 51	(2012) Food Equipment Materials
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TILE COUNCIL OF NORTH AMERICA (TCNA)

TCNA Hdbk	(2017) Handbook for Ceramic, Glass, and Stone Tile Installation
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1.2 SYSTEM DESCRIPTION

- a. Work under this section includes countertops, window stools, and other items utilizing solid polymer (solid surfacing) fabrication as shown on the drawings and as described in this specification. Do not change source of supply for materials after work has started, if the appearance of finished work would be affected.
- b. In most instances, installation of solid polymer fabricated components and assemblies will require strong, correctly located structural support provided by other trades. To provide a stable, sound, secure installation, close coordination is required between the solid polymer fabricator/installer and other trades to ensure that necessary structural wall support, cabinet counter top structural support, proper clearances, and other supporting components are provided for the installation of wall panels, countertops, shelving, and all other solid polymer fabrications to the degree and extent recommended by the solid polymer manufacturer.
- c. Appropriate staging areas for solid polymer fabrications. Allow variation in component size and location of openings of plus or minus 1/8 inch.

1.3 SUSTAINABILITY REPORTING

Materials in this technical specification may contribute towards contract compliance with sustainability requirements. See Section 01 33 29 SUSTAINABILITY REPORTING for project recycled content.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G
Installation; G

SD-03 Product Data

Solid Polymer Material
Qualifications
Fabrications

SD-04 Samples

Material; G
Counter and Vanity Tops; G

SD-06 Test Reports

Solid Polymer Material

SD-07 Certificates

Fabrications
Qualifications

SD-10 Operation and Maintenance Data

Clean-up

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

To ensure warranty coverage, solid polymer fabricators shall be certified to fabricate by the solid polymer material manufacturer being utilized. Mark all fabrications with the fabricator's certification label affixed in an inconspicuous location. Fabricators shall have a minimum of 5 years of experience working with solid polymer materials. Submit solid polymer manufacturer's certification attesting to fabricator qualification approval.

1.5.2 Mock-ups

Submit Detail Drawings indicating locations, dimensions, component sizes, fabrication and joint details, attachment provisions, installation details, and coordination requirements with adjacent work.

1.6 DELIVERY, STORAGE, AND HANDLING

Do not deliver materials to project site until areas are ready for installation. Deliver components and materials to the site undamaged, in containers clearly marked and labeled with manufacturer's name. Materials shall be stored indoors and adequate precautions taken to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation, for duration of project.

1.7 WARRANTY

Provide manufacturer's warranty of ten years against defects in materials, excluding damages caused by physical or chemical abuse or excessive heat. Warranty shall provide for material and labor for replacement or repair of defective material for a period of ten years after component installation.

PART 2 PRODUCTS

2.1 MATERIAL

Provide solid polymer material that is a homogeneous filled solid polymer; not coated, laminated or of a composite construction; meeting CSA B45.5-11/IAPMO Z124 requirements. Material shall have minimum physical and performance properties specified. Superficial damage to a depth of 0.01 inch shall be repairable by sanding or polishing. Material thickness shall be as indicated on the drawings. In no case shall material be less than 1/4 inch in thickness. Submit a minimum 4 by 4 inch sample of each color and pattern for approval. Samples shall indicate full range of color and pattern variation. Approved samples shall be retained as a standard for this work. Submit test report results from an

independent testing laboratory attesting that the submitted solid polymer material meets or exceeds each of the specified performance requirements.

2.1.1 Acrylic-modified Polymer Solid Surfacing Material

Cast, solid polymer material shall be composed of a formulation containing acrylic and polyester polymers, mineral fillers, and pigments. Acrylic polymer content shall be not less than 5 percent and not more than 10 percent in order to meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	4100 psi (max.)	ASTM D638
Hardness	50-Barcol Impressor (min.)	ASTM D2583
Thermal Expansion	.000023 in/in/F (max.)	ASTM D696
Boiling Water Surface Resistance	No Change	ANSI/NEMA LD 3-3.05
High Temperature Resistance	No Change	ANSI/NEMA LD 3-3.06
Impact Resistance (Ball drop)		ANSI/NEMA LD 3-303
1/4 inch sheet	36 inches, 1/2 lb ball, no failure	
1/2 inch sheet	140 inches, 1/2 lb ball, no failure	
3/4 inch sheet	200 inches, 1/2 lb ball, no failure	
Mold & Mildew Growth	No growth	ASTM G21
Bacteria Growth	No growth	ASTM G21
Liquid Absorption (Weight in 24 hrs.)	0.6 percent max.	ASTM D570
Flammability		ASTM E84
Flame Spread	25 max.	
Smoke Developed	100 max.	

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Sanitation	"Food Contact" approval	NSF/ANSI 51

2.1.2 Material Patterns and Colors

Patterns and colors for all solid polymer components and fabrications shall be those indicated on the project drawings. Pattern and color shall occur, and shall be consistent in appearance, throughout the entire depth (thickness) of the solid polymer material.

2.1.3 Surface Finish

Exposed finished surfaces and edges shall receive a uniform appearance. Exposed surface finish shall be matte; gloss rating of 5-20.

2.2 ACCESSORY PRODUCTS

Accessory products, as specified below, shall be manufactured by the solid polymer manufacturer or shall be products approved by the solid polymer manufacturer for use with the solid polymer materials being specified.

2.2.1 Seam Adhesive

Seam adhesive shall be a two-part adhesive kit to create permanent, inconspicuous, non-porous, hard seams and joints by chemical bond between solid polymer materials and components to create a monolithic appearance of the fabrication. Adhesive shall be approved by the solid polymer manufacturer. Adhesive shall be color-matched to the surfaces being bonded where solid-colored, solid polymer materials are being bonded together. The seam adhesive shall be clear or color matched where particulate patterned, solid polymer materials are being bonded together.

2.2.2 Panel Adhesive

Panel adhesive shall be neoprene based panel adhesive meeting TCNA Hdbk, Underwriter's Laboratories (UL) listed. Use this adhesive to bond solid polymer components to adjacent and underlying substrates.

2.2.3 Silicone Sealant

Sealant shall be a mildew-resistant, FDA and OSHA Nationally Recognized Testing Laboratory (NRTL) listed silicone sealant or caulk in a clear formulation. The silicone sealant shall be approved for use by the solid polymer manufacturer. Use sealant to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures.

2.2.4 Heat Reflective Tape

Heat reflective tape as recommended by the solid polymer manufacturer for use with cutouts for heat sources.

2.2.5 Mounting Hardware

Provide mounting hardware, including sink/bowl clips, inserts and fasteners for attachment of undermount sinks and lavatories.

2.3 FABRICATIONS

Components shall be factory or shop fabricated to sizes and shapes indicated, to the greatest extent practical, in accordance with approved Shop Drawings and manufacturer's requirements. Provide factory cutouts for sinks, lavatories, and plumbing fixtures where indicated on the drawings. Contours and radii shall be routed to template, with edges smooth. Defective and inaccurate work will be rejected. Submit product data indicating product description, fabrication information, and compliance with specified performance requirements for solid polymer, joint adhesive, sealants, and heat reflective tape. Both the manufacturer of materials and the fabricator shall submit a detailed description of operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

2.3.1 Joints and Seams

Form joints and seams between solid polymer components using manufacturer's approved seam adhesive. Joints shall be inconspicuous in appearance and without voids to create a monolithic appearance.

2.3.2 Edge Finishing

Rout and finish component edges to a smooth, uniform appearance and finish. Edge shapes and treatments, including any inserts, shall be as detailed on the drawings. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

2.3.3 Counter and Vanity Top Splashes

Fabricate backsplashes and end splashes from 1/2 inch thick solid surfacing material to be 4 inches high. Backsplashes and end splashes shall be provided at locations indicated on the drawings. Backsplashes shall be shop fabricated and be loose, to be field attached.

2.3.3.1 End Splashes

End splashes shall be provided loose for installation at the jobsite after horizontal surfaces to which they are to be attached have been installed.

2.3.4 Window Stools

Fabricate window stools from 3/4 inch thick solid surfacing, solid polymer material. Dimensions, edge shape, and other details shall be as indicated on the drawings.

2.3.5 Counter and Vanity Tops

Fabricate all solid surfacing, solid polymer counter top and vanity top components from 3/4 inch thick material. Edge details, dimensions, locations, and quantities shall be as indicated on the Drawings. Counter tops shall be complete with 4 inch high loose backsplash where indicated

on the drawings. Attach 2 inch wide reinforcing strip of polymer material under each horizontal counter top seam. Submit a minimum 1 foot wide by 6 inch deep, full size sample for each type of counter top shown on the project drawings. The sample shall include the edge profile and backsplash as detailed on the project drawings. Solid polymer material shall be of a pattern and color as indicated on the drawings. Sample shall include at least one seam. Approved sample shall be retained as standard for this work.

2.3.5.1 Counter Top With Sink

- a. Stainless Steel Sink. Countertops with sinks shall include cutouts to template as furnished by the sink manufacturer. Manufacturer's standard sink mounting hardware for stainless steel rimless installation shall be provided. Seam between sink and counter top shall be sealed with silicone sealant. Sink, faucet, and plumbing requirements shall be in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.
- b. Solid polymer sinks shall be a manufacturer's standard, pre-molded product specifically designed for attachment to solid polymer counter tops.

2.3.5.2 Vanity Tops With Bowls

- a. Solid polymer bowls shall be a solid polymer manufacturer's standard, pre-molded product specifically designed for attachment to solid polymer counter tops.

2.3.6 Solid Polymer Vanity Bowls

Solid polymer vanity bowls shall be a standard product of the solid polymer manufacturer, designed specifically to be installed in solid polymer vanity tops. Bowls shall be of the same polymer composition as the adjoining counter top. Bowl design shall support a seam adhesive undermount installation method. Bowl dimensions shall be as indicated on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Components

Install all components and fabricated units plumb, level, and rigid. Make field joints between solid polymer components using solid polymer manufacturer's approved seam adhesives, to provide a monolithic appearance with joints inconspicuous in the finished work. Attach metal or vitreous china sinks and lavatory bowls to counter tops using solid polymer manufacturer's recommended clear silicone sealant and mounting hardware. Solid polymer sinks and bowls shall be installed using a color-matched seam adhesive. Plumbing connections to sinks and lavatories shall be made in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.1.1.1 Loose Counter Top Splashes

Mount loose splashes in the locations noted on the drawings. Loose splashes shall be adhered to the counter top with a color matched silicone

sealant when the solid polymer components are solid colors. Use a clear silicone sealant to provide adhesion of particulate patterned solid polymer splashes to counter tops.

3.1.2 Silicone Sealant

Use a clear, silicone sealant or caulk to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures. Sealant bead shall be smooth and uniform in appearance and shall be the minimum size necessary to bridge any gaps between the solid surfacing material and the adjacent surface. Bead shall be continuous and run the entire length of the joint being sealed.

3.1.3 Plumbing

Make plumbing connections to sinks and lavatories in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.2 CLEAN-UP

Components shall be cleaned after installation and covered to protect against damage during completion of the remaining project items. Components damaged after installation by other trades will be repaired or replaced at the General Contractor's cost. Component supplier will provide a repair/replace cost estimate to the General Contractor who shall approve estimate before repairs are made. Submit a minimum of six copies of maintenance data indicating manufacturer's care, repair and cleaning instructions. Maintenance video shall be provided, if available. Maintenance kit for matte finishes shall be submitted.

-- End of Section --

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DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07 05 23

PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS

05/14

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SECTION 07 05 23

PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS
05/14

PART 1 GENERAL

1.1 SUMMARY

Employ an independent agency to conduct the pressure test on the building envelope in accordance with this specification section and ASTM E779.

1.2 REFERENCES

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

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189	(2016) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-105-2006)
ASNT CP-105	(2011) ASNT Standard Topical Outlines for Qualification of Nondestructive Testing Personnel - Item No. 2821
ASNT SNT-TC-1A	(2016) Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing

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

ASHRAE RP-935	(1998) Protocol for Field Testing of Tall Buildings to Determine Envelope Air Leakage Rate
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ASTM INTERNATIONAL (ASTM)

ASTM D3464	(1996; R 2014) Standard Test Method for Average Velocity in a Duct Using a Thermal Anemometer
ASTM E1186	(2017) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
ASTM E1827	(2011; R 2017) Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door
ASTM E2029	(2011) Standard Test Method for Volumetric and Mass Flow Rate Measurement in a Duct Using Tracer Gas Dilution

ASTM E779

(2010) Standard Test Method for
Determining Air Leakage Rate by Fan
Pressurization

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 6781

(1983) Thermal Insulation - Qualitative
Detection of Thermal Irregularities in
Building Envelopes - Infrared Method

1.3 DEFINITIONS

The following terms as they apply to this section:

1.3.1 Air Barrier Envelope

The surface that separates the inside air from the outside air. The combination of air barrier assemblies and air barrier components, connected by air barrier accessories are designed to provide a continuous barrier to the movement of air through an environmental separator. A single building may have more than one air barrier envelope. The air barrier surface includes the top, bottom, and sides of the envelope. The term "air barrier envelope" is also known as "air barrier system" or simply "air barrier".

1.3.2 Air Leakage Rate

How leaky, or conversely how air tight a building envelope is. The air leakage is normally described in terms of air flow rate for the surface area of the envelope at a defined differential pressure.

1.3.3 Bias Pressure

Also known as zero flow pressure, baseline pressure, offset pressure or background pressure. With the envelope not artificially pressurized, bias is the differential pressure that always exists between the envelope that has been prepared (sealed) for the pressure test and the outdoors. Bias pressure is made up of two components, fixed static offset (usually due to stack effect or the HVAC system) and fluctuating pressure (usually due to wind or a moving elevator). Because of pressure fluctuations many bias pressure readings are recorded and averaged for use in the calculations.

1.3.4 Blower Door

Commonly used term for an apparatus used to pressurize and depressurize the space within the building envelope and quantify air leakage through the envelope. The blower door typically includes a door fan and an air resistant fabric or a series of hard panels that extends to cover and seal the door opening between the fan shroud and door frame. The door fan is a calibrated fan capable of measuring air flow and is usually placed in the opening of an exterior door. With the air barrier otherwise sealed, air produced by the door fan pressurizes or de-pressurizes the envelope, depending on the fan's orientation.

1.3.5 Environmental Separator

The parts of a building that separate the controlled interior environment from the uncontrolled exterior environment, or that separate spaces within

a building that have dissimilar environments. The term "environmental separator" is also known as the "control layer".

1.3.6 Pressure Test

A generic term for a test in which the envelope is either pressurized or de-pressurized with respect to the outdoors.

1.3.6.1 Negative Pressure Test (Depressurization Test)

A test wherein air inside the envelope is drawn to the outdoors. This places the envelope at a lower (negative) pressure with respect to the outdoors.

1.3.6.2 Positive Pressure Test (Pressurization Test)

A test wherein outdoor air is pushed into the envelope. This air movement places the envelope at a higher (positive) pressure with respect to the outdoors.

1.4 WORK PLAN

Submit the following not later than 120 calendar days after contract award, but before start of pressure testing work, steps to be taken by the lead pressure test technician to accomplish the required testing.

a. Memorandum of test procedure.

(1) Proposed dates for conducting the pressure, thermographic and fog tests.

(2) Submit detailed pressure test procedures prior to the test. Provide a plan view showing proposed locations (personnel doors or other similar openings) to install blower doors or flexible ducts (for trailer-mounted fans), if used.

b. Test equipment to be used.

c. Scaffolding, scissor lifts, power, electrical extension cords, duct tape, plastic sheeting and other Contractor's support equipment required to perform all tests.

d. Other Contractor's support personnel who will be on site for testing.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Work Plan; G

SD-03 Product Data

Thermal Imaging Camera; G

SD-05 Design Data

Envelope Surface Area Calculations; G

SD-07 Certificates

Pressure Test Agency
Thermographer Qualifications
Test Instruments
Date Of Last Calibration

SD-06 Test Reports

Pressure Test Procedures; G
Air Leakage Test Report; G
Diagnostic Test Report; G

No later than 14 days after completion of the pressure test, submit 6 copies of an organized report bound in a durable 3-ring binder. The report is to contain a table of contents, an executive summary, an introduction, a results section and a discussion of the results. Submit the Air Leakage Test Report as described in paragraph AIR LEAKAGE TEST REPORT. Submit a diagnostic test report as described in paragraph LOCATING LEAKS BY DIAGNOSTIC TESTING. The diagnostic test report is to include the Thermographic Investigation Report and the Fog Test Report (if performed).

Submit field data and completed report forms found in the appendices. Use the sample forms, Test Agency Qualification Sheet, Air Leakage Test Form and Air Leakage Test Results Form to summarize the tests for the appropriate building envelope. Submit both electronically populated and field hand filled-in forms.

Report Data. Include in the report the following information for all tests:

- a. Date of Issue
- b. Project title and number
- c. Name, address, and telephone number of testing agency
- d. Dates and locations of samples and tests or inspections
- e. Names of individuals making the inspection or test
- f. Designation of the work and test method
- g. Identification of product and Specification Section
- h. Complete inspection or test data
- i. Test results and an interpretation of test results
- j. Comments or professional opinion on whether inspected or tested work complies with contract document requirements
- k. Recommendations on retesting

1.6 QUALITY ASSURANCE

1.6.1 Modification of References

Perform all pressure and diagnostic tests according to the referenced publications listed in paragraph REFERENCES and as modified by this

section. Consider the advisory or recommended provisions, of the referred references, as mandatory.

1.6.2 Qualifications

1.6.2.1 Pressure Test Agency

Submit, no later than 15 calendar days after contract award, information certifying that the pressure test agency is not affiliated with any other company participating in work on this contract. The work of the test agency is limited to pressure testing the building envelope, performing a thermography test and fog test, and investigating, through various methods, the location of air leaks through the air barrier. See paragraph PRESSURE TEST AGENCY for additional requirements. For thermographer qualifications, see paragraph THERMOGRAPHER QUALIFICATIONS.

Use the sample TEST AGENCY QUALIFICATIONS SHEET form (Appendix C), to submit the following information.

- a. Verification of 2 years of experience as an agency in pressure testing commercial and/or industrial buildings.
- b. List of at least ten commercial/industrial facilities with building envelopes that the agency has tested within the past 2 years. Include building name, address, and name of prime construction contractor and contractor's point-of-contact information.
- c. Confirmation of 2 years of commercial and or industrial building pressure test experience for the lead pressure test technician and the thermographer in using the specified ASTM E779 testing standard. References from five Contracting Officers for facilities where the lead test technician has supervised commercial and or industrial building pressure tests in the last 2 years.
- d. Verification that the lead pressure test technician has been employed by a building pressure testing agency in the capacity of a lead pressure test technician for not less than 1 year.

1.6.2.2 Thermographer Qualifications

To perform an infrared diagnostic evaluation, use a lead thermographer who has at least an active Level II Certification that is based on the requirements in ASNT CP-105 or ANSI/ASNT CP-189 and is in accordance with ASNT SNT-TC-1A. The course of study is to be specifically focused on infrared thermography for building science. The thermographer must have at least two years of building science thermography experience in IR testing commercial or industrial buildings. The thermographer must also have experience in building envelopes and building science in order to make effective recommendations to the contractor should the envelope require additional sealing. Submit the thermographer's certificate for approval. Submit a list of at least ten commercial/industrial buildings on which the thermographer has performed IR thermography in the past two years. The thermographer is to have a current active certification. Submit certification at least 60 days prior to thermography testing.

1.6.3 Test Instruments And Date Of Last Calibration

Submit a signed and dated list of test instruments, their application, manufacturer, model, serial number, range of operation, accuracy and date

of most recent calibration.

1.7 CLIMATE CONDITIONS SUITABLE FOR A PRESSURE TEST

As the test date approaches, monitor the weather forecast for the test site. Avoid testing on days forecast to experience high winds, rain, or snow. Monitor weather forecasts prior to shipping pressure test equipment to the site. Preferred ambient weather test conditions as stated in ASTM E779 are 0 to 4 mph winds and an ambient temperature range of 41 - 95 degrees F. Based on current and forecast weather conditions, the Contracting Officer's representative is to grant final approval for testing to occur.

1.7.1 Rain

Rain can temporarily seal roof and wall assemblies so that they leak less than under no-rain conditions. Do not test during rain or if rain is anticipated during testing. If pneumatic hoses are installed and exposed to rain inspect the hose to insure rainwater has not migrated into the hose ends. Orient all exposed hose ends to keep them out of water puddles. Success in temporarily sealing outdoor ventilation components such as louvers and exhaust fans may also be compromised by rain. Don't seal roof-mounted ventilation components during times of potential lightning.

1.7.2 Snow

Snow piled against a wall or on top of a roof can make a building envelope appear to be more airtight than it actually is. Snow may also impact thermography readings. Remove snow from around and on top of the building prior to testing.

1.7.3 Wind

Because wind can skew pressure test results, test only on days and at times when winds are anticipated to be the calmest. Avoid pressure testing during gusty or high wind conditions.

PART 2 PRODUCTS

2.1 PRESSURE TEST EQUIPMENT

Depending on site conditions and size of the envelope, the test may be conducted using blower door equipment and/or trailer-mounted fans or the building's own supply air system. The testing agency is to supply sufficient quantity of blower equipment that will produce a minimum of 75 Pa differential pressure between the envelope and outdoors using the test methods described herein. Supplying additional blower test equipment to provide additional airflow capacity or to act as a backup is highly recommended.

2.1.1 Blower Door Fans and Trailer Mounted Fans

Each air flow measuring system including blower door fans and trailer mounted fans are to be calibrated within the last 3 years in accordance with ASTM E1827. Calibrated blower door fans and trailer mounted fans must measure accurately to within plus or minus 5 percent of the flow reading. Blower door equipment and trailer mounted fans are to be specifically designed to pressurize building envelopes. Each set of

blower door equipment is to include fan(s), digital gage(s), door frame, door fabric or hard panels.

2.1.2 Digital Gages as Test Instruments

Use only digital gages as measuring instruments in the pressure test; analog gages are not acceptable. The gauges must be accurate to within 1.0 percent of the pressure reading or 0.15 Pa, whichever is greater. Each gage is to have been calibrated within two years of the test. The calibration is to be checked against a National Institute of Standards and Technology (NIST, formerly National Bureau of Standards) traceable standard.

2.2 THERMAL IMAGING CAMERA REQUIREMENTS

The thermal imaging camera used in the thermography test must have a thermal sensitivity (Noise Equivalent Temperature Difference.) of +/- 0.18 degrees F at 86 degrees F or less. Ensure the camera's operating spectral range falls between 2 and 15 micrometers. Ensure the camera's IR image viewing screen resolution measures at least 240x180 pixels. Ensure the camera has a means of recording thermal images seen on the camera viewing screen. The camera is to display output as individual still frame images that also can be downloaded and inserted into an electronic Thermographic Investigation Report. Submit camera make and model, and catalog information that defines the camera thermal sensitivity for approval.

PART 3 EXECUTION

3.1 PRESSURE TEST AGENCY

The test agency is to be an independent third party subcontractor, not an affiliated or subsidiary of the prime contractor, subcontractors or A/E firm. The agency is to be regularly engaged in pressure testing of commercial/industrial building envelopes. If using blower door or trailer-mounted fans, the lead test technician must have at least two years of experience in using such equipment in building envelope pressurization tests. Formal training using pressure test equipment is highly recommended. Technicians using the building's air handling system for pressure testing are to have tested at least five commercial/industrial buildings within the past two years with each building having over 50,000 square feet of floor area. Submit the name, address and floor areas of each of these five buildings for approval.

3.1.1 Field Work

The lead pressure test technician and thermographer are to be present at the project site while testing is performed and is to be responsible for conducting, supervising, and managing of their respective test work. Management includes health and safety of test agency employees.

3.1.2 Reporting Work

The lead pressure test technician is to prepare, sign, and date the test agenda, equipment list, and submit a certified Air Leakage Test Report. The thermographer is to prepare, sign, and date the test agenda, equipment list, and submit a certified Thermographic Investigation Report. The contractor is to prepare a final report that identifies improvements that were made to the envelope to reduce leaks, mitigate thermal bridging, eliminate moisture migration, repair insulation voids discovered during

diagnostic tests. Jointly submit all reports.

3.2 ENVELOPE SURFACE AREA CALCULATIONS

The architectural air barrier boundary includes the floor, walls, and ceiling. After construction of the air barrier envelope is complete, field measure the envelope to ensure the physical measurements match the design drawings and the air barrier envelope surface area calculations. If the measurements are not consistent with the defined air barrier boundary as indicated, re-calculate the envelope surface area and submit the envelope surface area calculation and results for review.

3.3 PREPARING THE BUILDING ENVELOPE FOR THE PRESSURE TEST

3.3.1 Testing During Construction

The pressure test cannot be conducted until all components of the air barrier system have been installed. After all sealing as described herein has been completed, inspect the envelope to ensure it has been adequately prepared. During the pressure test, stop all ongoing construction within and neighboring the envelope which may impact the test or the air barrier integrity. The pressure test may be conducted before finishes that are not part of the air barrier envelope have been installed. For example, if suspended ceiling tile, interior gypsum board or cladding systems are not part of the air barrier the test can be conducted before they are installed. Recommend testing prior to installing the finished ceilings within the envelope and immediately surrounding it. The absence of finished ceilings allows for inspection and diagnostic testing of the roof/wall interface and for implementation of repairs to the air barrier, if necessary to comply with the maximum allowed leakage.

3.3.2 Sealing The Air Barrier Envelope

Seal all penetrations through the air barrier. Unavoidable penetrations due to electrical boxes or conduit, plumbing, and other assemblies that are not air tight are to be made so by sealing the assembly and the interface between the assembly and the air barrier or by extending the air barrier over the assembly. Support the air barrier so as to withstand the maximum positive and negative air pressure to be placed on the building without displacement or damage, and transfer the load to the structure. Durably construct the air barrier to last the anticipated service life of the assembly and to withstand the maximum positive and negative pressures placed on it during pressure testing. Do not install lighting fixtures that are equipped with ventilation holes through the air barrier.

3.3.3 Sealing Plumbing

Prime all plumbing traps located within the envelope full of water.

3.3.4 Close and Lock Doors

Close and lock all doors and windows in the envelope perimeter. For doors not equipped with latching hardware, temporarily secure them in the closed position. Secure the doors in such a way that they remain fully closed even when the maximum anticipated differential air pressure produced during the test acts on them.

3.3.5 Hold Excluded Building Areas at the Outdoor Pressure Level

Keep building areas immediately surrounding but excluded from the test envelope at the outdoor pressure level during the pressure test. Maintain these areas at the outdoor pressure level by propping exterior doors open, opening windows and de-energizing all air moving devices in or serving these areas.

3.3.6 Maintain an Even Pressure within the Envelope

Ensure the pressure differences within the envelope are minimized by opening all internal air pathways including propping open all interior doors. Distribute test fans throughout the envelope as necessary to ensure the internal pressures are uniform (within 10 percent of the average differential pressure). Ideally, do not install suspended ceilings until after all pressure tests have been completed. If, however the envelope includes finished suspended ceiling spaces, temporarily remove approximately 5 percent of all ceiling tiles or a minimum of 1 tile from each isolated suspended ceiling space, whichever comprises the greatest surface area. Temporarily remove additional ceiling tiles during testing to allow for inspection and diagnostic testing of the ceiling/wall interface.

3.3.7 Maintain Access to Mechanical and Electrical Rooms

Maintain access to mechanical rooms and electrical rooms associated with the envelope to allow for de-energizing ventilation equipment and resetting circuit breakers tripped by blower door equipment, if used.

3.3.8 Minimize Potential for Blowing Dust and Debris

Because high velocity air will be blown into and out of the envelope during the test, debris, including dust and litter, may become airborne. Airborne debris may become trapped or entangled in test equipment, thereby skewing test results. Ensure areas within and surrounding the envelope are free of dust, litter and construction materials that are easily airborne. If pressurizing existing, occupied areas, provide adequate notice to building occupants of blowing dust and debris, and general disruption of normal activities during the test.

3.3.9 De-energize Air Moving Devices

De-energize all air moving devices serving the envelope to keep air within the envelope as still as reasonably achievable. De-energize all fans that deliver air to, exhaust air from, or recirculate air within the envelope. Also de-energize all fans serving areas adjacent to but excluded from the envelope.

3.3.10 Installing Blower Door Equipment in a Door Opening

Where blower door fans are used, before installing blower door equipment, select a door opening that does not restrict air flow into and out of the envelope and has at least 5 feet clear distance in front of and behind the door opening. Disconnect the door actuator and secure the door open to prevent it from being drawn into the fan by fan pressure.

3.4 BUILDING ENVELOPE AIR TIGHTNESS REQUIREMENT

For each building envelope, perform two pressure tests; the Architectural

Only test and the Architectural Plus HVAC System test. The purpose of the pressure (air leakage) test is to determine final compliance with the airtightness requirement by demonstrating the performance of the continuous air barrier. An effective air barrier envelope minimizes infiltration and exfiltration through unintended air paths (leaks). The tests may be performed in any desired order.

3.4.1 Architectural Only Test

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

3.4.1.1 Test Goal

Input data from the test into the Air Leakage Rate by Fan Pressurization spreadsheet as described in paragraph CALCULATION PROGRAM via the Air Leakage Test Form. Compare output from the spreadsheet against the maximum allowable leakage defined in Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM. The envelope passes the test if the leakage rate, as calculated using the spreadsheet, is equal to or lower than the Architectural Only leakage rate goal.

3.4.1.2 Preparing The Envelope For The Pressure Test - Seal All Openings Through The Air Barrier

Temporarily close all perimeter windows, roof hatches and doors in the envelope perimeter except for those doors that are to remain open to accommodate blower door or trailer mounted fan test equipment installation. Seal, or isolate all other intentional openings, pathways and fenestrations through the architectural envelope prior to pressure testing. Follow the Recommended Test Envelope Conditions identified in ASTM E1827, Table 1, for the Closed Envelope condition. These openings may include boiler flues, fuel-burning water heater flues, fuel-burning kitchen equipment, clothes dryer vents, fireplaces, wall or ceiling grilles, diffusers etc. Before sealing flues, close their associated fuel valves and verify the associated pilot lights are extinguished. Prime all plumbing traps located within the envelope full of water. In lieu of applying tape and/or plastic, Typical temporary sealing materials include tape and sheet plastic or a self-adhesive grille wrap. Use and apply tape and plastic in a manner that does not deface or remove paint or mar the finish of permanent surfaces. Be especially aware of residue that remains from tape applied to stainless steel surfaces such as kitchen hoods or rollup doors. For painted surfaces, use tape types that do not remove finish paint when the tape is removed. If paint is removed from the finished surface, repaint to match existing surfaces. Secure dampers closed either manually or by using the building's HVAC system controls. Use the table below for further guidance in building preparation.

Building Component	Envelope Condition
Air handling units, duct fans	As found (open) or temporarily sealed as necessary
Clothes dryer	Off

Building Component	Envelope Condition
Clothes dryer vents	Temporarily sealed
Dampers - intake, exhaust	Physically closed or closed using control power or temporarily sealed
Diffusers, registers, grilles within the envelope	Temporarily sealed
Doors, personnel type, at the envelope perimeter	Secured closed
Doors, personnel type, within the envelope	Secured (propped) open
Doors, roll-up type, at the envelope perimeter	Closed (no additional sealing)
Exhaust hoods	Closed* and temporarily sealed
Fireplace hearth	Temporarily sealed *
Kitchen hoods	Temporarily sealed *
Pilot light and associated fuel valve	Extinguished and closed, respectively
Vented combustion appliance	Temporarily sealed *
Vented combustion appliance exhaust flue	Off
Windows	Secured closed
* If the building component has an associated manual or automatic damper, consider securing the damper closed in lieu of temporarily sealing.	

3.4.2 Architectural Plus HVAC System Test

This test envelope includes the architectural air barrier boundary as defined on the contract drawings plus all HVAC supply, return and exhaust systems that penetrate and terminate within said architectural air barrier boundary and that extends outward from said boundary. All associated ductwork, intake and exhaust dampers, and air moving devices, including air handling units and fans, are included in this test envelope even if they are physically located outside of the architectural air barrier boundary. The boundary extends to and includes the low leakage intake and exhaust dampers. Perform both a positive pressure test and a negative pressure test on this envelope, unless otherwise indicated.

3.4.2.1 Test Goal

Data from the test is to be input into the Air Leakage Rate by Fan Pressurization spreadsheet as described in paragraph CALCULATION PROGRAM via the Air Leakage Test Form. If both a positive and negative pressure tests were performed, both data sets are together to be input in the spreadsheet. Compare output from the spreadsheet against the leakage rate goal. The envelope passes the test if the leakage rate, as calculated using the spreadsheet, is equal to or lower than the Architectural Plus HVAC System leakage rate goal.

3.4.2.2 Preparing the Building for the Pressure Test

In preparation of this test, de-energize all air moving devices within this envelope by putting their controls in the Unoccupied mode. This allows the building's HVAC controls to close all associated motorized intake, exhaust, and relief dampers. Make no other changes to the HVAC systems. Temporarily sealing diffusers, grilles, registers, kitchen hoods, exhaust hoods, fans, air handling units and all other HVAC system elements with tape and/or plastic sheeting or any other means is not allowed. If the envelope includes a fireplace hearth do not seal it with tape and plastic. Use the table below for further guidance in building preparation.

Building Component	Envelope Condition
Air handling units, duct fans	As found (open)
Clothes dryer	Off
Clothes dryer vents	As found (no preparation)
Dampers - intake, exhaust	As found (no preparation)
Diffusers, registers, grilles within the envelope	As found (open)
Doors, personnel type, at the envelope perimeter	Secured closed
Doors, personnel type, within the envelope	Secured (propped) open
Doors, roll-up type, at the envelope perimeter	Closed (no preparation)
Exhaust hoods	Closed
Fireplace hearth	As found (open)
Kitchen hoods	As found (open)
Pilot light and associated fuel valve	Extinguished and closed, respectively
Vented combustion appliance	Off
Vented combustion appliance exhaust flue	As found (open)
Windows	Secured closed

3.5 CONDUCTING THE PRESSURE TEST

Notify the Contracting Officer at least 10 working days before conducting the pressure tests to provide the Government the opportunity to witness the tests and to monitor weather forecasts for conditions favorable for testing. Do not pressure test until verifying that the continuous air barrier is in place and installed without failures in accordance with installation instructions. During the pressure test periodically inspect

temporarily sealed items to ensure they are still sealed. Seals on temporarily sealed items tend to release more readily at higher pressures. Test data obtained after temporarily sealed items become unsealed cannot be used as input into the calculation program. Follow the Envelope Pressure Test Procedures in the paragraphs below. Submit detailed pressure test procedures indicating the test apparatus, the test methods and procedures, and the analysis methods to be employed for the building envelope pressure (air tightness) test. Submit these procedures not later than 60 days after Notice to Proceed.

3.5.1 Extend Pneumatic Tubes and Establish a Reference Differential Pressure

Confirm the various zones within the envelope have a relatively uniform interior pressure distribution by establishing a representative differential pressure between the envelope and the outdoors with blower door or trailer-mounted fans operating. The number of indoor pressure difference measurements (pneumatic hoses) required depends on the number of interior zones separated by bottle necks that could create significant pressure drops (e.g. doorways and stairwells). Extend at least four pneumatic hoses (differential pressure monitoring ports) to locations within the envelope that are physically opposite of each other. In multiple story buildings, especially those over three stories, extend hoses to multiple floors. Locate the hose ends away from the effects of air discharge from blower test equipment. Select one of the four (or more) interior hoses, one judged by the test agency to be the most unaffected by air velocity produced by blower test equipment, to serve as the interior reference pressure port. Extend at least one additional pneumatic hose to the outdoors (outdoor pressure port). To the end of this hose manifold at least four hoses together and terminate each hose on a different side of the building. With the envelope sealed and the blowers energized, measure the differential pressure using the interior reference pressure port and the four outdoor pressure ports. Then measure and record the differential pressure by individually using each of the remaining three interior hoses. Ensure each reading is within plus or minus 10 percent of the reference reading. Thus at an average 75 Pa maximum pressure difference across the envelope, the difference between the highest and lowest interior pressure difference measurements should be 15 Pa or less. If this condition cannot be met, attempt to create additional air pathways within the envelope to minimize pressure differences within the envelope. If necessary, move the interior hose ends. See step 2.13 of the Air Leakage Test Form in Appendix A.

3.5.2 Bias Pressure Readings

With the fan pressurization equipment de-energized and the envelope sealed, obtain the differential pressure between the outdoors and the envelope. Record 12 bias pressure readings before the pressure test and 12 bias pressure readings after the pressure test. Each reading is the average of ten or more 1-second measurements. Include positive and negative signs for each reading. To help dampen bias pressures that significantly contribute to test pressure, reduce temperature differences between indoor and outdoor air. Temperature differences can be reduced by operating test fan equipment for a few minutes to replace most of the indoor air with outdoor air.

3.5.3 Testing in Both Positive and Negative Directions

The preferred method for testing a building envelope is to test in both

the pressurized and depressurized directions. Testing in one direction is only allowed if opposite direction testing cannot logistically be performed due to test equipment limitations or restrictions. After obtaining the pre-test bias differential pressure readings, conduct the pressure test. Record the envelope pressures (in units of Pascals) from one interior pneumatic hose (monitoring port) and the outdoor pneumatic hose(s), averaged or manifolded, with corresponding flows (in units of cfm) for each fan. Record the flow rates at at least 10 to 12 positive and 10 to 12 negative building pressure readings. If conducting both positive and negative pressure tests the lowest allowable test pressure is 40 Pa and the highest test pressure is 85 Pa. Keep at least 25 Pa difference between the lowest and highest test pressure readings. Include the 75 Pa pressure value between the lowest and highest readings. The 10 to 12 readings in each direction are to be roughly evenly spaced along the range of pressures and flows. After testing is complete de-energize the equipment used to provide pressurization and obtain an additional 10 to 12 post-test bias pressure readings. None of the bias pressure readings are allowed to exceed 30 percent of the minimum test pressure. If these limits are exceeded the test fails and must be repeated.

3.5.4 Single Direction Testing

After obtaining the 12 aforementioned bias pressure readings, conduct the positive pressure test. Obtain flow rates at 10 to 12 roughly evenly spaced pressure readings over a pressure range of 50 to 85 Pa. After the data is recorded, de-energize the blower equipment and obtain an additional 10 to 12 bias pressure readings. None of the bias pressure readings may exceed 10 percent of the minimum test pressure. If these limits are exceeded the test fails.

3.5.5 Using a Building's Own Air Handling System to Pressure Test an Envelope

3.5.5.1 Test Setup

Temporarily seal the envelope in a manner similar to that for testing with blower door or trailer-mounted fans. To positively pressurize the envelope, de-energize all ventilation equipment and close all associated dampers, except those outside air intake dampers associated with supply fans that will be used to pressurize the building envelope. Fully open these dampers. For the negative pressure test, de-energize all ventilation equipment except for those fans that will be used to de-pressurize the envelope. All dampers associated with de-energized fans are to be closed and all exhaust dampers associated with fans used to de-pressurize the envelope will be fully opened.

3.5.5.2 Measuring Airflows

When using the building's own air handling system to pressure test the envelope, air flows can generally be measured using one of the following methods:

- a. Pitot tube or hot wire anemometer traverse in accordance with ASTM D3464.
- b. Pressure compensated shrouds (especially recommended for rooftop exhaust fans)
- c. Tracer gas methods for measuring airflows in ducts in accordance with

ASTM E2029. Do not use tracer gas decay, constant injection and constant concentration methods for estimating the total ventilation rate of the envelope.

3.5.5.3 Outdoor Air Flow Measuring Stations

Air flow stations may be used to measure outdoor airflows if one of the above methods is used to check accuracy of at least one air flow reading for each station or if the design of the HVAC system specifically placed outdoor air flow stations in locations that will yield accurate results. Field verify the accuracy of readings at the air flow measuring stations before obtaining pressure test readings.

3.5.6 Pressure Testing - Special Cases

3.5.6.1 Pressure Testing a Tall or Large Building Envelope

Pressure testing the envelope of a tall or large building may be unworkable and unrealistic using blower door or trailer-mounted equipment. In this case, the test agency may define and pressure test separate zones or floors within the envelope and sum the leakage of all of the zones to create an overall envelope leakage rate. Using this method, the test agency is to comply with the requirements of ASHRAE RP-935.

3.5.6.2 Pressure Testing a Multiple Isolated Zoned Building

Pressure test each exterior corner zone plus at least an additional 20 percent (as measured by floor area) of remaining zones. The Contracting Officer is responsible for selecting which of these additional zones to test. If all zones pass the pressure test it is assumed that all untested zones also pass and no further testing is required. If, however, any zone fails to pass the test's leakage requirements, re-seal and re-test until it passes in accordance with paragraph FAILED PRESSURE TEST. Test an additional 20 percent of previously untested zones. If all tested zones pass, no further testing is needed. If any zone in this group fails the test re-seal and re-test the zone until it passes. Continue this process until all the tested zones pass. When testing a zone, the doors to all adjacent zones that share a common surface with the tested zone are to have their doors opened to the outdoors. The resulting leakage from the test zoned is that through all 6 surfaces (4 walls, roof and floor, for a rectangular shaped zone).

3.5.7 Failed Pressure Test

If the pressure test fails to meet the established criteria, use diagnostic test methods described in paragraph LOCATING LEAKS BY DIAGNOSTIC TESTING to discover the leak locations. Provide additional permanent sealing measures to reduce or eliminate leak sources discovered during diagnostic testing. Retest (perform another pressure test) after sealing has been completed. Repeat this sequence of documenting test results in the test report, performing diagnostic tests, documenting recommendations for additional sealing measures in the test report, sealing leak locations per recommendations, and re-testing as necessary until the building envelope passes the pressure test and is in compliance with the performance requirements.

3.5.8 Air Leakage Test Report

Report volumetric flow rates and corresponding differential pressures in

cubic feet per minute (cfm) and Pascals (Pa), respectively, on the Air Leakage Test Form sample form found in Appendix A. Populate the accompanying spreadsheet file entitled Pressure Test Data Analysis with information obtained during the test. The spreadsheet uses equations found in ASTM E779 as a basis for calculating the envelope leakage rate. Other similar leakage rate calculation programs cannot be used or submitted for review. Submit a printout of the data input and output in the report. Should any air tightness (pressure) test fail, the pressure test report is to include data and results from all previous failed tests along with the final successful test data and results. Indicate if the resulting leakage rate did or did not meet the goal leakage requirement. Identify and document deficiencies in the building construction upon failure of a test to meet the specified maximum leakage rate.

Include the Test Agency Qualification Sheet, Air Leakage Test Form and Air Leakage Test Results Form in the written report. Document every test set-up condition with diagrams and photos to ensure the tests can be made repeatable. Document all pneumatic hose termination locations. Record in detail how the building envelope was prepared for the tests. Also describe in detail which building items were temporarily sealed. Include photos of test equipment and sealing measures in the report. Include an electronic (pdf) version of all test reports on a CD. If the building envelope fails to meet the leakage rate goal, provide recommendations to further seal the envelope and document these recommendations in the test report.

3.6 LOCATING LEAKS BY DIAGNOSTIC TESTING

Use diagnostic test methods described herein to discover obvious leaks through the envelope. Perform diagnostic tests on the building envelope regardless of the envelope meeting or failing to meet the designated leakage rate goal. Use diagnostic test methods in accordance with ASTM E1186 and in conjunction with pressurization equipment as necessary. Use the thermography diagnostic test to establish a baseline for envelope leakage. Apply additional diagnostic tests (find, feel, fog or other tests) as necessary to further define leak locations and pathways discovered using thermography or to find additional leaks not readily detected by thermography. Using a variety of diagnostic tests may help locate leaks that would otherwise go undetected if only a single diagnostic test were used. Pay special attention to locating leaks at interfaces where there is a change in materials or a change in direction of like materials. These interfaces, at a minimum, include roof/wall, wall/wall, floor/wall, wall/window, wall/door, wall/louver, roof mounted equipment/roof curb interfaces and all utility penetrations (ducts, pipes, conduit, etc) through the envelope's architecture. Also use diagnostic tests to check for leakage between the air duct and duct damper, when the damper, under normal control power, is placed in the closed position. Should leaks be discovered during diagnostic tests, thoroughly document their exact locations on a floor plan so that sealing can be later applied, if required or as directed. If the envelope passes the leakage test, use the diagnostic test procedure described above to identify obvious leakage locations. Seal the leaks at the discretion of the COR based on the magnitude, location, potential for liquid moisture penetration or retention, potential for condensation, presence of daylight through an architectural surface or if the leakage location could potentially cause rapid deterioration or mold growth of, or in the building envelope materials and assemblies. Apply sealing measures after diagnostic testing is complete and all pressurization blowers are off. To verify that the applied sealing measures that are effective, re-test for

leaks using the same diagnostic methods that discovered the leak. Reseal and retest until the envelope meets the leakage rate goal and all obvious leaks through the envelope are sealed.

3.6.1 Find Test

Use visual observation to locate daylight and/or artificial light streaming from the opposite side of the envelope. Observe all interfaces identified above.

3.6.2 Feel Test

Use the building's air handling system or blower door equipment to negatively pressurize the building envelope, to at least 25 Pa but no greater than 85 Pa, with respect to the outdoors. The larger the pressure difference, the easier discovering leaks by feeling them becomes. While inside the envelope, hand feel roof/wall, wall/wall, and floor/wall interfaces and utility penetrations (ducts, pipes, conduit, etc) for leaks and note the leak locations on a floor plan. The "Feel" test may also be used to check for leaks between the ductwork and ductwork damper. To do this, positively pressurize the envelope and check for air movement from the envelope exterior.

3.6.3 Infrared Thermography Test

Avoid performing thermography tests just after pressure testing the building envelope (pressurizing and/or depressurizing the building envelope) as thermography readings may be inaccurate due to excessive air-wash. Perform thermography either before the pressure test or wait an appropriate amount of time after pressure test completion for the temperatures within the building envelope to stabilize before starting the thermography tests. Coordinate thermography examination with the pressure test agency and the test agency's pressurization equipment. The pressure test agency is to allow adequate time for the thermographer to perform a complete thermographic examination, as described hereinafter, of the envelope interior and exterior.

3.6.3.1 Thermography Test Methods

Before thermographic testing, remove furniture, construction equipment, and all other obstructions both inside and outside the building as necessary to gain a clear field of view. In the Thermographic Investigation Report, document all areas where obstructions remain. For exterior thermal examination of the envelope, verify that no direct solar radiation has heated the envelope surfaces to be examined for a period of approximately 3 hours for frame construction and for approximately 8 hours for masonry veneer construction. Conduct exterior investigations after sunset, before sunrise, or on an overcast day when the influence of solar radiation can be determined to be minimal. Limit exterior examinations to times when the influence of solar radiation is minimal, such as after sunset or before sunrise or during an overcast day. Conduct thermal imaging tests only when wind speeds are less than 8 mph at the time of analysis and at the end of analysis. Document any variations in wind during the test. Document all variations of test conditions in the Thermographic Investigation Report. Test only when exterior surfaces are dry. Monitor and document ongoing test parameters, such as the temperatures inside and outside the air barrier envelope, wind speed, and differential pressure.

3.6.3.1.1 Thermography Testing of the Air Barrier

Test the building envelope in accordance with ISO 6781, and ASTM E1186. Perform a complete thermographic inspection consisting of the full inspection of the interior and exterior of the complete air barrier envelope. Document envelope areas that are inaccessible for testing. Use infrared thermography technology in concert with standard pressurization methods (blower doors, trailer mounted fans and/or the building's own air handling systems) to locate leaks through the air barrier. Because thermography works best with at least a 18 degree F temperature difference between the envelope interior and the exterior, adjust the HVAC system, if possible, to create or enhance this temperature difference. The minimum allowable temperature difference is 3 degrees F. Maintain this temperature difference for at least 3 hours prior to the test. Use pressurization methods to establish a minimum of +20 Pa pressure difference with respect to the outdoors while using an infrared camera to view the envelope from outdoors. When viewing with the camera from inside the envelope, keep the envelope at a pressure differential of -20 Pa with respect to the outdoors using pressure testing equipment or the building's own air handling system.

3.6.3.1.2 Thermography Testing of the Insulation Envelope to Find Insulation Voids (Qualitative Test)

After installation of the insulation envelope is complete, use thermography to identify anomalies (insulation voids) in this envelope. Test only when the temperature difference between inside and outside wall surfaces and as defined by the surface being imaged is a minimum of 18 degrees F or greater for a period of 4 hours before the test. Alternatively, the thermographer is to verify and document in the Thermographic Investigation Report that the imaging system is capable of providing satisfactory results with less temperature difference between inside and outside. Test during a time when there is no more than 0.05 inches differential pressure across the insulation envelope. Document the location of the voids on floor plans or wall sections.

3.6.3.1.3 Thermography Testing of Thermal Bridging

Take sample thermal images of representative parts of the building envelope being examined and analyze to demonstrate the majority of areas with anomalies or identifiable thermal features. Also sample thermal bridges in parts of the building that have no apparent anomalies to demonstrate the correct functioning of building components.

3.6.3.2 Thermography Test Results

Document the location of all leaks, anomalies, and unusual thermal features on a floor plan and/or elevation view and catalog them with a visible light picture for locating the defect for correction. The thermographer is to recommend corrective actions to eliminate the leaks, anomalies and unusual thermal features. Where leaks are found perform corrective sealing as necessary to achieve the whole envelope air leakage rate specified. After sealing, again use thermography in concert with standard pressurization methods to verify that the air leakage has been reduced. After these leaks have been permanently sealed note all actions taken on the drawings or in the Thermographic Investigation Report. Submit the drawings for approval as part of the Thermographic Investigation Report. Also include thermographic photos that show where leaks were discovered. Include thermograms using an imaging palette that

clearly shows the observed thermal patterns indicating air leakage. The Contracting Officer's Representative is to witness all testing.

3.6.4 Fog Test

Before using a theatrical fog generator, disable all building smoke detectors as they may alarm when fog is issued. Coordinate fog tests and the disabling of all smoke detectors with the Contracting Officer's representative and the local fire department as necessary. Use pressure test equipment or the buildings own air handling system to positively pressurize the building envelope to at least 25 Pa but not greater than 85 Pa over the outdoors. Using a theatrical fog generator within the envelope, direct fog at suspected leakage points such as at building interfaces. Test the following interfaces: roof/wall, wall/wall, floor/wall, wall/window, roof/ mounted mechanical equipment. From the vantage point immediately outside the envelope and opposite that of the interface being tested, observe the effect as the fog is issued. Detection may also be further enhanced by using a scented fog liquid or a fog liquid that produces a colored fog. Look for fog and smell for associated odor percolating through the interface. Also use smoke puffers and smoke sticks as necessary to locate leaks at these and other interface locations. If the Architectural Plus HVAC System pressure test will be/was performed introduce fog into ductwork to check for leakage between ductwork and associated dampers. After fog testing has ended, reactivate the building smoke detectors and notify the Contracting Officer and local fire department that the test has ended. After sealing has been completed retest these areas using fog. Seal additional leaks that are found.

3.6.5 Diagnostic Test Report

Once the diagnostic tests have been completed and the leakage locations identified and sealed, document these procedures, locations and recommendations in the diagnostic test report. Submit plan and/or profile drawings that thoroughly identify leak locations. Describe in detail all leak locations so that the seal-up crew knows where to apply sealing measures. After sealing measures have been applied, describe the methods used along with applicable photos of the final sealed condition.

3.6.5.1 Thermographic Investigation Report

Submit a report of each thermographic investigation identifying the thermal discontinuities in the thermal control layer. Indicate in the final report locations to which improvements for both the air control layer and the thermal control layer were made to reduce air leaks and correct discontinuities in the thermal control layer. Include in the report some selected radiometric images of suspected failure points in the air barrier envelope that indicate before and after conditions. Devote a chapter(s) of the Thermographic Investigation Report to identifying suspected points of thermal bridging, moisture migration through roofs and walls, and insulation voids. Indicate in the final report improvements that were made to the envelope to reduce air leaks, correct wet roof and wall areas, and repair insulation. Include the following items in the report:

- a. Brief description of the building construction
- b. Types of interior and exterior surface materials used in the building.
- c. Geographical orientation of the building with a description of the

exterior surroundings including other buildings, vegetation, landscaping, and surface water drainage.

- d. Camera brand, model and serial number, and date of most recent calibration date; optional lenses with serial numbers (if applicable)
- e. Thermographer's and Government Inspector's names
- f. Date and time of tests
- g. Air temperature and humidity inside the air barrier envelope
- h. Outdoor air temperature and humidity
- i. General information for the last 12 hours on the solar radiation conditions in the geographic area where the test is being performed.
- j. Ambient conditions such as precipitation and wind direction and speed occurring with the last 24 hours, as applicable. Refer to specific requirements in each section of each thermographic inspection type for requirements in each specific area.
- k. Documentation of those portions of the building envelope which were not within test conditions when the scan was performed and which portions were obstructed by adjacent structures, interior furnishings, intervening cavities or reflective surfaces.
- l. Other relevant information, which may have influenced test results.
- m. Drawings, sketches, floor plans and/or photographs detailing the locations in the buildings where thermograms were taken detailing possible irregularities in the components being tested.
- n. Thermal images taken during the inspection with their relative locations and written or voiced recorded explanations of the anomaly listed along with visual and reference images.
- o. An identification of the aspects or components of the building being examined.
- p. Explanations for the type and the extent of each construction defect observed during the inspection.
- q. Any results from additional measurements and investigations. Identify additional equipment used and support with type, model number, serial number and date of most recent calibrated.

3.6.5.2 Fog Test Report

Document all turbulent air flow and dead air spaces within the envelope. Report fog behavior as it exits from and/or is entrained within the building. Include a floor plan in the report that documents the locations where fog passed through the envelope.

3.7 CALCULATION PROGRAM

To calculate the envelope leakage rate and other required outputs, input the data obtained during the pressure tests as documented in the Air Leakage Test Form (Appendix A) into the Air Leakage Rate by Fan

Pressurization Excel spreadsheet. This spreadsheet can be found at the following web site:
<http://www.wbdg.org/FFC/DOD/unified-facilities-guide-specifications-ufgs/forms-graphics-tables>.

3.8 AFTER COMPLETION OF THE PRESSURE AND/OR DIAGNOSTIC TEST

After all pressure and/or diagnostic testing has been completed unseal all temporarily sealed items. Unless otherwise directed by the Contracting Officer, return all dampers, doors, and windows to their pre-test condition. Remove tape and plastic from all temporarily sealed openings, being careful not to deface painted surfaces. If paint is removed from finished surfaces, repaint to match existing surfaces. Unless otherwise directed by the Contracting Officer's representative, return fuel (gas) valves to their pre-test position and relight pilot lights. Return all fans and air handling units to pre-test conditions.

3.9 REPAIR AND PROTECTION

Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for testing, inspection, and similar services. Upon completion of inspection, testing, or sample taking and similar services, repair damaged construction and restore substrates and finishes, protect construction exposed by or for quality control service activities, and protect repaired construction.

3.10 APPENDICES

The following forms are available for download as a MS Word file at <http://www.wbdg.org/FFC/DOD/unified-facilities-guide-specifications-ufgs/forms-graphics-tables>.

Appendix A - Air Leakage Test Form
Appendix B - Air Leakage Test Results Form
Appendix C - Test Agency Qualifications Sheet

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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 D1187/D1187M	(1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM D1227	(2013) Emulsified Asphalt Used as a Protective Coating for Roofing
ASTM D4263	(1983; R 2012 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-07 Certificates

Materials

1.3 DELIVERY AND STORAGE

Deliver materials in sealed containers bearing manufacturer's original labels. Labels shall include date of manufacture, contents of each container, performance standards that apply to the contents and recommended shelf life. While in storage, do not allow water based bituminous dampproofing to freeze.

PART 2 PRODUCTS

2.1 EMULSION-BASED ASPHALT DAMPPROOFING

2.1.1 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.

2.1.2 Non-Fibrated Emulsion-Based Asphalt

Non-fibrated emulsion-based asphalt dampproofing shall be cold-applied type conforming to ASTM D1187/D1187M Type II or ASTM D1227 Type III, manufactured of refined asphalt, emulsifiers and selected clay. Asphalt shall contain a minimum 58 percent solids by weight, 55 percent solids by volume.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Remove or cut form ties and repair all surface defects as required in Section 03 30 00 CAST-IN-PLACE CONCRETE. Clean concrete 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.

3.2 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 dampproofing unless recommended otherwise by dampproofing materials manufacturer. Apply dampproofing after priming coat is dry, but prior to any deterioration of primed surface, and when ambient temperature is above 40 degrees F.

3.3.1 Cold-Application Method

3.3.1.1 Emulsion-Based Asphalt

Emulsion-based asphalt dampproofing work shall not be performed in temperatures below 40 degrees F. Emulsions shall have a smooth and uniform consistency at time of application. Dampproofing materials shall be applied in accordance with manufacturer's published instructions to produce a smooth uniform dry film of not less than 12 mils thick without voids or defects. Dull or porous spots shall be recoated. Dampproofing materials shall seal tightly around pipes and other items projecting through dampproofing. Rates of application shall be as follows:

- a. Primer: 1/2 gallon per 100 square feet, cold-applied.
- b. Fibrated Dampproofing: 2 gallons per 100 square feet, cold-applied with spray, brush or trowel.
- c. Non-fibrated Dampproofing: 2 gallons per 100 square feet, cold-applied with spray, brush or trowel.

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ELASTOMERIC SHEET WATERPROOFING
02/16

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM C1305	(2008) Standard Test Method for Crack Bridging Ability of Liquid-Applied Waterproofing Membrane
ASTM D146/D146M	(2004; E 2012; R 2012) Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing
ASTM D1876	(2008; R 2015; E 2015) Standard Test Method for Peel Resistance of Adhesives (T-Peel Test)
ASTM D41/D41M	(2011; R 2016) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D5385/D5385M	(1993; R 2014; E 2014) Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
ASTM D570	(1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
ASTM D903	(1998; R 2017) Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
ASTM E154/E154M	(2008a; R 2013; E 2013) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-03 Product Data

Manufacturer's Standard Details; G
Elastomeric Waterproofing Sheet Material; G
Protection Board; G
Primers, Adhesives, and Mastics; G

SD-06 Test Reports

Elastomeric Waterproofing Sheet Material; G
Field Quality Control documentation; G
Protective Covering; G

SD-07 Certificates

Elastomeric Waterproofing Sheet Material; G
Primers, Adhesives, and Mastics; G
Protective Coverings; G
Draft Special Warranties; G
Final Special Warranties; G
Certificates Of Compliance; G

SD-08 Manufacturer's Instructions

Primers, Adhesives, and Mastics; G

SD-11 Closeout Submittals

Certificates Of Compliance with sustainable requirements for items listed in SD-07; G

1.3 MANUFACTURER'S DETAILS

Submit manufacturer's standard details indicating methods of attachment and spacing, transition and termination details, and installation details. Include verification of existing conditions.

1.4 PRODUCT DATA

Include data for material descriptions, recommendations for product shelf life, requirements for protective coverings, and manufacturer's Safety Data Sheets (SDS) for primers, adhesives, and mastics.

1.5 DELIVERY, STORAGE, HANDLING, IDENTIFICATION

Deliver and store materials in accordance with manufacturer's printed instructions, out of the weather, in manufacturer's original packaging with brand name and product identification clearly marked. Keep materials wrapped and separated from off-gassing materials (such as drying paints and adhesives). Do not use materials that have visible moisture or biological growth. Do not permit unidentified materials in the work area or in the project.

1.6 ENVIRONMENTAL CONDITIONS

Do not apply waterproofing during inclement weather or when there is ice, frost, surface moisture, or visible dampness on the surface to receive waterproofing for when ambient and surface temperatures are 40 degrees F or below.

1.7 SPECIAL WARRANTIES

1.7.1 Guarantee

Guarantee waterproofing membrane installation against failure due to leaks for a period of two years from the date of Beneficial Occupancy. Submit draft and final guarantees in accordance with Section 01 78 00.00 37 CLOSEOUT SUBMITTALS.

1.7.2 Warranty

Provide manufacturer's material warranty for all system components for a period of ten years from the date of Beneficial Occupancy. Submit draft and final warranties in accordance with Section 01 78 00.00 37 CLOSEOUT SUBMITTALS.

PART 2 PRODUCTS

2.1 SUSTAINABILITY CRITERIA

Where allowed by performance criteria:

2.1.1 Reduced Volatile Organic Compound (VOC) Content

Provide products with reduced VOC content and provide certificates of compliance in accordance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph REDUCE VOLATILE ORGANIC COMPOUNDS.

2.1.2 Recycled Content

Provide products with recycled content and provide certificates of compliance in accordance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph RECYCLED CONTENT.

2.2 MATERIALS

Provide one of the types of elastomeric waterproofing sheet material and related primers, adhesives, and mastics as specified herein. Ensure compatibility of waterproofing materials with each other, and with materials on which they are applied. Provide materials that comply with applicable requirements cited below when tested in accordance with the

referenced ASTM publications.

2.3 COMPOSITE, SELF-ADHERING MEMBRANE SHEETING

Cold applied composite sheet consisting of rubberized asphalt and cross laminated, high density polyethylene film. Not less than 60 mils minimum thickness is required.

2.3.1 Composite, Self-Adhering Sheeting Performance Requirements

- a. Tensile Strength ASTM D412, Die C: 250 psi minimum.
- b. Ultimate Elongation, ASTM D412, Die C: 200 percent minimum.
- c. Water Vapor Transmission, ASTM E96/E96M 80 degrees F Permeance, Procedure B: 0.1 perm maximum.
- d. Pliability degrees, ASTM D146/D146M: (180 degrees Bend Over 1 Inch Mandrel): No cracks at minus minus 25 degrees F.
- e. Provide test report data for crack bridging ability: Either in accordance with ASTM C1305 as modified for a dry film thickness specified by the manufacturer and conducted at low temperature; or in accordance with a cycling over crack test also conducted for the specified dry film thickness at low temperature. Using either test, verify crack bridging up to 1/4 inch without damage to the membrane system.
- f. Puncture Resistance, ASTM E154/E154M REV A: 40 lb minimum.
- g. Lap Adhesion at Minimum Application Temperature, ASTM D1876 Modified, 5 lbs/in..
- h. Peel Strength, ASTM D903: Modified 9 lbs/in.
- i. Resistance to Hydrostatic Head, ASTM D5385/D5385M: 231 ft of water.
- j. Water Absorption, ASTM D570; 0.1 percent maximum.

2.3.2 Primers

Asphalt composition, ASTM D41/D41M, or synthetic polymer in solvent as recommended by the membrane manufacturer.

2.3.3 Mastics

Polymer modified asphalt in suitable solvent of trowel grade consistency and as recommended by the membrane manufacturer.

2.4 Protection Board

Provide protection board that is compatible with the waterproofing membrane. Use a minimum 1/2 inch thick fir bitumen impregnated board 1 inch for polystyrene 1/8 inch thick for vertical and 1/4 inch for horizontal premolded bituminous protection board as recommended by the manufacturer.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

Before starting the work, verify surfaces that must be waterproofed are in satisfactory condition. Notify the Contracting Officer of defects or conditions anticipated to prevent a satisfactory application. Do not start application until defects and conditions have been corrected.

3.2 SURFACE PREPARATION

Ensure surfaces to receive treatment are clean, dry, smooth, and free from deleterious materials and projections. Thoroughly wet holes, joints, cracks, and voids in concrete with water and fill with Portland cement mortar, strike flush, and permit to dry. Cut off high spots or grind smooth. Finish top surfaces of projecting masonry or concrete ledges below grade, except footings, to a steep bevel with Portland cement mortar. Sweep surfaces to receive covering before applying waterproofing to remove dust and foreign matter. Cure concrete by a method compatible with the waterproofing system.

3.3 APPLICATION

3.3.1 Building Envelope Requirements

Provide a continuous waterproofing system at all material and building transitions. Lap, wrap, fasten and seal products in accordance with manufacturer's printed instructions. Envelope assembly variations are not permitted without written approval from the Contracting Officer's Representative.

3.3.2 General Installation Requirements

Provide sheet waterproofing in accordance with manufacturer's printed installation instructions. Ensure the surface to receive membrane is clean, smooth and dry without surface irregularities; correct deficiencies prior to installation. When using solvent welding liquid, avoid prolonged contact with skin and breathing of vapor and provide adequate ventilation. Carry waterproofing of horizontal surfaces up abutting vertical surfaces and adhere solid to the substrate. Avoid wrinkles and buckles in applying membrane and joint reinforcement.

3.3.2.1 Self-Adhering Membrane

Apply composite, self-adhering membrane on surfaces primed at a uniform coverage rate in accordance with membrane manufacturer's printed instructions. Remove release sheet and apply with tacky surface in contact with dried primer.

3.3.2.2 Protection

Protect membrane over horizontal surfaces from traffic during installation. Use only equipment with rubber tires. Provide walkway protection where heavy traffic from other trades is expected. Do not store material on membrane.

3.4 COMPOSITE, SELF-ADHERING MEMBRANE

Lap sheets at edges and ends a minimum of 2-1/2 inches over the preceding

sheet. Provide all side laps a minimum 2-1/2 inches and end laps 5 inches. Provide self-adhesive, mastic laps in accordance with manufacturer's recommendation. Roll or firmly press to adhere membrane to substrate. Cover corners and joints with two layers of reinforcement by first applying a 12 inch width of membrane centered along the axis. Flash drains and projections with a second ply of membrane for a distance of 6 inches from the drain or projection. Finish exposed, terminated edges of membrane on horizontal or vertical surfaces with a toweled bead of mastic. Apply mastic around edges of membrane, and drains and projections. Apply mastic at end of each work day.

3.5 FLASHING

Flash penetrations through membrane. Seal all penetrations where reinforcing bars penetrate a waterproofing membrane with the appropriate sealant or mastic flashing component. Embed elastomeric membrane in a heavy coat of adhesive, except for self-adhering membrane. Position continuous metal reglets horizontally on footing and vertically on intersecting and connecting walls, and as specified in Section 07 60 00 FLASHING AND SHEET METAL. Metal reglets are to receive exposed edges of membrane waterproofing. Secure membrane into reglets by lead wedges and fill with cement as recommended in writing by manufacturer of waterproofing materials. Counterflash upper edge of membrane waterproofing and protective covering as specified in Section 07 60 00 FLASHING AND SHEET METAL.

3.6 FIELD QUALITY CONTROL

Notify the Contracting Officer 5 working days prior to date of performing tests. Before concealment, cover elastomeric waterproofing on horizontal surfaces over finished spaces with 3 inches of ponded water for 24 hours. Do not add water after start of 24 hour period. Accurately measure water level at beginning and end of 24 hour period. If water level falls, remove water and inspect waterproofing membrane. Make repairs or replacement as directed, and repeat test. Do not proceed with work that conceals membrane waterproofing before receiving approval and acceptance of the Contracting Officer.

3.7 PROTECTIVE COVERING

After installation has been inspected and approved by the Contracting Officer, apply a protective covering to the membrane waterproofing prior to backfilling. Protect vertical membrane waterproofing with a 1/2 inch minimum thickness of asphalt plank; 1/2 inch minimum thickness of fiberboard; or 1/8 inch minimum thickness of compatible water resistant bitumen type protection board with edges abutting adjacent edges and exposed surfaces covered by a taping system recommended by manufacturer of protection board. Cover horizontal membrane waterproofing with similar protection board and Portland cement mortar not less than 3/4 inch thick; place uniformly and allow to set before installing subsequent construction.

-- End of Section --

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BOARD AND BLOCK INSULATION

02/16

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-- End of Section Table of Contents --

SECTION 07 21 13

BOARD AND BLOCK INSULATION
02/16

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM C1289	(2017) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C272/C272M	(2016) Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions
ASTM C553	(2013) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C578	(2018) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C930	(2018) Standard Classification of Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D1621	(2016) Standard Test Method for Compressive Properties of Rigid Cellular Plastics
ASTM D3833/D3833M	(1996; R 2011) Water Vapor Transmission of Pressure-Sensitive Tapes
ASTM D4397	(2016) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E154/E154M	(2008a; R 2013; E 2013) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2015) International Building Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211 (2016) Standard for Chimneys, Fireplaces,
Vents, and Solid Fuel-Burning Appliances

NFPA 31 (2016) Standard for the Installation of
Oil-Burning Equipment

NFPA 54 (2018) National Fuel Gas Code

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2;
TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6;
TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10;
TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14;
TIA 17-15; TIA 17-16; TIA 17-17) National
Electrical Code

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

29 CFR 1910.134 Respiratory Protection

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-03 Product Data

Manufacturer's Standard Details; G

Block or Board Insulation; G

Vapor Retarder; G

Pressure Sensitive Tape; G

Protection Board or Coatings; G

Accessories including sealants; G

Environmental Product Declaration for Insulation; S

Material Ingredient Report for Insulation; S

Recycled Content; S

Emissions Testing Data; S

SD-07 Certificates

Block or Board Insulation; G

Vapor Retarder; G

Protection Board or Coating; G

Draft Special Warranties; G

Final Special Warranties; G

SD-08 Manufacturer's Instructions

Block or Board Insulation

Adhesive

1.3 MANUFACTURER'S DETAILS

Submit manufacturer's standard details indicating methods of attachment and spacing, transition and termination details, and installation details. Include verification of existing conditions.

1.4 PRODUCT DATA

Include data for material descriptions, recommendations for product shelf life, requirements for protection board or coatings, and precautions for flammability and toxicity. Include data to verify compatibility of sealants with insulation.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Deliver materials to the site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.5.2 Storage

Inspect materials delivered to the site for damage and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling. Keep materials wrapped and separated from off-gassing materials (such as drying paints and adhesives). Do not use materials that have visible moisture or biological growth. Comply with manufacturer's recommendations for handling, storage, and protection of materials before and during installation.

1.6 SAFETY PRECAUTIONS

1.6.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by the National Institute for

Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) and in accordance with 29 CFR 1910.134.

1.6.2 Other Safety Considerations

Comply with the safety requirements of ASTM C930.

1.7 SPECIAL WARRANTIES

1.7.1 Guarantee

Guarantee insulation installation against failure due to ultraviolet light exposure for a period of three years from the date of Beneficial Occupancy. Submit draft and final guarantees in accordance with Sections 01 78 00.00 37 CLOSEOUT SUBMITTALS.

1.7.2 Warranty

Provide manufacturer's material warranty for all system components for a period of three years from the date of Beneficial Occupancy. Submit draft and final warranties in accordance with Sections 01 78 00.00 37 CLOSEOUT SUBMITTALS.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

Provide the following:

Environmental Product Declaration for Insulation
Material Ingredient Report for Insulation
Recycled Content

Where allowed by performance criteria:

2.1.1 Emissions Testing Data

Provide products with reduced emissions and provide documentation in accordance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph REDUCE VOLATILE ORGANIC COMPOUNDS.

2.2 BLOCK OR BOARD INSULATION

Provide thermal insulating materials as recommended by manufacturer for each type of application indicated. Provide insulation with the following physical properties and in accordance with the following standards:

- a. Extruded Preformed Cellular Polystyrene: ASTM C578 REV A
- b. Faced Rigid Cellular Polyisocyanurate and Polyurethane Insulation:
ASTM C1289 REV A

(1) Type I Aluminum Foil on both major surfaces. Class 1 -
Non-reinforced core foam.

2.2.1 Thermal Resistance

Unless otherwise indicated, Wall R-6.0 per inch, minimum; Slab R-5.0 per inch, minimum.

2.2.2 Fire Protection Requirements

- a. Flame spread index of 75 or less when tested in accordance with ASTM E84.
- b. Smoke developed index of 450 or less when tested in accordance with ASTM E84.
- c. Provide insulated assemblies in accordance ICC IBC Chapter Fire and Smoke Protection Features.

2.2.3 Other Material Properties

Provide thermal insulating materials with the following properties:

- a. Rigid cellular plastics: Compressive Resistance at Yield: Not less than 10 pounds per square inch (psi) when measured according to ASTM D1621.
- b. Water Vapor Permeance: Not more than 1.1 Perms or less when measured according to ASTM E96/E96M, desiccant method, in the thickness required to provide the specified thermal resistance, including facings, if any.
- c. Water Absorption: Not more than 2 percent by total immersion, by volume, when measured according to ASTM C272/C272M.
- d. Water Adsorption: Not more than 1 percent by volume when measured in accordance with paragraph 14 of ASTM C553.

2.2.4 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the material meets all other requirements of this section. The minimum required recycled material contents (by weight, not volume) are:

Polyisocyanurate/Polyurethane:	9 percent
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2.2.5 Prohibited Materials

Do not provide materials containing asbestos.

2.3 VAPOR RETARDER AND DAMPPROOFING

2.3.1 Vapor Retarder in Framed Walls and Roofs

- a. 6 mil thick polyethylene sheeting conforming to ASTM D4397 and having a water vapor permeance of 1 Perm or less when tested in accordance with ASTM E96/E96M.

2.3.2 Dampproofing for Masonry Cavity Walls

Bituminous material is specified in Section 07 11 13 BITUMINOUS DAMPPROOFING.

2.3.3 Vapor Retarder under Floor Slab

- a. Water vapor permeance: 0.2 Perm or less when tested in accordance with ASTM E96/E96M.
- b. Puncture resistance: Maximum load no less than 40 pounds when tested according to ASTM E154/E154M REV A.

2.4 PRESSURE SENSITIVE TAPE

As recommended by manufacturer of vapor retarder(s). Match water vapor permeance rating for each vapor retarder specified. Provide tape in accordance with ASTM D3833/D3833M.

2.5 PROTECTION BOARD OR COATING

As recommended by insulation manufacturer.

2.6 ACCESSORIES

2.6.1 Adhesive

As recommended by insulation manufacturer.

2.6.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

Prior to installation, ensure all areas that are in contact with the insulation are dry and free of projections that could cause voids, compressed insulation, or punctured vapor retarders. For foundation perimeter or under slab applications, check that subsurface fill is flat, smooth, dry, and well tamped. Do not proceed with installation if moisture or other conditions are present, and notify the Contracting Officer of such conditions. Do not proceed with the work until conditions have been corrected and verified to be dry.

3.2 PREPARATION

3.2.1 Blocking Around Heat Producing Devices

Provide noncombustible blocking at all spaces between heat producing devices and the floors, ceilings and roofs through which they pass. Provide the following clearances:

- a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is placed above fixture or device, 24 inches above fixture.
- b. Vents and vent connectors used for venting products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.

c. Gas Fired Appliances: Clearances as required in NFPA 54.

d. Oil Fired Appliances: Clearances as required in NFPA 31.

3.3 INSTALLATION

3.3.1 Installation and Handling

Provide insulation in accordance with the manufacturer's printed installation instructions. Keep material dry and free of extraneous materials.

3.3.2 Electrical Wiring

Do not install insulation in a manner that would enclose electrical wiring between two layers of insulation.

3.3.3 Cold Climate Requirement

Place insulation on the outside of pipes.

3.3.4 Continuity of Insulation

Butt tightly against adjoining boards, studs, rafters, joists, sill plates, headers and obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joint, roof, and floor. Avoid creating thermal bridges and voids. Provide and verify continuity of insulative barrier throughout the building enclosure.

3.3.5 Coordination

Verify final installed insulation thicknesses comply with thicknesses indicated, R-values specified herein, and with the approved insulation submittal(s).

3.4 INSTALLATION ON WALLS

3.4.1 Installation on Masonry Walls

Apply board directly to masonry with adhesive or fasteners as recommended by the insulation manufacturer. Fit between obstructions without impaling board on ties or anchors. Apply in parallel courses with joints breaking midway over course below. Place boards in moderate contact with adjoining insulation without forcing and without gaps. Cut and shape as required to fit around wall penetrations, projections or openings to accommodate conduit or other utilities. Seal around cutouts with sealant. Install insulation in wall cavities so that it leaves at least a nominal 1 inch air space outside of the insulation to allow for cavity drainage.

3.4.2 Protection Board or Coating

Install protection board or coating in accordance with manufacturer's printed instructions. Install protection over all exterior exposed insulation and to 1 foot below grade.

3.5 PERIMETER AND UNDER SLAB INSULATION

3.5.1 Manufacturer's Instructions

Layout insulation, tape edges, provide vapor retarder and other required accessories to protection against vermin, insects, and damage in accordance with manufacturer's printed instructions.

3.5.2 Insulation on Vertical Surfaces

Provide thermal insulation as indicated on drawings. Fasten insulation with adhesive or mechanical fasteners.

3.5.3 Protection of Insulation

Protect insulation from damage during construction and back filling by application of protection board or a coating. Do not leave installed vertical insulation unprotected overnight. Protect installed insulation from weather, including rain and ultraviolet light, from mechanical abuse, compression, and dislocation.

3.6 VAPOR RETARDER

Apply vapor retarder continuous across all surfaces. Overlap all joints at least 6 inches and seal with pressure sensitive tape. Seal at sills, header, windows, doors and utility penetrations. Repair punctures or tears with pressure sensitive tape.

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SECTION 07 21 16

MINERAL FIBER BLANKET INSULATION

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SECTION 07 21 16

MINERAL FIBER BLANKET INSULATION
11/11

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM C665	(2017) Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C930	(2018) Standard Classification of Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D5359	(2015) Standard Specification for Glass Cullet Recovered from Waste for Use in Manufacture of Glass Fiber
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134	Respiratory Protection
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UL ENVIRONMENT (ULE)

ULE Greenguard	UL Greenguard Certification Program
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to

Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-03 Product Data

Blanket Insulation

Accessories

Environmental Product Declaration for Insulation; S

Material Ingredient Report for Insulation; S

Material Ingredient Optimization Report for Insulation; S

Emissions Testing Data for Insulation Materials; S

Recycled Content for Insulation Materials; S

SD-08 Manufacturer's Instructions

Insulation

1.3 SUSTAINABLE DESIGN CERTIFICATION

Product must be third party certified in accordance with ULE Greenguard.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials to site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.4.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

1.5 SAFETY PRECAUTIONS

1.5.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in accordance with 29 CFR 1910.134.

1.5.2 Other Safety Concerns

Consider other safety concerns and measures as outlined in ASTM C930.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

Provide the following:

Environmental Product Declaration for Insulation
Material Ingredient Report for Insulation
Material Ingredient Optimization Report for Insulation

For products in this section, where applicable and to extent allowed by performance criteria, provide and document the following:

2.1.1 Recycled Content for Insulation Materials

Provide insulation materials meeting the recycled content requirements as stated within this section and provide documentation in accordance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph RECYCLED CONTENT.

2.1.2 Emissions Testing Data for Insulation Materials

Provide insulation materials meeting the reduced emissions requirements as stated within this section and provide documentation in accordance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph REDUCE VOLATILE ORGANIC COMPOUNDS.

2.2 BLANKET INSULATION

ASTM C665, Type I, blankets without membrane coverings with a flame spread rating of 25 or less and a smoke developed rating of 450 or less when tested in accordance with ASTM E84.

2.2.1 Recycled Materials

Provide Thermal Insulation containing recycled materials to the extent practicable, provided the material meets all other requirements of this section. The minimum required recycled materials content by weight are:

Fiberglass: 20 to 25 percent glass cullet complying with ASTM D5359

2.2.2 Prohibited Materials

Do not provide asbestos-containing materials.

2.2.3 Reduced Volatile Organic Compounds (VOC) for Insulation Materials

ULE Greenguard

2.3 ACCESSORIES

2.3.1 Adhesive

As recommended by the insulation manufacturer.

Adhesives must follow the manufacturer's requirements for low pollutant emitting materials in achieving ULE Greenguard certification for their insulation products.

2.3.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

Before installing insulation, ensure that areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If moisture or other conditions are found that do not allow the workmanlike installation of the insulation, do not proceed but notify Contracting Officer of such conditions.

3.2 PREPARATION

3.2.1 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

- a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless these are certified by the manufacturer for installation surrounded by insulation: 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 24 inches above fixture.

3.3 INSTALLATION

3.3.1 Insulation

Install and handle insulation in accordance with manufacturer's instructions. Keep material dry and free of extraneous materials. Any materials that show visual evidence of biological growth due to presence of moisture must not be installed on the building project. Ensure personal protective clothing and respiratory equipment is used as required. Observe safe work practices.

3.3.1.1 Electrical wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.3.1.2 Continuity of Insulation

Install blanket insulation to butt tightly against adjoining blankets and to studs, rafters, joists, sill plates, headers and any obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joints, roof, and floor. Avoid creating thermal bridges.

3.3.1.3 Installation at Bridging and Cross Bracing

Insulate at bridging and cross bracing by splitting blanket vertically at center and packing one half into each opening. Butt insulation at bridging and cross bracing; fill in bridged area with loose or scrap insulation.

3.3.1.4 Insulation without Affixed Vapor Retarder

Provide snug friction fit to hold insulation in place. Stuff pieces of insulation into cracks between trusses, joists, studs and other framing, such as access doors, door and window heads, jambs, and sills, band joists, and headers.

3.3.1.5 Sizing of Blankets

Provide only full width blankets when insulating between trusses, joists, or studs. Size width of blankets for a snug fit where trusses, joists or studs are irregularly spaced.

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ROOF AND DECK INSULATION
02/16

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM C1177/C1177M	(2017) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C1289	(2017) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C578	(2018) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM D4601/D4601M	(2004; R 2012) Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM 4450	(1989) Approval Standard for Class 1 Insulated Steel Deck Roofs
FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage
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UNDERWRITERS LABORATORIES (UL)

UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to

Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Insulation Board Layout and Attachment; G

Verification of Existing Conditions; G

SD-03 Product Data

Insulation; G

Cover Board; G

Fasteners; G

Moisture Control; G

Environmental Product Declaration for Insulation; S

Material Ingredient Report for Insulation; S

Material Ingredient Optimization Report for Insulation; S

Emissions Testing Data for Insulation; S

Recycled Content for Insulation Materials; S

SD-06 Test Reports

Flame Spread Rating; G

SD-07 Certificates

Volatile Organic Compounds (VOC) Content; G

Installer Qualifications; G

SD-08 Manufacturer's Instructions

Nails and Fasteners; G

Roof Insulation; G

1.3 SHOP DRAWINGS

Submit insulation board layout and attachment indicating methods of attachment and spacing, transitions, tapered components, thicknesses of materials, and closure and termination conditions. Show locations of ridges, valleys, crickets, interface with, and slope to, roof drains. Base shop drawings on verified field measurements and include verification of existing conditions..

1.4 PRODUCT DATA

Include data for material descriptions, recommendations for product shelf life, requirements for cover board or coatings, and precautions for flammability and toxicity. Include data to verify compatibility of

sealants with insulation.

1.5 MANUFACTURER'S INSTRUCTIONS

Include field of roof and perimeter attachment requirements.

Provide a complete description of installation sequencing for each phase of the roofing system. Include weatherproofing procedures.

1.6 QUALITY CONTROL

Provide certification of installer qualifications from the insulation manufacturer confirming the specific installer has the required qualifications for installing the specific roof insulation system(s) indicated.

1.7 FIRE PERFORMANCE REQUIREMENTS

1.7.1 Insulation in Roof Systems

Roof insulation to have a flame spread rating of 75 or less when tested in accordance with ASTM E84. Additional documentation of compliance with flame spread rating is not required when insulation of the type used for this project as part of the specific roof assembly is listed and labeled as FM Class 1 approved.

1.8 CERTIFICATIONS

Provide products that are third party certified for low Volatile Organic Compounds (VOC) Content in accordance with UL 2818 Greenguard, SCS Scientific Certification Systems Indoor Advantage or approved equal.

1.9 DELIVERY, STORAGE, AND HANDLING

1.9.1 Delivery

Deliver materials to the project 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

Deliver materials in sufficient quantity to allow continuity of the work.

1.9.2 Storage and Handling

Store and handle materials in accordance with manufacturer's printed instructions. Protect from damage, exposure to open flame or other ignition sources, wetting, condensation, and moisture absorption. Keep materials wrapped and separated from off-gassing materials (such as drying paints and adhesives). Do not use materials that have visible moisture or biological growth. Store in an enclosed building or trailer that provides a dry, adequately ventilated environment. Replace damaged material with new material.

1.10 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.

1.11 PROTECTION

1.11.1 Completed Work

Cover completed work with cover board for the duration of construction. Avoid traffic on completed work particularly when ambient temperature is above 80 degrees F. Replace crushed or damaged insulation prior to roof surface installation.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

Provide the following:

Environmental Product Declaration for Insulation

Material Ingredient Report for Insulation

Material Ingredient Optimization Report for Insulation

Recycled Content for Insulation Materials

Where allowed by performance criteria:

2.1.1 Emissions Testing Data for Insulation

Provide products with reduced emissions and provide documentation in accordance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph REDUCE VOLATILE ORGANIC COMPOUNDS.

2.1.2 Recycled Content

Provide products with recycled content and provide documentation in accordance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph RECYCLED CONTENT.

2.2 INSULATION

2.2.1 Insulation Types

Provide one, or an assembly of a maximum of three, of the following roof insulation materials. Provide roof insulation that is compatible with attachment methods for the specified insulation and roof membrane.

- a. Polyisocyanurate Board: Provide in accordance with ASTM C1289 REV A Type II, fibrous felt or glass mat membrane both sides, except minimum compressive strength of 20 pounds per square inch (psi).
- b. Polystyrene Board: In accordance with ASTM C578 REV A, Type II, IV, or X.

2.2.2 Recycled Materials

Provide thermal insulation materials containing recycled content in accordance with paragraph PRODUCT SUSTAINABILITY CRITERIA. Unless specified otherwise, the minimum required recycled content for listed materials are:

Polyisocyanurate/polyurethane:	9 percent recovered material
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2.2.3 Insulation Thickness

As necessary to provide the thermal resistance (R-value) indicated. Base calculation on the R-value for aged insulation. For insulation over steel decks, satisfy both specified R-value and minimum thickness for width of rib opening recommended in insulation manufacturer's published literature.

2.2.4 Cants and Tapered Edge Strips

Provide preformed cants and tapered edge strips of the same material as the roof insulation. When unavailable, provide pressure-preservative treated wood, wood fiberboard, or rigid perlite board cants and edge strips as recommended by the roofing manufacturer for the specific application, unless otherwise indicated. Face of cant strips to incline at 45 degrees with a minimum vertical height of 4 inches. Taper edge strips at a rate of one to 1 1/2 inch per foot down to approximately 1/8 inch thick.

2.3 COVER BOARD

For use as a thermal barrier (underlayment), fire barrier (overlayment), or cover board for adhesive-applied roofing membrane over roof insulation.

2.3.1 Glass Mat Gypsum Roof Board

ASTM C1177/C1177M, 0 Flame Spread and 0 Smoke Developed when tested in accordance with ASTM E84, 500 psi, Class A, non-combustible, 5/8 inch thick, 4 by 8 feet board size.

2.4 MOISTURE CONTROL

2.4.1 Vapor Retarder

2.4.1.1 Asphalt Saturated Felt Base Sheet for Single Layer Application

Provide in accordance with ASTM D4601/D4601M, weighing not less than 35 pounds per 100 square feet.

2.5 FASTENERS

Provide flush-driven fasteners through flat round or hexagonal steel or plastic plates. Provide zinc-coated steel plates, flat round not less than 1 3/8 inch diameter, hexagonal not less than 28 gage. Provide high-density plastic plates, molded thermoplastic with smooth top surface, reinforcing ribs and not less than 3 inches in diameter. Fully recess fastener head into plastic plate after it is driven. Form plates to prevent dishing. Do not use bell or cup shaped plates. Provide fasteners for steel or concrete decks in accordance with FM APP GUIDE (<http://www.approvalguide.com/>) for Class I roof deck construction, and

spaced to withstand uplift pressure as indicated on drawings.

2.5.1 Fasteners for Steel Decks

Approved hardened penetrating fasteners or screws in accordance with FM 4450 and listed in FM APP GUIDE for Class I roof deck construction. Quantity and placement to withstand a minimum uplift pressure as indicated on the drawings..

2.6 WOOD NAILERS

Pressure-preservative treated as specified in Section 06 10 00 ROUGH CARPENTRY.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

3.1.1 Surface Inspection

Ensure surfaces are clean, smooth, and dry prior to application. Check roof deck surfaces, including surfaces sloped to roof drains and outlets, for defects before starting work.

The Contracting Officer will inspect and approve the surfaces immediately before starting installation. Prior to installing 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.
- b. In the presence of the Contracting Officer perform the following surface dryness test on concrete substrates:
 - (1) Foaming: When poured on the deck, one pint of asphalt when heated in the range of 350 to 400 degrees F, does not foam upon contact.
 - (2) Strippability: After asphalt used in the foaming test application has cooled to ambient temperatures, test coating for adherence. Should a portion of the sample be readily stripped clean from surface, do not consider surface to be dry and do not start application. Should rain occur during application, stop work and do not resume until surface has been re-tested by method above and found dry.

3.1.2 Surface Preparation

Correct defects and inaccuracies in roof deck surface to eliminate poor drainage from hollow or low spots, perform the following:

- a. Provide wood nailers of the same thickness as the insulation at eaves, edges, curbs, walls, and roof openings for securing of cant strips, gravel stops, gutters, and flashing flanges. Space nailers in accordance with approved shop drawings.
- b. Cover steel decks with a layer of insulation board of sufficient width to span the width of a deck rib opening, and in accordance with fire safety requirements. Secure with piercing or self-drilling,

self-tapping fasteners of quantity and placement in accordance with FM APP GUIDE. Locate insulation joints parallel to ribs of deck 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. Unless otherwise specified, vapor retarder to consist of two plies of No. 15 asphalt-saturated felt, two plies of asphalt-coated glass felt, or one layer of asphalt-saturated felt base sheet. Lay vapor retarder at right angles to direction of slope. Install first ply of felt or base sheet as specified herein for the specific deck. Apply second ply of 2-ply vapor retarder system using asphalt at rate of 20 to 35 lbs per 100 square feet, applied within plus or minus 25 degrees F of EVT. Do not heat asphalt above asphalt's FBT or 525 degrees F, whichever is less. Use thermometers to check temperatures during heating and application. Completely seal side and end laps. Asphalt must be visible beyond all edges of each ply as it is being installed. Lay plies free of wrinkles, buckles, creases or fishmouths. Do not walk on mopped surfaces while asphalt is sticky. Press out air bubbles to obtain complete adhesion between surfaces. At walls, eaves, rakes, and other vertical surfaces, extend vapor retarder organic felts or separate plies 9 inches, with not less than 9 inches on the substrate, and the extended portion turned back and mopped in over the top of the insulation. At roof penetrations other than walls, eaves and rakes, and vertical surfaces, extend vapor retarder or separate plies 9 inches to form a lap folded back over the edge of the insulation. Provide asphalt roof cement under the vapor retarder for at least 9 inches from walls, eaves, rakes and other penetrations.

3.2.1 Vapor Retarder on Steel Decks

Even mop the mechanically secured insulation surface with asphalt before installing vapor retarder. For a two-ply vapor retarder, install each sheet lapping 19 inches over the preceding sheet. Lap ends not less than 4 inches. Stagger the laps a minimum of 12 inches. Cement felts together with solid mopping of asphalt. Apply asphalt moppings at rate of 20 to 35 lbs per 100 square feet.

3.3 INSTALLATION OF VENTILATING FELT

Apply ventilating felt in accordance with manufacturer's printed instructions. Extend over roof cants, up vertical surfaces and terminate under cap flashing. At roof edges terminate under outside edge of perimeter edge nailers or under gravel stop fascia.

3.4 INSULATION INSTALLATION

Apply insulation in two layers 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, provide joints of each succeeding layer that are parallel and offset in both directions with respect to the layer below. Keep insulation 1/2 inch clear of vertical surfaces penetrating and projecting from roof surface. Verify required slopes to each roof drain.

3.4.1 Installation Using Only Mechanical Fasteners

Secure total thickness of insulation with penetrating type fasteners.

3.4.2 Special Precautions for Installation of Foam Insulation

3.4.2.1 Polyisocyanurate Insulation

Where polyisocyanurate foam board insulation is provided, install 1/2 inch thick wood fiberboard, or glass mat gypsum roof board, over top surface of foam board insulation. Stagger joints of insulation with respect to foam board insulation below.

3.4.2.2 Polystyrene Insulation

- a. Over the top surface of non-composite polystyrene board, install 1/2 inch thick high density wood fiberboard, glass mat gypsum roof board, or other overlayment approved by roofing sheet manufacturer. Tightly butt and stagger joints of field applied overlayment board at least 6 inches with respect to the polystyrene board below. Apply 6 inch wide glass fiber roofing tape centered over joints and edges of overlayment board.
- b. Where composite boards consisting of polystyrene insulation are provided, apply 6 inch wide glass fiber roofing tape centered over joints and edges of composite board. Apply joint strips as recommended by roofing sheet manufacturer.

3.4.3 Cant Strips

Where indicated, provide cant strips at intersections of roof with walls, parapets, and curbs extending above roof. Wood cant strips must bear on and be anchored to wood blocking. Fit cant strips flush to vertical surfaces. Where possible, nail cant strips to adjoining surfaces. Where cant strips are installed against non-nailable materials, install in an approved adhesive.

3.4.4 Tapered Edge Strips

Where indicated, provide edge strips in the right angle formed by the juncture of roof and wood nailing strips that extend above the level of the roof. Install edge strips flush to vertical surfaces of wood nailing strips. Where possible, nail edge strips to adjoining surfaces. Where installed against non-nailable materials, install in an approved adhesive.

3.5 PROTECTION

3.5.1 Protection of Applied Insulation

Completely cover each day's installation of insulation with finished roofing specified on same day. Phased construction is not permitted. Protect open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, until permanent roofing and flashing are applied. Storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces is not permitted. Provide smooth, clean board or plank walkways, runways, and platforms near supports, as necessary, to distribute weight in accordance with indicated live load limits of roof construction. Protect exposed edges of insulation with cutoffs at the end of each work day or whenever

precipitation is imminent. Cutoffs must be two layers of bituminous-saturated felt set in plastic bituminous cement set in roof cement. Fill all profile voids in cutoffs to prevent trapping moisture below the membrane. Remove cutoffs when work resumes.

3.5.2 Damaged Work and Materials

Restore work and materials that become damaged during construction to original condition or replace with new materials.

3.6 INSPECTION

Establish and maintain inspection procedures to assure compliance of the installed roof insulation with contract requirements. Remove, replace, correct in an approved manner, any work found not in compliance. Quality control must include, but is not 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 Data Sheets. (
<https://www.fmglobal.com/fmglobalregistration/Downloads.aspx>)
- 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, cants, sleepers, 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.
- j. Verification of required slope to each roof drain.

-- End of Section --

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EXTERIOR INSULATION AND FINISH SYSTEMS
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PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2016) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM C67/C67M	(2018) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C150/C150M	(2018) Standard Specification for Portland Cement
ASTM C473	(2016) Standard Test Methods for Physical Testing of Gypsum Panel Products
ASTM C578	(2018) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C1177/C1177M	(2017) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C1278/C1278M	(2017) Standard Specification for Fiber-Reinforced Gypsum Panel
ASTM D968	(2017) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D2247	(2015) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D3273	(2016) Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E330/E330M	(2014) Structural Performance of Exterior Windows, Doors, Skylights and Curtain

Walls by Uniform Static Air Pressure
Difference

- ASTM E331 (2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
- ASTM E2098/E2098M (2013) Determining Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for Use in Class PB Exterior Insulation and Finish Systems (EIFS) after Exposure to a Sodium Hydroxide Solution
- ASTM E2486 (2006) Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)
- ASTM E2570/E2570M (2007; R 2014; E 2014) Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage
- ASTM G153 (2013) Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

INTERNATIONAL CODE COUNCIL (ICC)

- ICC IBC (2015) International Building Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 268 (2012) Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source
- NFPA 285 (2012) Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

1.2 SYSTEM DESCRIPTION AND REQUIREMENTS

The exterior insulation and finish system (EIFS) must be a job-fabricated, drainable, exterior wall covering consisting of sheathing, air and moisture barrier, insulation board, reinforcing fabric, base coat, finish coat, adhesive and mechanical fasteners as applicable. The system components must be compatible with each other and with the substrate as recommended or approved by, and the products of, a single manufacturer regularly engaged in furnishing Exterior Insulation and Finish Systems. All materials must be installed by an applicator approved by the system manufacturer. EIFS must be Class PB and must be FS-23617 (TAN) color and medium worm/swirl finish.

1.2.1 System Requirements and Tests

The system must meet the performance requirements as verified by the tests listed below. Where a wall system of similar type, size, and design as specified for this project has been previously tested under the condition specified herein, the resulting test reports may be submitted in lieu of job specific tests.

1.2.1.1 Water Penetration

Test the system for water penetration by uniform static air pressure in accordance with ASTM E331. There must be no penetration of water beyond the plane of the base coat/EPS board interface after 15 minutes at 6.4 psf, or 20 percent of positive design wind pressure, whichever is greater.

1.2.1.2 Wind Load

Test the system for wind load by uniform static air pressure in accordance with ASTM E330/E330M (procedure A) to a minimum pressure of 90 psf. There must be no permanent deformation, delamination, or other deterioration.

1.2.1.3 Full scale or intermediate scale fire test

Conduct wall fire test using apparatus, specimen, performance criteria, and procedure in accordance with NFPA 285 when required by ICC IBC 2603.5.5. The following requirements must be met:

- a. No vertical spread of flame within core of panel from one story to the next.
- b. No flame spread over the exterior surface.
- c. No vertical flame spread over the interior surface from one story to the next.
- d. No significant lateral spread of flame from compartment of fire origin to adjacent spaces.

1.2.1.4 Mock-Up Installation of EIFS

Complete wall mock-up installation 8 ft high by 8 ft wide, including typical control joints and at least one window opening. Control joints to be filled with sealant of type, manufacturer, and color selected. Construct mock-up installation at job site. Build mock-up to comply with the following requirements, using materials indicated for the completed work:

- a. Locate mock-up installation(s) in the location and size as directed by the Contracting officer.
- b. Demonstrate the proposed range of color, texture, thickness, insulation, and workmanship.
- c. Obtain Contracting Officer's written approval of mock-up before starting fabrication of work.
- d. Maintain mock-up installation(s) during construction as a standard for judging the completed work by protecting them from weather and construction activities.

- e. When directed, demolish and remove mock-up from the site.

1.2.2 Component Requirements and Tests

The components of the system must meet the performance requirements as verified by the tests listed below.

1.2.2.1 Surface Burning Characteristics

Conduct ASTM E84 test on samples consisting of base coat, reinforcing fabric, and finish coat. Cure for 28 days. The flame spread index must be 25 or less and the smoke developed index must be 450 or less.

1.2.2.2 Radiant Heat

The system must be tested in accordance with NFPA 268 on both the minimum and maximum thickness of insulation intended for use with no ignition during the 20-minute period.

1.2.2.3 Impact Resistance

- a. Class PB Systems: Hemispherical Head Test; 28 day cured specimen of PB EIFS in accordance with ASTM E2486. The test specimen must exhibit no broken reinforcing fabric per ASTM E2486 at an impact of 20-49 in/lb.

1.2.3 Sub-Component Requirements and Tests

Unless otherwise stated, the test specimen must consist of reinforcing mesh, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building. For mildew resistance, only the finish coat is applied onto glass slides for testing. These specimen must be suitably sized for the apparatus used and be allowed to cure for a minimum of 28 days prior to testing.

1.2.3.1 Abrasion Resistance

Test in accordance with ASTM D968, Method A. Test a minimum of two specimens. After testing, the specimens must show only very slight smoothing, with no loss of film integrity after 132 gallons of sand.

1.2.3.2 Accelerated Weathering

Test in accordance with ASTM G153, Cycle 1. After 2000 hours specimens must exhibit no visible cracking, flaking, peeling, blistering, yellowing, fading, or other such deterioration.

1.2.3.3 Mildew Resistance

Test in accordance with ASTM D3273. The specimen shall consist of the finish coat material, applied to clean 3 inch by 4 inch glass slides and must be allowed to cure for 28 days. After 28 days of exposure, the specimen must not show any growth.

1.2.3.4 Salt Spray Resistance

Test in accordance with ASTM B117. The specimen must be a minimum of 4

inch by 6 inch and must be tested for a minimum of 300 hours. After exposure, the specimen must exhibit no observable deterioration, such as chalking, fading, or rust staining.

1.2.3.5 Water Resistance

Test in accordance with ASTM D2247. The specimen must be a minimum of 4 inch by 6 inch. After 14 days, the specimen must exhibit no cracking, checking, crazing, erosion, blistering, peeling, or delamination.

1.2.3.6 Absorption-Freeze/Thaw

Class PB systems must be tested in accordance with ASTM E2570/E2570M for 60 cycles of freezing and thawing. After testing, the specimen must exhibit no cracking, checking, or splitting, and negligible weight gain. Class PM systems must be tested in accordance with ASTM C67/C67M for 50 cycles of freezing and thawing. After testing, the specimens must exhibit no cracking or checking and have negligible weight gain.

1.2.3.7 Sample Boards

Unless otherwise stated, provide sample EIFS Component 12 by 24 inches, on sheathing board, including finish color and texture, typical joints and sealant. If more than one color, finish, or pattern is used, provide one sample for each. The test specimen must consist of reinforcing mesh, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building.

1.2.4 Moisture Analysis

Perform a job specific vapor transmission analysis based on project specific climate and specified wall components and materials. Indicate the temperatures and relative humidities for the inside and outside of the building; a complete listing of the building components, their thickness, thermal resistance and permeance, as well as building location and use. If a mathematical model was used for the analysis, include the name of the model and the supplier/developer.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings; G

Show wall layout, construction and expansion joints, decorative grooves, layout of sheathing board, thermal insulation board, and reinforcing mesh and strip reinforcing fabric; joint and flashing details; details at wall penetrations; types and location of fasteners; details at windows and details at base, roof, corners, roof/wall intersections, abutments of lower walls with higher walls.

SD-03 Product Data

Sheathing Board

Thermal Insulation

Adhesive

Accessories

Base Coat

Portland Cement

Reinforcing Fabric

Finish Coat

Joint Sealant

Sealant Primer

Bond Breaker

Backer Rod

Insulation Board

Recycled Content for Insulation Materials; S

Warranty

Include joint and other details, such as end conditions, corners, windows, and parapet. Include shelf life and recommended cleaning solvents in data for sealants. Include Safety Data Sheets (SDS) for all components of the EIFS. The SDS shall be available at the job site.

SD-04 Samples

Sample Boards; G

Color and Texture

Mock-up Installation of EIFS; G

SD-05 Design Data

Wind Load Calculations

Moisture Analysis Calculations

SD-06 Test Reports

Abrasion Resistance

Accelerated Weathering

Impact Resistance

Mildew Resistance

Salt Spray Resistance

Water Vapor Transmission

Absorption-Freeze-Thaw

Wall Fire Test

Water Penetration

Water Resistance

Full Scale or Intermediate Scale Fire Test

Surface Burning Characteristics

Radiant Heat

Substrate

Wind Load

SD-07 Certificates

Qualifications of EIFS Manufacturer

Qualification of EIFS Installer

Qualification of Sealant Applicator

Certify that EIFS installer meets requirements specified under paragraph "Qualification of Installer," and that sealant applicator is approved by the EIFS Manufacturer.

Qualifications of Third Party Inspector

Inspection Check List; G

Submit filled-out inspection check list as required in paragraph "Quality Control," certifying that the installation of critical items meets the requirements of this specification.

SD-08 Manufacturer's Instructions

Installation

Manufacturer's standard printed instructions for the installation of the EIFS. Include requirements for condition and preparation of substrate, installation of EIFS, and requirements for sealants and sealing.

SD-10 Operation and Maintenance Data

EIFS

Include detailed finish repair procedures and information

regarding compatibility of sealants with base and finish coatings.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications of EIFS Manufacturer

The EIFS must be the product of a manufacturer who has been in the practice of manufacturing and designing EIFS for a period of not less than 3 years, and has been involved in at least five projects similar to this project in size, scope, and complexity, in the same or a similar climate as this project.

1.4.2 Qualification of EIFS Installer

The EIFS Installer must be trained by the EIFS manufacturer to perform the installation of the System and must have successfully installed at least five projects at or near the size and complexity of this project. The contractor must employ qualified workers trained and experienced in installing the manufacturer's EIFS.

1.4.3 Qualification of Sealant Applicator

The sealant applicator must be experienced and competent in the installation of high performance industrial and commercial sealants and must have successfully installed at least five projects at or near the size and complexity of this project.

1.4.4 Qualifications of Third Party Inspector

Submit evidence that third party inspector has current certification from the Exterior Design Institute or equal inspector certification as inspector for the installation of EIFS.

1.4.5 Insulation Board

Insulation Board must be approved and labeled under third party quality program as required by applicable building code.

1.4.6 Pre-Installation Conference

After approval of submittals and before commencing any work on the EIFS, including installation of any sheathing board, insulation, and associated work, the Contracting Officer will hold a pre-installation conference to review:

- a. Drawings, specifications, and samples;
- b. Procedure for on site inspection and acceptance of EIFS substrate and pertinent details (for example, mock-up installation);
- c. Contractor's plan for coordination of work of the various trades involved in providing EIF system and other components;
- d. Inspection procedures; and
- e. Safety requirements.

Pre-installation conference must be attended by the Contractor, EIFS Q.C. Specialist (EIFS Inspector), and all personnel directly responsible for

installation of the EIF system, including sealant applicator, and personnel responsible for related work, such as flashing and sheet metal, windows and doors, and a representative of the EIFS manufacturer. Before beginning EIFS work, the contractor must confirm in writing the resolution of conflicts among those attending the pre-installation conference.

1.5 DELIVERY AND STORAGE

Deliver materials to job site in original unopened packages, marked with manufacturer's name, brand name, and description of contents. Store materials off the ground and in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area. Protect stored materials from rain, sunlight, and excessive heat. Keep coating materials which would be damaged by freezing at a temperature not less than 40 degrees F. Do not expose insulation board to flame or other ignition sources.

1.6 ENVIRONMENTAL CONDITIONS

- a. Do not prepare materials or apply EIFS during inclement weather unless appropriate protection is provided. Protect installed materials from inclement weather until they are dry.
- b. Apply sealants and wet materials only at ambient temperatures of 40 degrees F or above and rising, unless supplemental heat is provided. The system must be protected from inclement weather and maintain this temperature for a minimum of 24 hours after installation.
- c. Do not leave insulation board exposed to sunlight after installation.

1.7 WARRANTY

Furnish manufacturer's standard warranty for the EIFS. Warranty must run directly to Government and cover a period of not less than 5 years from date Government accepted the work.

PART 2 PRODUCTS

2.1 COMPATIBILITY

Provide all materials compatible with each other and with the substrate, and as recommended by EIFS manufacturer.

2.2 SHEATHING BOARD

2.2.1 Glass Mat Gypsum Sheathing Board

- a. Conform to ASTM C1177/C1177M; or.
- b. ASTM C1278/C1278M, Water Resistant Exterior Type only
- c. Flexural Strength parallel, 356 N 80 lbf.; 4ft weak direction.
- d. Nail Pull Resistance: No less than 120 lb when tested in accordance with ASTM C473.

2.3 ADHESIVE

Manufacturer's standard product, including primer as required, must be

compatible with substrate and insulation board to which the system is applied.

2.4 THERMAL INSULATION

2.4.1 Manufacturer's Recommendations

Provide only thermal insulation recommended by the EIFS manufacturer for the type of application intended.

2.4.2 Insulation Board

Insulation board must be standard product of manufacturer and must be compatible with other systems components. Boards must be factory marked individually with the manufacturer's name or trade mark, the material specification number, the R-value at 75 degree F, and thickness. No layer of insulation shall be less than 3/4 inch thick. The maximum thickness of all layers must not exceed 4 inches. Insulation Board must be certified as aged, in block form, prior to cutting and shipping, a minimum of 6 weeks by air drying, or equivalent.

- a. Thermal resistance: As indicated on drawings.
- b. Insulating material: ASTM C578 Type I as recommended by the EIFS manufacturer and treated to be compatible with other EIFS components. Age insulation by air drying a minimum of 6 weeks prior to cutting and shipping.
- c. Drainage: Preform channels into the interior face of insulation board or provide polypropylene drainage lath spacer to provide water drainage system.
- d. Recycled Content: Provide insulation material that has minimum of 10 percent recycled material. Provide data identifying percentage of recycled content for insulation materials.

2.5 BASE COAT

Manufacturer's standard product and compatible with other systems components.

2.6 PORTLAND CEMENT

Conform to ASTM C150/C150M, Type I or II as required, fresh and free of lumps, and approved by the systems manufacturer.

2.7 REINFORCING FABRIC

Reinforcing fabric mesh must be alkali-resistant, balanced, open weave, glass fiber fabric made from twisted multi-end strands specifically treated for compatibility with the other system materials, and comply with ASTM E2098/E2098M and as recommended by EIFS manufacturer.

2.8 FINISH COAT

Manufacturer's standard product conforming to the requirements in the paragraph on Sub-Component Requirements and Tests. For color consistency, use materials from the same batch or lot number.

2.9 SEALANT PRIMER

Non-staining, quick-drying type recommended by sealant manufacturer and EIFS manufacturer.

2.10 ACCESSORIES

Conform to recommendations of EIFS manufacturer, including trim, edging, anchors, and expansion joints. All metal items and fasteners to be corrosion resistant.

2.11 JOINT SEALANT

Non-staining, quick-drying type meeting ASTM C920, as Type S or M, minimum Grade NS, minimum Class 25 and compatible with the finish system type and grade, and recommended by both the sealant manufacturer and EIFS manufacturer.

2.12 BOND BREAKER

As required by EIFS manufacturer and recommended by sealant manufacturer and EIFS manufacturer.

2.13 BACKER ROD

Closed cell polyethylene free from oil or other staining elements and as recommended by sealant manufacturer and EIFS manufacturer. Do not use absorptive materials as backer rod. The backer rod should be sized 25 percent larger than the width of the joint.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrate and existing conditions to determine that the EIFS can be installed as required by the EIFS manufacturer and that all work related to the EIFS is properly coordinated. Surface must be sound and free of oil, loose materials or protrusions which will interfere with the system installation. If deficiencies are found, notify the Contracting Officer and do not proceed with installation until the deficiencies are corrected. The substrate must be plane, with no deviation greater than 1/4 inch when tested with a 10 foot straightedge. Determine flatness, plumbness, and any other conditions for conformance to manufacturer's instructions.

3.2 SURFACE PREPARATION

Prepare existing surfaces for application of the EIFS to meet flatness tolerances and surface preparation according to manufacturer's installation instructions but provide a flatness of not more than 1/4 inch in 10 feet. Provide clean surfaces free of oil and loose material without protrusions adversely affecting the installation of the insulation board. For adhesively attached EIFS, existing deteriorated paint must be removed. Due to substrate conditions or as recommended by the system manufacturer, a primer may be required. Apply the primer to existing surfaces as recommended by the manufacturer. Use masking tape to protect areas adjacent to the EIFS to prevent base or finish coat to be applied to areas not intended to be covered with the EIFS. The contractor must not proceed with the installation until all noted deficiencies of the

substrate are corrected.

3.3 INSTALLATION

Install EIFS as indicated, comply with manufacturer's instructions except as otherwise specified, and in accordance with the shop drawings. EIFS must be installed only by an applicator trained by the EIFS manufacturer. Specifically, include all manufacturer recommended provisions regarding flashing and treatment of wall penetrations. Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

3.3.1 Sheathing Board

Edges and ends of boards must be butted snugly with vertical joints staggered to provide full and even support for the insulation. Do not align sheathing board joints with wall openings. Provide support at both vertical and horizontal joints. Attach sheathing board to metal studs with self-tapping drywall screws. Place fasteners sufficiently close to support imposed loads, but not more than:

- a. Maximum of 8 inches apart on each supporting stud

Space fasteners more closely when required for negative wind load resistance.

3.3.2 Insulation Board

Unless otherwise specified by the system manufacturer, place the long edge horizontally from level base line. Stagger vertical joints and interlock at corners. Butt joints tightly. Provide flush surfaces at joints. Offset insulation board joints from joints in sheathing by at least 8 inches. Align drainage channels of integral drainage system or provide polypropylene drainage lath space to provide a path for any water weeped from behind the insulation to escape wall construction. Use L-shaped insulation board pieces at corners of openings. Joints of insulation must be butted tightly. Surfaces of adjacent insulation boards must be flush at joints. Gaps greater than 1/16 inch between the insulation boards must be filled with slivers of insulation. Uneven board surfaces with irregularities projecting more than 1/16 inch must be rasped in accordance with the manufacturer's instructions to produce an even surface. Attach insulation board as recommended by manufacturer. The adhered insulation board must be allowed to remain undisturbed for 24 hours prior to proceeding with the installation of the base coat/reinforcing mesh, or longer if necessary for the adhesive to dry. However, do not leave insulation board exposed longer than recommended by insulation manufacturer.

3.3.2.1 Adhesively Fastened Insulation Boards

Apply insulation board using adhesive spread with a notched trowel to the back of the insulation boards in accordance with the manufacturer's instructions.

3.3.3 Base Coat and Reinforcing Fabric Mesh,

3.3.3.1 Class PB Systems

Allow the adhered insulation board to dry for 24 hours, or longer if

necessary, prior to proceeding with the installation of the base coat/reinforcing fabric mesh. Install reinforcing fabric in accordance with manufacturer's instructions. Mix base coat in accordance with the manufacturer's instructions and apply to insulated wall surfaces to the thickness specified by the system manufacturer and provide any other reinforcement recommended by EIFS manufacturer. Trowel the reinforcing fabric mesh into the wet base coat material. Fully embed the mesh in the base coat. When properly worked-in, the pattern of the reinforcing fabric mesh must not be visible. Provide diagonal reinforcement at opening corners. Back-wrap or edge wrap all terminations of the EIFS. Overlap the reinforcing fabric mesh a minimum of 2.5 inches on previously installed mesh, or butted, in accordance with the manufacturer's instructions.

3.3.4 Finish Coat

The base coat/reinforcing mesh must be allowed to dry a minimum of 24 hours prior to application of the finish coat. Surface irregularities in the base coat, such as trowel marks, board lines, reinforcing mesh laps, etc., must be corrected prior to the application of the finish coat. Apply and level finish coat in one operation. Obtain final texture by trowels, floats, or by spray application as necessary to achieve the required finish matching approved mock-up installation. Apply the finish coat to the dry base coat maintaining a wet edge at all times to obtain a uniform appearance. The thickness of the finish coat must be in accordance with the system manufacturer's current published instructions. Apply finish coat so that it does not cover surfaces to which joint sealants are to be applied.

3.4 JOINT SEALING

Seal EIFS at openings as recommended by the system manufacturer. Apply sealant only to the base coat or base coat with EIFS Manufacturer's color coating. Do not apply sealant to the finish coat.

3.4.1 Surface Preparation, Backer Rod, and Primer

Immediately prior to application, remove loose matter from joint. Ensure that joint is dry and free of finish coat, or other foreign matter. Install backer rod. Apply primer as required by sealant and EIFS manufacturer. Check that joint width is as shown on drawings but in no case shall it be less than 0.5 inch for perimeter seals and 0.75 inch for expansion joints. The width must not be less than 4 times the anticipated movement. Check sealant manufacturer's recommendations regarding proper width to depth ratio.

3.4.2 Sealant

Do not apply sealant until all EIFS coatings are fully dry. Apply sealant in accordance with sealant manufacturer's instructions with gun having nozzle that fits joint width. Do not use sealant that has exceeded shelf life or cannot be discharged in a continuous flow. Completely fill the joint solidly with sealant without air pockets so that full contact is made with both sides of the joint. Tool sealant with a round instrument that provides a concave profile and a uniformly smooth and wrinkle free sealant surface. Do not wet tool the joint with soap, water, or any other liquid tooling aid. During inclement weather, protect the joints until sealant application. Use particular caution in sealing joints between window and door frames and the EIFS wall and at all other wall penetrations. Clean all surfaces to remove excess sealant.

3.5 FIELD QUALITY CONTROL

Throughout the installation, the contractor must establish and maintain an inspection procedure to assure compliance of the installed EIFS with contract requirements. Work not in compliance must be removed and replaced or corrected in an approved manner. The inspection procedures, from acceptance of deliveries through installation of sealants and final acceptance must be performed by qualified inspector trained by the manufacturer. No work on the EIFS is allowed unless the inspector is present at the job site.

3.5.1 Third Party Inspection

Provide full time third party inspection during the entire process of installing the EIFS, from examination through cleanup. The third party inspector must be certified by the Exterior Design Institute (EDI), AWCI, or by an equivalent independent party and must be trained in the proper installation of EIFS.

3.5.2 Inspection Check List

During the installation and at the completion of installation, perform inspections covering at the minimum all applicable items enumerated on the attached check list. The inspector must initial and date all applicable items, sign the check list, and submit it to the Contracting Officer at the completion of the EIFS erection.

CHECK LIST

<u>Item</u>	<u>Description</u>	<u>Appr'd/Date</u>
a.	Materials are handled and stored correctly.	_____
b.	Environmental conditions are within specified limits, including temperature not below 4 degrees C (40 degrees F), and the work is protected from the elements as required.	_____
c.	Preparation and installation is performed by qualified personnel using the correct tools.	_____
d.	Adjacent areas to which EIFS is not to be applied (such as on window and door frames) are protected with masking tape, plastic films, drop cloths, etc. to prevent accidental application of EIFS materials.	_____
e.	Control, expansion and aesthetic joints are installed as indicated or recommended. Accessories are properly installed.	_____
f.	Substrate is in-plane, properly attached, clean, dry, and free of contaminants. Concrete substrate is free of efflorescence.	_____
g.	Materials are mixed thoroughly and in proper proportions.	_____
h.	Adhesive is applied in sufficient quantity with proper-size notched trowel.	_____

CHECK LIST

<u>Item</u>	<u>Description</u>	<u>Appr'd/Date</u>
i.	Mechanical attachments have proper spacing, layout and fastener depth.	=====
j.	Insulation boards are tightly abutted, in running bond pattern, with joints staggered with the sheathing, board corners interlocked, L-shaped boards around openings, edges free of adhesive, and provision for joints. Gaps are filled and surfaces rasped.	=====
k.	Insulation adhesive must be allowed to dry (a minimum of 24-hours) prior to the application of the base coat.	=====
l.	Reinforcing fabric mesh is properly back-wrapped at terminations.	=====
m.	Reinforcing fabric mesh is fully embedded and properly placed. Corners are reinforced. Openings are diagonally reinforced. Mesh overlaps minimum 65 mm (2-1/2 inches).	=====
n.	Base coat thickness is within specified limits.	=====
o.	The base coat/reinforcing fabric mesh must be allowed to dry (a minimum of 24-hours) prior to the application of the finish coat.	=====
p.	Finish coat is applied with sufficient number of personnel and stopped at suitable points. Floats and methods of texturing are uniform.	=====
q.	All flashings are properly installed.	=====
r.	All joints are properly sealed in their entire length at time and under environmental conditions as specified by the manufacturer.	=====
s.	All scaffolding, equipment, materials, debris and temporary protection are removed from site upon completion.	=====

Name of Inspector: _____ Signed: _____
Date: _____

3.6 CLEANUP

Upon completion, remove all scaffolding, equipment, materials and debris from site. Remove all temporary protection installed to facilitate installation of EIFS.

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BUILDING AIR BARRIER SYSTEM

05/14

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SECTION 07 27 10.00 10

BUILDING AIR BARRIER SYSTEM
05/14

PART 1 GENERAL

1.1 SUMMARY

This Section specifies the construction and quality control of the installation of an air barrier system. Construct the air barrier system indicated, taking responsibility for the means, methods, and workmanship of the installation of the air barrier system. The air barrier must be contiguous and connected across all surfaces of the enclosed air barrier envelope indicated. The maximum leakage requirements of individual air barrier components and materials are specified in the other specification sections covering these items.

This section also defines the maximum allowable leakage of the final air barrier system. The workmanship must be adequate to meet the maximum allowable leakage requirements of this specification. Test the assembled air barrier system to demonstrate that the building envelope is properly sealed and insulated. Passing the air barrier system leakage test and thermography test will result in system acceptance. Conform air barrier system leakage and thermography testing and reporting to the requirements of Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS.

1.2 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM D4541 (2017) Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

1.3 DEFINITIONS

The following terms as they apply to this section:

1.3.1 Air Barrier Accessory

Products designated to maintain air tightness between air barrier materials, air barrier assemblies and air barrier components, to fasten them to the structure of the building, or both (e.g., sealants, tapes, backer rods, transition membranes, fasteners, strapping, primers).

1.3.2 Air Barrier Assembly

The combination of air barrier materials and air barrier accessories that are designated and designed within the environmental separator to act as a continuous barrier to the movement of air through the environmental

separator.

1.3.3 Air Barrier Component

Pre-manufactured elements such as windows, doors, dampers and service elements that are installed in the environmental separator.

1.3.4 Air Barrier Envelope

The combination of air barrier assemblies and air barrier components, connected by air barrier accessories that are designed to provide a continuous barrier to the movement of air through an environmental separator. There may be more than one air barrier envelope in a single building. Also known as Air Barrier System.

1.3.5 Air Barrier Material

A building material that is designed and constructed to provide the primary resistance to airflow through an air barrier assembly.

1.3.6 Air Barrier System

Same as AIR BARRIER ENVELOPE.

1.3.7 Air Leakage Rate

The rate of airflow (CFM) driven through a unit surface area (sq.ft.) of an assembly or system by a unit static pressure difference (Pa) across the assembly. (example: 0.25 CFM/sq.ft. @ 75 Pa)

1.3.8 Air Leakage

The total airflow (CFM) driven through the air barrier system by a unit static pressure difference (Pa) across the air barrier envelope. (example: 6500 CFM @ 75 Pa)

1.3.9 Air Permeance

The rate of airflow (CFM) through a unit area (sq.ft.) of a material driven by unit static pressure difference (Pa) across the material (example: 0.004 CFM/sq.ft. @ 75 Pa).

1.3.10 Environmental Separator

The parts of a building that separate the controlled interior environment from the uncontrolled exterior environment, or that separate spaces within a building that have dissimilar environments. Also known as the Control Layer.

1.4 PREPARATORY PHASE OR PRECONSTRUCTION CONFERENCE

Organize pre-construction conferences between the air barrier inspector and the sub-contractors involved in the construction of or penetration of the air barrier system to discuss where the work of each sub-contractor begins and ends, the sequence of installation, and each sub-contractor's responsibility to ensure airtight joints, junctures, penetrations and transitions between materials. Discuss the products, and assemblies of products specified in the different sections to be installed by the different sub-contractors.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-04 Samples

Mock-Up; G

Build one as specified prior to building construction.

SD-06 Test Reports

Design Review Report; G

Two copies not later than 14 days after approval of the Air Barrier Inspector Qualifications.

Testing and Inspection; G

SD-07 Certificates

Air Barrier Inspector; G

Two copies 30 days after Notice to Proceed.

1.6 AIR BARRIER ENVELOPE SURFACE AREA AND LEAKAGE REQUIREMENTS

The building air barrier systems must meet the following leakage requirements. The allowable leakage rate and the maximum leakage are at a differential test pressure of 75 Pa.

Air Barrier Envelope	
Surface Area	See drawings for Air Barrier Envelope extensions
Architectural Only Test:	
Allowable leakage rate	0.25 CFM/sq.ft
Architectural Plus HVAC System Test:	
Allowable leakage rate	0.30 CFM/sq.ft

1.7 AIR BARRIER INSPECTOR

Employ a designated Air Barrier Inspector on this project. The Air Barrier Inspector performs a Design Review, oversees quality control testing specified in these specifications, performs quality control air barrier inspection as specified, interfaces with the designer and product manufacturer's representatives to assure all installation requirements are

met, and coordinates efforts between all workers installing or penetrating the air barrier materials. Qualification for the Air Barrier Inspector are as follows:

- a. Training and certification as an Air Barrier Installer from the Air Barrier Association of America (ABAA) or other third party air barrier association.
- b. Experience coordinating and instructing personnel involved in the installation, joining, and sealing of air barrier materials and components.

1.8 DESIGN REVIEW

Review the Contract Plans and Specifications and advise the Contracting Officer of any deficiencies that would prevent the construction of an effective air barrier system. Provide a Design Review Report individually listing each deficiency and the corresponding proposed corrective action necessary for proper air barrier system.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 QUALITY CONTROL

3.1.1 Documentation and Reporting

Document the entire installation process on daily job site reports. These reports include information on the Installer, substrates, substrate preparation, products used, ambient and substrate temperature, the location of the air barrier installation, the results of the quality control procedures, and testing results.

3.1.2 Construction Mock-Up

- a. Prepare a construction mock-up to demonstrate proper installation of the air barrier assemblies and components. Include air barrier system connections between floor and wall, wall and window, wall and roof. Also, include the sealing method between membrane joints at transitions from one material or component to another, at pipe or conduit penetrations of the wall and roof, and at duct penetration of the wall and roof. Work will not begin until the mock-up is satisfactory to the Contracting Officer.
- b. Size the mock-up to approximately 8 feet long by 8 feet high. The mock-up must be representative of primary exterior wall assemblies and glazing components including backup wall and typical penetrations as acceptable to the Contracting Officer. A corner of the actual building may be used as the mock-up.
- c. Mock-Up Tests for Adhesion: Test the mock-up of materials for adhesion in accordance with manufacturer's recommendations. Perform the test after the curing period recommended by the manufacturer. Record the mode of failure and the area which failed in accordance with ASTM D4541. When the air barrier material manufacturer has established a minimum adhesion level for the product on the particular

substrate, the inspection report must indicate whether this requirement has been met. Where the manufacturer has not declared a minimum adhesion value for their product/substrate combination, simply record the value.

3.1.3 Quality Control Testing And Inspection

Conduct the following tests and inspections as applicable in the presence of the Contracting Officer during installation of the air barrier system, and submit quality control reports as indicated below.

- a. Provide a Daily Report of Observations with a copy to the Contracting Officer.
- b. Inspect to assure continuity of the air barrier system throughout the building enclosure and that all gaps are covered, the covering is structurally sound, and all penetrations are sealed allowing for no infiltration or exfiltration through the air barrier system.
- c. Inspect to assure structural support of the air barrier system to withstand design air pressures.
- d. Inspect to assure masonry surfaces receiving air barrier materials are smooth, clean, and free of cavities, protrusions and mortar droppings, with mortar joints struck flush or as required by the manufacturer of the air barrier material.
- e. Inspect and test to assure site conditions for application temperature, and dryness of substrates are within guidelines.
- f. Inspect to assure substrate surfaces are properly primed if applicable and in accordance with manufacturer's instructions. Priming must extend at least 2 inches beyond the air barrier material to make it obvious that the primer was applied to the substrate before the air barrier material.
- g. Inspect to assure laps in materials are at least a 2-inch minimum, shingled in the correct direction or mastic applied in accordance with manufacturer's recommendations, and with no fishmouths.
- h. Inspect to assure that a roller has been used to enhance adhesion. Identify any defects such as fishmouths, wrinkles, areas of lost adhesion, and improper curing. Note the intended remedy for the deficiencies.
- i. Measure application thickness of liquid applied materials to assure that manufacturer's specifications for the specific substrate are met.
- j. Inspect to assure that the correct materials are installed for compatibility.
- k. Inspect to assure proper transitions for change in direction and structural support at gaps.
- l. Inspect to assure proper connection between assemblies (membrane and sealants) for cleaning, preparation and priming of surfaces, structural support, integrity and continuity of seal.
- m. Perform adhesion tests for fluid-applied and self-adhered air barrier

membranes to assure that the manufacturer's specified adhesion strength properties are met. Determine the bond strength of coatings to substrate in accordance with ASTM D4541.

- n. Provide cohesion tests for spray polyurethane foam (SPF). Perform adhesion tests as follows: Using a coring tool remove a sample and determine the relative adhesion quality of the foam. If the foam is hard to remove and leaves small bits of foam on the substrate it is called cohesive foam failure and is considered the best adhesion. If the foam comes away from the substrate with some force but is clean, it is called a mechanical bond. If it comes away easily from the substrate, the adhesion is poor. Cohesive foam failure and a good mechanical bond are acceptable.
- o. Provide written test reports of all tests performed.

3.2 REPAIR AND PROTECTION

Upon completion of inspection, testing, sample removal and similar services, repair damaged construction and restore substrates, coatings and finishes. Protect construction exposed by or for quality control service activities, and protect repaired construction.

-- End of Section --

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SECTION 07 27 19.01

SELF-ADHERING AIR BARRIERS
05/17

PART 1 GENERAL

1.1 REFERENCES

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

AIR BARRIER ASSOCIATION OF AMERICA (ABAA)

ABAA Accreditation

Accreditation

ABAA QAP

Quality Assurance Program

ASTM INTERNATIONAL (ASTM)

ASTM D146/D146M

(2004; E 2012; R 2012) Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing

ASTM D412

(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension

ASTM D570

(1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics

ASTM D903

(1998; R 2017) Standard Test Method for Peel or Stripping Strength of Adhesive Bonds

ASTM D1876

(2008; R 2015; E 2015) Standard Test Method for Peel Resistance of Adhesives (T-Peel Test)

ASTM D4263

(1983; R 2012 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

ASTM D4541

(2017) Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

ASTM E84

(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E96/E96M

(2016) Standard Test Methods for Water Vapor Transmission of Materials

ASTM E154/E154M

(2008a; R 2013; E 2013) Water Vapor Retarders Used in Contact with Earth Under

Concrete Slabs, on Walls, or as Ground
Cover

ASTM E283 (2004; R 2012) Determining the Rate of Air
Leakage Through Exterior Windows, Curtain
Walls, and Doors Under Specified Pressure
Differences Across the Specimen

ASTM E331 (2000; R 2016) Standard Test Method for
Water Penetration of Exterior Windows,
Skylights, Doors, and Curtain Walls by
Uniform Static Air Pressure Difference

ASTM E2178 (2013) Standard Test Method for Air
Permeance of Building Materials

ASTM E2357 (2017) Standard Test Method for
Determining Air Leakage of Air Barrier
Assemblies

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 285 (2012) Standard Fire Test Method for
Evaluation of Fire Propagation
Characteristics of Exterior
Non-Load-Bearing Wall Assemblies
Containing Combustible Components

1.2 RELATED REQUIREMENTS

Coordinate the requirements of Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM, Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS and other building enclosure sections to provide a complete building air barrier system. Submit all materials, components, and assemblies of the air barrier system together as one complete submittal package.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualifications of Manufacturer; G

Qualifications of Installer; G

SD-02 Shop Drawings

Self-adhering Air Barrier; G

SD-03 Product Data

Self-adhering Air Barrier; G

Primers, Adhesives, and Mastics; G

Safety Data Sheets; G

SD-06 Test Reports

Field Peel Adhesion Test; G

Flame Propagation of Wall Assemblies; G

Flame Spread and Smoke Developed Index Ratings; G

Site Inspections and Testing; G

SD-07 Certificates

Self-adhering Air Barrier; G

Qualifications of Manufacturer; G

Qualifications of Installer; G

SD-08 Manufacturer's Instructions

Self-adhering Air Barrier; G

Primers, Adhesives, and Mastics; G

1.4 MISCELLANEOUS REQUIREMENTS

For self-adhering air barrier provide the following:

1.4.1 Shop Drawings

Submit self-adhering air barrier shop drawings showing locations and extent of air barrier assemblies and details of all typical conditions, intersections with other building enclosure assemblies and materials, and membrane counterflashings. Show details for bridging of gaps in construction, treatment of inside and outside corners, expansion joints, methods of attachment of materials covering the self-adhered barrier without compromising the barrier. Indicate how miscellaneous penetrations such as conduit, pipes, electric boxes, brick ties, and similar items will be sealed.

1.4.2 Product Data

Submit manufacturer's technical data indicating compliance with performance and environmental requirements, manufacturer's printed instructions for evaluating, preparing, and treating substrates, temperature and other limitations of installation conditions, safety requirements for installation, and Safety Data Sheets. Indicate flame and smoke spread ratings for all products.

1.4.3 Test Reports

Submit test reports indicating that field peel-adhesion tests on all materials have been performed and the changes made, if required, in order

to achieve successful and lasting adhesion. Submit test reports for flame propagation of wall assemblies tested in accordance with NFPA 285. Submit test reports for flame spread and smoke developed index ratings of barrier system materials tested in accordance with ASTM E84.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Deliver and store materials in sufficient quantity to allow for uninterrupted flow of work. Inspect materials delivered to the site for damage and store out of weather. Deliver materials to the jobsite in their original unopened packages, clearly marked with the manufacturer's name, brand designation, description of contents, and shelf life of containerized materials. Store and handle to protect from damage.

1.5.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling. Protect stored materials from direct sunlight. Keep materials sealed and separated from absorptive materials, such as wood and insulation.

1.6 FIELD PEEL ADHESION TEST

Perform a field peel-adhesion test on the construction mockup. Test the self-adhering air barrier for adhesion in accordance with ASTM D4541 using a Type II pull tester except use a disk that is 4 inches in diameter and cut through the membrane to separate the material attached to the dish from the surrounding material. Perform test after curing period in accordance with manufacturer's written recommendations. Record mode of failure and area which failed in accordance with ASTM D4541. Compare adhesion values with the manufacturer's established minimum values for the particular combination of material and substrate. Indicate on the inspection report whether the manufacturer's requirement has been met. Where the manufacturer has not declared a minimum adhesion value for their product and substrate combination, the inspector must record actual values.

1.7 AIR BARRIER TESTING

Perform air barrier testing in accordance with Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM and Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS.

1.8 QUALITY ASSURANCE

1.8.1 Qualifications of Manufacturer

Submit documentation verifying that the manufacturer of the self-adhering air barrier is currently accredited by Air Barrier Association of America (ABAA Accreditation <https://www.airbarrier.org/>).

1.8.2 Qualifications of Installer

Submit documentation verifying that installers of the self-adhering air barrier are currently certified in accordance with the ABAA QAP Quality Assurance Program (<https://www.airbarrier.org/qap/>).

1.9 PRECONSTRUCTION MEETING

Conduct a preconstruction meeting a minimum of two weeks prior to commencing work specified in this Section. Agenda must include, at a minimum, construction and testing of mockup, sequence of construction, coordination with substrate preparation, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction. Attendance is required by representatives of related trades including covering materials, substrate materials, adjacent materials, and materials and components of the air barrier system.

1.10 ENVIRONMENTAL CONDITIONS

1.10.1 Temperature

Install air barrier within the range of ambient and substrate temperatures as recommended in writing by the air barrier manufacturer. Verify that the surface to receive self-adhering air barrier is dry for a minimum of 48 hours prior to the installation of the barrier. Do not apply air barrier to damp or wet substrates. Do not apply during inclement weather or when ice, frost, surface moisture, or visible dampness is present on surfaces to be covered, or when precipitation is imminent.

1.10.2 Exposure to Weather and Ultraviolet Light

Protect air barrier products from direct exposure to rain, snow, sunlight, mist, and other extreme weather conditions. Replace, at no additional cost to the government, barrier products that have been exposed to ultraviolet (sun)light longer than allowed by manufacturer's written requirements.

PART 2 PRODUCTS

2.1 SELF ADHERING AIR BARRIER

Provide minimum 0.040 inch thick self-adhering, vapor permeable air barrier membrane consisting of a cross-laminated high density polyethylene (HDPE) film, fully coated with rubberized asphalt adhesive. Provide membrane in rolls of various widths interleaved with disposable silicone release paper. Self-adhering air barrier must exhibit no visible water leakage when tested in accordance with ASTM E331 and must perform as a liquid water drainage plane flashed to discharge to the exterior any incidental condensation or water penetration. Use regular or low temperature formulation depending on site conditions, within temperature ranges specified by manufacturer.

2.1.1 Physical Properties

- a. Air Permeance (ASTM E2178): In accordance with Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM.
- b. Air Leakage (ASTM E2357, ASTM E283): In accordance with Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM and Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS.
- c. Tensile Strength (ASTM D412 die C modified): Not less than 400 psi.

- d. Tensile Elongation (ASTM D412 die C modified): Not less than 200 percent.
- e. Puncture Resistance (ASTM E154/E154M): Not less than 40 lbs.
- f. Pliability (ASTM D146/D146M): Unaffected at minus 25 degrees F, 0.063 inch mandrel.
- g. Lap Adhesion (ASTM D1876 modified): Not less than 4.0 lbs per inch.
- h. Peel Adhesion (ASTM D903): Not less than 5.0 lbs per inch.
- i. Water Vapor Permeance (Vapor Permeable Air Barrier) (ASTM E96/E96M, desiccant method B): greater than 10.0 perms.
- j. Water Absorption (ASTM D570): Not to exceed 0.12 percent by weight.
- k. Flame propagation of wall assemblies (NFPA 285): Pass
- l. Surface Burning Characteristics (ASTM E84):
 - (1) Flame Spread Index Rating not higher than 75.
 - (2) Smoke Developed Index Rating not higher than 150.

2.2 PRIMERS, ADHESIVES, AND MASTICS

Provide primers, adhesives, mastics and other accessory materials as recommended in writing by the manufacturer of the self-adhering air barrier for adequate bonding to each type of substrate.

2.3 SHEET METAL FLASHING

Provide as specified in Section 07 60 00 FLASHING AND SHEET METAL.

2.4 JOINT SEALANTS

Provide as specified in Section 07 92 00 JOINT SEALANTS. Verify compatibility with adjacent products that are or will be in contact with one another.

PART 3 EXECUTION

3.1 EXAMINATION

Before installing air barrier, examine substrates, areas, and conditions under which air barrier assemblies will be applied, with Installer present, for compliance with requirements. Ensure the following conditions are met:

- a. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants.
- b. Concrete surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions.
- c. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263 and take suitable measures until substrate passes moisture

test.

- d. Verify sealants used in sheathing are compatible with membrane proposed for use. Perform field peel adhesion test on materials to which sealants are adhered.

3.2 PREPARATION

Clean, prepare, and treat substrate in accordance with manufacturer's written instructions. Ensure clean, dust-free, and dry substrate for air barrier application.

- a. Prime masonry and concrete substrates with conditioning primer.
- b. Prime gypsum sheathing an adequate number of coats to achieve required bond, with adequate drying time between coats.
- c. Prime wood, metal, and painted substrates with primer.
- d. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air barrier and at protrusions.

3.3 INSTALLATION

3.3.1 Installation of Self-adhering Air Barrier

Install materials in accordance with manufacturer's recommendations and the following:

- a. Apply primer at rate recommended by manufacturer prior to membrane installation. Allow primer to dry completely before membrane application. Apply as many coats as necessary for proper adhesion.
- b. When membrane is properly positioned, press into place and roll membrane with roller immediately after placement.
- c. Apply membrane sheets to shed water naturally without interception by a sheet edge, unless that edge is sealed with permanently flexible termination mastic.
- d. Position subsequent sheets of membrane applied above so that membrane overlaps the membrane sheet below by a minimum of 2-1/2 inches, unless greater overlap is recommended by manufacturer. Roll into place with roller.
- e. Make all side laps a minimum of 2-1/2 inches and all end laps a minimum of 5 inches, unless greater overlap is recommended by manufacturer. Roll seams with roller.
- f. Roll membrane to adhere to substrate. Cover corners and joints with two layers of reinforcement by first applying a 12 inch width of membrane centered along the axis. Flash drains and projections with a second ply of membrane for a distance of 6 inches from the drain or projection.
- g. Seal around all penetrations through the air barrier resulting from pipes, vents, conduit, electrical fixtures, structural members, or other construction passing through it. Seal with termination mastic, extruded silicone sealant, membrane counterflashing or other sealing

methods in accordance with manufacturer's written recommendations.

- h. Continuously connect the air barrier between walls, roof, floor and below grade assemblies to form a continuous integrated air barrier system around the entire building enclosure. Extend the air barrier membrane into rough openings such as doors, windows, louvers, and other exterior penetrations. Seal edges of barrier at junctures with rough openings.
- i. At changes in substrate plane, provide transition material (e.g. bead of sealant, mastic, extruded silicone sealant, membrane counterflashing or other material recommended by manufacturer) under membrane to eliminate all sharp 90 degree inside corners and to make a smooth transition from one plane to another.
- j. Provide mechanically fastened non-corrosive metal sheet to span gaps in substrate plane and to make a smooth transition from one plane to the other. Continuously support membrane with substrate.
- k. At deflection and control joints, provide backup for the membrane to accommodate anticipated movement.
- l. At expansion and seismic joints provide transition to the joint assemblies.
- m. Apply a bead or trowel coat of mastic along membrane seams at reverse lapped seams, rough cuts, and as recommended by the manufacturer.
- n. At end of each working day, seal top edge of membrane to substrate with termination mastic.
- o. Do not allow materials to come in contact with chemically incompatible materials.
- p. Counterflash upper edge of thru-wall flashing and air barrier. Counter flashing and thru-wall flashing are specified in Section 07 60 00 FLASHING AND SHEET METAL.

3.4 FIELD QUALITY CONTROL

3.4.1 Site Inspections and Testing

Provide site inspections and testing in accordance with ABAA protocol to verify conformance with the manufacturer's instructions, the ABAA QAP Quality Assurance Program (<https://www.airbarrier.org/qap/>), Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM, Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS, and this section.

- a. Conduct inspections and testing at 5, 50, and 95 percent completion of this scope of work. Forward written site inspections and testing reports to the Contracting Officer within five working days of the inspection and test being performed.
- b. If inspections reveal any defects, promptly remove and replace defective work at no additional expense to the Government.

3.5 FIELD PEEL ADHESION TEST

Conduct in accordance with test protocol indicated in Part 1, paragraph

FIELD PEEL ADHESION TEST.

3.6 PROTECTION AND CLEANING

3.6.1 Protection

3.6.1.1 Adjacent Surfaces

Protect exposed adjacent surfaces that could be damaged by primers and adhesives associated with air barrier membrane. Provide protection during application and the remainder of construction in accordance with manufacturer's written instructions.

3.6.1.2 The Air Barrier Assembly

Protect finished portions of the air barrier assembly from damage during ongoing application and throughout the remainder of the construction period in accordance with manufacturer's written instructions. Coordinate timing of installation of materials that will cover the air barrier membrane to ensure the exposure period does not exceed that recommended by the air barrier manufacturer's written installation instructions. Remove and replace, at no additional cost to the government, membrane products that exceed the manufacturer's allowed exposure limits.

3.6.2 Cleaning

Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and as acceptable to the primary material manufacturer.

-- End of Section --

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SECTION 07 27 26

FLUID-APPLIED MEMBRANE AIR BARRIERS
05/17

PART 1 GENERAL

1.1 REFERENCES

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

AIR BARRIER ASSOCIATION OF AMERICA (ABAA)

ABAA Accreditation	Accreditation
ABAA QAP	Quality Assurance Program

ASTM INTERNATIONAL (ASTM)

ASTM C836/C836M	(2015) High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use With Separate Wearing Course
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D4263	(1983; R 2012 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4541	(2017) Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM D5590	(2000; R 2010; E 2012) Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials
ASTM E283	(2004; R 2012) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E331	(2000; R 2016) Standard Test Method for

Water Penetration of Exterior Windows,
Skylights, Doors, and Curtain Walls by
Uniform Static Air Pressure Difference

ASTM E2178

(2013) Standard Test Method for Air
Permeance of Building Materials

ASTM E2357

(2017) Standard Test Method for
Determining Air Leakage of Air Barrier
Assemblies

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 285

(2012) Standard Fire Test Method for
Evaluation of Fire Propagation
Characteristics of Exterior
Non-Load-Bearing Wall Assemblies
Containing Combustible Components

1.2 RELATED REQUIREMENTS

Coordinate the requirements of Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM, Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS, and other building enclosure sections to provide a complete building air barrier system. Submit all materials, components and assemblies of the air barrier system together as one complete submittal package.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualifications of Manufacturer; G

Qualifications of Installer; G

SD-02 Shop Drawings

Fluid-Applied Membrane Air Barrier; G

SD-03 Product Data

Fluid-Applied Membrane Air Barrier; G

Transition Membrane; G

Primers, Adhesives, and Mastics; G

Reinforcement; G

Safety Data Sheets; G

SD-04 Samples

Fluid-Applied Membrane Air Barrier Mockup; G

SD-06 Test Reports

Capillary Moisture Test; G

Field Peel Adhesion Test; G

Flame Propagation of Wall Assemblies; G

Flame Spread and Smoke Developed Index Ratings; G

Site Inspections Reports; G

SD-07 Certificates

Fluid-Applied Membrane Air Barrier; G

Transition Membrane; G

Qualifications of Manufacturer; G

Qualifications of Installer; G

SD-08 Manufacturer's Instructions

Fluid-Applied Membrane Air Barrier; G

Transition Membrane; G

Primers, Adhesives, and Mastics; G

1.4 MISCELLANEOUS REQUIREMENTS

For fluid-applied membrane air barriers provide the following:

1.4.1 Shop Drawings

Submit fluid-applied membrane air barrier shop drawings showing locations and extent of barrier assemblies, transition membranes, details of all typical conditions, intersections with other envelope assemblies and materials, and membrane counterflashings. Show details for bridging of gaps in construction, treatment of inside and outside corners, expansion joints, methods of attachment of materials covering the self-adhered barrier without compromising the barrier. Indicate how miscellaneous penetrations such as conduit, pipes, electric boxes, brick ties, and similar items will be sealed.

1.4.2 Product Data

Submit manufacturer's technical data indicating compliance with performance and environmental requirements, manufacturer's printed instructions for evaluating, preparing, and treating substrates, temperature and other limitations of installation conditions, safety requirements for installation, and Safety Data Sheets. Indicate flame and smoke spread ratings for all products.

1.4.3 Mockup

Provide a mockup of the fluid-applied membrane air barrier. Apply product in an area designated by the Contracting Officer. Apply an area of not less than 54 square feet. Include all components specified as representative of the complete system. Notify the Contracting Officer a minimum of 48 hours prior to the test application. Select a test area representative of conditions to be covered including window or door openings, wall to ceiling transitions, flashings, and penetrations, as applicable.

1.4.4 Test Reports

Submit test reports indicating that capillary moisture tests and field peel adhesion tests on all substrate materials have been performed and the changes made, if required, in order to achieve successful and lasting adhesion. Submit test reports for flame propagation of wall assemblies tested in accordance with NFPA 285. Submit test reports for flame spread and smoke developed index ratings of barrier materials tested in accordance with ASTM E84.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Deliver and store materials in sufficient quantity to allow for uninterrupted flow of work. Inspect materials delivered to the site for damage and store out of weather. Deliver materials to the jobsite in their original unopened packages, clearly marked with the manufacturer's name, brand designation, description of contents, and shelf life of containerized materials. Store and handle to protect from damage.

1.5.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling. Protect stored materials from direct sunlight.

1.6 CAPILLARY MOISTURE TEST

Perform a capillary moisture test by plastic sheet method in accordance with ASTM D4263 on the construction mockup and substrate materials. Perform test after curing period as recommended by the air barrier manufacturer. Record mode of failure and area which failed in accordance with ASTM D4263. Once the air barrier material manufacturer has established a minimum adhesion or moisture level for the product on the particular substrate, indicate on the inspection report whether this requirement has been met. Where the manufacturer has not declared a minimum adhesion or moisture value for their product and substrate combination, the inspector must record actual values.

1.7 FIELD PEEL ADHESION TEST

Perform a field peel adhesion test on a construction mockup. Test the applied product for adhesion in accordance with manufacturer's recommendations. Perform test after curing period recommended by the manufacturer. Record mode of failure and area which failed in accordance

with ASTM D4541. When the manufacturer has established a minimum adhesion level for the product on the particular substrate, the inspection report must indicate whether this requirement has been met. Where the manufacturer has not declared a minimum adhesion value for their product/substrate combination, the inspector must record actual values.

1.8 AIR BARRIER TESTING

Perform air barrier testing in accordance with Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS.

1.9 QUALITY ASSURANCE

1.9.1 Qualifications of Manufacturer

Submit documentation verifying that manufacturer of fluid-applied membrane air barrier is currently accredited by the Air Barrier Association of America (ABAA Accreditation <https://www.airbarrier.org/>).

1.9.2 Qualifications of Installer

Submit documentation verifying that installers of the fluid-applied membrane air barrier are currently certified in accordance with the ABAA QAP Quality Assurance Program (<https://www.airbarrier.org/qap/>).

1.10 PRECONSTRUCTION MEETING

Conduct a preconstruction meeting a minimum of two weeks prior to commencing work specified in this Section. Agenda must include, at a minimum, construction and testing of construction mock up, sequence of construction, coordination with substrate preparation, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction. Attendance is required by representatives of related trades including covering materials, substrate materials, adjacent materials, and materials and components of the fluid-applied membrane air barrier.

1.11 ENVIRONMENTAL CONDITIONS

1.11.1 Temperature

Install fluid-applied membrane air barrier within the range of ambient and substrate temperatures as recommended in writing by the fluid-applied membrane air barrier manufacturer. Do not apply fluid-applied membrane air barrier to a damp or wet substrate. Do not apply during inclement weather or when ice, frost, surface moisture, or visible dampness is present on surfaces to be covered, or when precipitation is imminent.

1.11.2 Exposure to Weather

Protect fluid-applied membrane air barrier products from direct exposure to rain, snow, sunlight, mist, and other extreme weather conditions. Replace, at no additional cost to the government, barrier products that have been exposed to ultraviolet (sun)light longer than allowed by manufacturer's written requirements.

PART 2 PRODUCTS

2.1 FLUID-APPLIED MEMBRANE AIR BARRIER

Provide a fluid-applied, vapor permeable, air barrier. This barrier must exhibit no visible water leakage when tested in accordance with ASTM E331 and must perform as a liquid water drainage plane with thru-wall flashing to discharge incidental condensation and water penetration to the exterior of the building enclosure. Provide products suitable for use within temperature ranges specified by manufacturer for the location of the project.

2.1.1 Physical Properties

- a. Air Permeance (ASTM E2178): in accordance with Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM.
- b. Air Leakage (ASTM E2357, ASTM E283): in accordance with Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM and Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS.
- c. Water Vapor Permeance (Vapor Permeable Membrane) (ASTM E96/E96M, desiccant method A): 10.0 perms.
- d. Tensile Strength (ASTM D412): Not less than 138 psi.
- e. Elongation (ASTM D412): Not less than 300 percent.
- f. Low temperature Flexibility and Crack Bridging (ASTM C836/C836M): Pass at minus 15 degrees F.
- g. Solids by Volume: minimum 50 percent.
- h. Flame propagation of wall assemblies (NFPA 285): Pass
- i. Surface Burning Characteristics (ASTM E84):
 - (1) Flame Spread Index Rating not higher than 75.
 - (2) Smoke Developed Index Rating not higher than 150.
- j. Resistance to Mold, Mildew and Fungal Growth (ASTM D5590): 0, No growth.

2.2 PRIMERS, ADHESIVES, AND MASTICS

Provide primers, adhesives, mastics, sealants and other accessories as recommended by manufacturer of fluid-applied membrane air barrier for a complete installation.

2.3 TRANSITION MEMBRANE

Provide as specified in Section 07 27 19.01 SELF-ADHERING AIR BARRIERS.

2.4 SHEET METAL FLASHING

Provide as specified in Section 07 60 00 FLASHING AND SHEET METAL.

2.5 JOINT SEALANTS

Provide as specified in Section 07 92 00 JOINT SEALANTS.

2.6 REINFORCEMENT

Provide fiberglass mesh tape, or fluid-applied air barrier manufacturer's approved comparable equal product, reinforcement at seams, edges, projections and penetrations. Reinforce all joints exceeding 1/4 inch with fiberglass mesh.

PART 3 EXECUTION

3.1 EXAMINATION

Before installing fluid-applied membrane air barrier, examine substrates, areas, and conditions under which fluid-applied membrane air barrier assemblies will be applied, with installer present, for compliance with requirements. Ensure the following conditions are met:

- a. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants detrimental to the adhesion of the membranes.
- b. Concrete and masonry surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions. Do not proceed with installation until after minimum concrete curing period recommended by fluid-applied membrane air barrier manufacturer.
- c. Fill voids, gaps and spalled areas in substrate to provide an even plane. Strike masonry joints full flush.
- d. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263 and take suitable measures until substrate passes moisture test.
- e. Verify sealants used in substrates, and in joints between substrates, are compatible with fluid-applied membrane air barrier.

3.2 PREPARATION

Clean, prepare, and treat substrate in accordance with manufacturer's written instructions. Ensure clean, dust-free, and dry substrate for fluid-applied membrane air barrier application.

- a. Remove dust, dirt and other contaminants from joints and cracks before coating surfaces.
- b. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through fluid-applied membrane air barrier.
- c. At changes in substrate plane, provide transition material (bead of sealant, mastic, extruded silicone sealant, membrane counterflashing or other material recommended by manufacturer) under transition membrane to eliminate all sharp 90 degree inside corners and to make a smooth transition from one plane to another.

- d. Provide mechanically fastened non-corrosive metal sheet to span gaps in substrate plane and to make a smooth transition from one plane to the other. Continuously support membrane with substrate.
- e. For exterior sheathing substrates, ensure that exterior sheathing is stabilized, with corners and edges fastened with appropriate screws. Treat all joints in accordance with the air barrier manufacturer's instructions prior to application of air barrier material. Allow sufficient time for joint treatments to fully cure before application of transition membranes and fluid-applied membrane air barrier.
- f. For concrete and masonry substrates, fill all voids and holes, particularly in mortar joints, with non-shrinking grout.
- g. Mask off and cover adjacent surfaces to protect from spillage and overspray.

3.3 INSTALLATION

3.3.1 Installation of Transition Membrane

Install transition membrane materials in accordance with the details on the drawings, Section 07 27 19.01 SELF-ADHERING AIR BARRIERS, and the following:

- a. Install transition membrane at all required locations prior to installation of the fluid-applied membrane air barrier.
- b. Verify transition membrane is fully adhered to substrate and that its surface is clean, dry and wrinkle free prior to installation of the fluid-applied membrane air barrier.
- c. Verify transition membrane completely covers all transition areas and will provide continuity of the finished fluid-applied membrane air barrier without gaps or cracks.

3.3.2 Installation of Flashing

Counterflash upper edge of thru-wall flashing and fluid-applied air barrier. Counter flashing and thru-wall flashing are specified in Section 07 60 00 FLASHING AND SHEET METAL.

3.3.3 Installation of Fluid-Applied Membrane Air Barrier

Install materials in accordance with manufacturer's recommendations and the following:

- a. Apply fluid-applied membrane air barrier in single or dual coat application by spray or roller. Apply fluid-applied membrane air barrier within manufacturer's recommended temperature range for application.
- b. Apply fluid-applied membrane air barrier at rate recommended by manufacturer to yield a wet film thickness of 90 mils.
- c. Apply fluid-applied membrane air barrier around all penetrations ensuring a complete and continuous air barrier. Lap fluid-applied membrane air barrier a minimum of 3 inch over transition membrane to seal leading edge.

- d. Seal membrane terminations, heads of mechanical fasteners, masonry tie fasteners, around penetrations, HVAC assemblies, plumbing and electrical assemblies, doors, windows, louvers, and other assemblies penetrating the fluid-applied membrane air barrier with a termination sealant recommended by the fluid-applied membrane air barrier manufacturer.
- e. Notify the Contracting Officer and Testing Agency upon completion of fluid-applied membrane air barrier installation. Air barrier materials and assemblies must remain exposed until tested and inspected by the ABAA.
- f. Do not allow materials to come in contact with chemically incompatible materials.

3.3.4 Installation of Reinforcement

Install reinforcement at projections, corners, joints, and penetrations where applicable.

3.4 FIELD QUALITY CONTROL

3.4.1 Site Inspections and Testing

Provide site inspections and testing in accordance with ABAA protocol to verify conformance with the manufacturer's instructions, the ABAA QAP Quality Assurance Program (<https://www.airbarrier.org/qap/>), Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM, Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS, and this section.

- a. Conduct inspections and testing at 5, 50, and 95 percent completion of this scope of work. Forward written inspection reports to the Contracting Officer within five working days of the inspection and test being performed.
- b. If the inspections reveal any defects, promptly remove and replace defective work at no additional expense to the Government.

3.5 PROTECTION AND CLEANING

3.5.1 Protection

Protect fluid-applied membrane air barrier assemblies from damage during application and remainder of construction in accordance with manufacturer's written instructions.

Coordinate installation, testing, and inspection procedures to ensure exposure period does not exceed that recommended by the product manufacturer. Remove and replace, at no additional cost to the government, membrane products that exceed manufacturer's allowed exposure limits.

3.5.2 Cleaning of Adjacent Surfaces

Clean excess product from adjacent construction using cleaning agents and procedures as recommended in writing by the manufacturer of each type of affected construction and as acceptable to same.

3.6 CLEANUP OF SPILLS

Conduct cleanup of uncured product spillage in accordance with manufacturer's written safe handling instructions.

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METAL ROOF PANELS
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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 S100 (2012) 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 SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2010) Minimum Design Loads for Buildings and Other Structures

AMERICAN WELDING SOCIETY (AWS)

AWS A5.1/A5.1M (2012) Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

AWS D1.2/D1.2M (2014) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2014) Standard Specification for Carbon Structural Steel

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A463/A463M (2010; R 2015) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process

ASTM A653/A653M (2018) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A755/A755M (2018) Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip

Process and Prepainted by the Coil-Coating
Process for Exterior Exposed Building
Products

ASTM A792/A792M	(2010) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A1008/A1008M	(2016) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM B117	(2016) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM C552	(2017; E 2018) Standard Specification for Cellular Glass Thermal Insulation
ASTM C553	(2013) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C792	(2004; R 2008) Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM D522/D522M	(2014) Mandrel Bend Test of Attached Organic Coatings
ASTM D523	(2014; R 2018) Standard Test Method for Specular Gloss
ASTM D610	(2008; R 2019) Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D714	(2002; R 2017) Standard Test Method for Evaluating Degree of Blistering of Paints
ASTM D822	(2013) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D968	(2017) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1056	(2014) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1308	(2013) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D1654	(2008; R 2016; E 2017) Standard Test

	Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D1667	(2017) Standard Specification for Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D1970/D1970M	(2018) Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
ASTM D2244	(2016) Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D2247	(2015) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D2794	(1993; R 2019) Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D3359	(2017) Standard Test Methods for Rating Adhesion by Tape Test
ASTM D3363	(2005; E 2011; R 2011; E 2012) Film Hardness by Pencil Test
ASTM D4214	(2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D4587	(2011) Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
ASTM D5894	(2016) Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E1592	(2005; R 2012) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E2140	(2001; R 2017) Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head
ASTM G152	(2013) Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

ASTM G153	(2013) Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
FM GLOBAL (FM)	
FM 4471	(2010) Class I Panel Roofs
METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)	
MBMA RSDM	(2012) Metal Roofing Systems Design Manual
NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)	
NRCA 0420	(2010) Architectural Metal Flashing, Condensation Control and Reroofing
NRCA RoofMan	(2017) The NRCA Roofing Manual
SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)	
SMACNA 1793	(2012) Architectural Sheet Metal Manual, 7th Edition
U.S. DEPARTMENT OF ENERGY (DOE)	
Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)
UNDERWRITERS LABORATORIES (UL)	
UL 580	(2006; Reprint Nov 2018Mar 2019) UL Standard for Safety Tests for Uplift Resistance of Roof Assemblies
UL Bld Mat Dir	(updated continuously online) Building Materials Directory

1.2 DESCRIPTION OF METAL ROOF SYSTEM

1.2.1 Performance Requirements

Steel panels and accessory components must conform to the following standards:

ASTM A1008/A1008M
ASTM A123/A123M
ASTM A36/A36M
ASTM A463/A463M for aluminum coated steel sheet
ASTM A755/A755M for metallic coated steel sheet for exterior coil prepainted applications.
ASTM D522/D522M for applied coatings
UL Bld Mat Dir

1.2.1.1 Hydrostatic Head Resistance

No water penetration when tested according to ASTM E2140. Submit leakage

test report upon completion of installation.

1.2.1.2 Wind Uplift Resistance

Provide metal roof panel system that conform to the requirements of ASTM E1592 and UL 580. Uplift force due to wind action governs the design for panels. Submit wind uplift test report prior to commencing installation.

Provide roof system and attachments that resist the wind loads as determined by ASCE 7, in pounds per square foot. Metal roof panels and component materials must also comply with the requirements in FM 4471 as part of a panel roofing system as listed in Factory Mutual Guide (FMG) "Approval Guide" for class 1 or noncombustible construction, as applicable. Identify all materials with FMG markings.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Roofing Panels; G

Flashing and Accessories; G

Gutter/Downspout Assembly; G

SD-03 Product Data

Submit manufacturer's catalog data for the following items:

Roof Panels; G

Recycled Content for Steel Roof Panels; S

Energy Star Label for Metal Roofing Product; S

Factory-Applied Color Finish; G

Accessories; G

Fasteners; G

Pressure Sensitive Tape; G

Underlayments; G

Gaskets and Sealing/Insulating Compounds; G

Coil Stock; G

Aluminized Steel Repair Paint; G

Environmental Product Declaration for Roof Panels; S

Material Ingredient Report for Roof Panels; S

Material Ingredient Optimization Report for Roof Panels; S

SD-04 Samples

Roof Panels; G

Factory-applied Color Finish, Samples, 9 inch lengths, full width;
G

Accessories; G

Fasteners; G

Gaskets and Sealant/Insulating Compounds; G

SD-05 Design Data

Wind Uplift Resistance; G

SD-06 Test Reports

Leakage Test Report; G

Wind Uplift Test Report; G

Factory Finish and Color Performance Requirements; G

SD-07 Certificates

Roof Panels; G

Coil Stock Compatibility; G

Self-Adhering Modified Bitumen Underlayment; G

Qualification of Manufacturer; G

Qualification of Applicator; G

SD-08 Manufacturer's Instructions

Installation Manual; G

SD-09 Manufacturer's Field Reports

Manufacturer's Field Inspection Reports; G

SD-11 Closeout Submittals

Warranties; G

Information Card; G

1.4 QUALITY ASSURANCE

1.4.1 Qualification of Manufacturer

Submit documentation verifying metal roof panel manufacturer has been in the business of manufacturing metal roof panels for a period of not less than 5 years.

Manufacturer must also provide engineering services by an authorized engineer, currently licensed in the geographic area of the project, with a minimum of five (5) years experience as an engineer knowledgeable in roof wind design analysis, protocols and procedures for MBMA RSDM, ASCE 7, UL 580, and FM 4471. Engineer must provide certified engineering calculations for the project conforming to the stated references.

1.4.1.1 Manufacturer's Technical Representative

The manufacturer's technical representative must be thoroughly familiar with the products to be installed, installation requirements and practices, and with any special considerations in the geographical area of the project. The representative must perform field inspections and attend meetings as specified.

1.4.1.2 Single Source

Provide roofing panels, clips, closures, and other accessories that are standard products of the same manufacturer, and the most recent design of the manufacturer to operate as a complete system for the intended use.

1.4.2 Qualification of Applicator

Metal roof system applicator must be approved, authorized, or licensed in writing by the roof panel manufacturer and have a minimum of three years experience as an approved, authorized, or licensed applicator with that manufacturer, approved at a level capable of providing the specified warranty. Supply the names, locations and client contact information of 5 projects of similar size and scope constructed by applicator using the manufacturer's roofing products submitted for this project within the previous three years.

1.4.3 Field Verification

Prior to the preparation of drawings and fabrication, verify location of roof framing, roof openings and penetrations, and any other special conditions. Indicate all special conditions and measurements on final shop drawings.

1.4.4 Qualifications for Welding Work

Perform welding procedures in conformance to AWS D1.1/D1.1M for steel or AWS D1.2/D1.2M for aluminum.

Operators are permitted to make only those types of weldments for which each is specifically qualified.

1.4.5 Pre-roofing Conference

After approval of submittals and before performing roofing system installation work, hold a pre-roofing conference to review the following:

- a. Drawings, specifications, and submittals related to the roof work. Submit, as a minimum; sample profiles of roofing panels, with factory-applied color finish samples, flashing and accessories, gutter/downspout assembly samples, typical fasteners and pressure sensitive tape, sample gaskets and sealant/insulating compounds. Also include data and 1/2 pint sample of aluminized steel repair paint, and technical data on coil stock and coil stock compatibility, and manufacturer's installation manual.
- b. Roof system components installation;
- c. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roofing substrate, the name of the manufacturer's technical representatives, the frequency of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representative;
- d. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing; and
- e. Quality control plan for the roof system installation;
- f. Safety requirements.

Coordinate pre-roofing conference scheduling with the Contracting Officer. Attendance is mandatory for the Contractor, the Contracting Officer's designated personnel, personnel directly responsible for the installation of metal roof system, flashing and sheet metal work, mechanical and electrical work, other trades interfacing with the roof work, and representative of the metal roofing manufacturer. Before beginning roofing work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start of roof work.

1.5 DELIVERY, HANDLING, AND STORAGE

Deliver, store, and handle panel materials, bulk roofing products, accessories, and other manufactured items in a manner to prevent damage and deformation, as recommended by the manufacturer, and as specified.

1.5.1 Delivery

Package and deliver materials to the site in undamaged condition. Provide adequate packaging to protect materials during shipment. Do not uncrate materials until ready for use, except for inspection. Immediately upon arrival of materials at jobsite, inspect materials for damage, deformation, dampness, and staining. Remove affected materials from the site and immediately replace. Remove moisture from wet materials not otherwise affected, restack and protect from further moisture exposure.

1.5.2 Handling

Handle materials in a manner to avoid damage. Select and operate material handling equipment so as not to damage materials or applied roofing.

1.5.3 Storage

Stack materials stored on site on platforms or pallets, and cover with tarpaulins or other weathertight covering which prevents trapping of water or condensation under the covering. Store roof panels so that water which may have accumulated during transit or storage will drain off. Do not store panels in contact with materials that might cause staining. Secure coverings and stored items to protect from wind displacement.

1.6 PROJECT CONDITIONS

Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements, and specified safety requirements.

1.7 FABRICATION

Fabricate and finish metal roof panels and accessories on a factory stationary industrial type rolling mill to the greatest extent possible, per manufacturer's standard procedures and processes, and as necessary to fulfill indicated performance requirements. Comply with indicated profiles, dimensional and structural requirements.

Provide panel profile, as indicated on drawings for full length of panel. Fabricate panel side laps with factory installed captive gaskets providing a weather tight seal and preventing metal-to metal contact, and minimizing noise from movements within the panel assembly.

1.7.1 Finishes

Finish quality and application processes must conform to the related standards specified within this section. Noticeable variations within the same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize any contrasting variations.

1.7.2 Accessories

Fabricate flashing and trim to comply with recommendations in SMACNA 1793 as applicable to the design, dimensions, metal, and other characteristics of the item indicated.

- a. Form exposed sheet metal accessories which are free from excessive oil canning, buckling, and tool marks, and are true to line and levels indicated, with exposed edges folded back to form hems.
- b. End Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.
- c. Sealed Joints: Form non-expansion, but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA 1793.
- d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
- e. Fabricate cleats and attachments devices of size and metal thickness recommended by SMACNA or by metal roof panel manufacturer for application, but not less than the thickness of the metal being

secured.

1.8 WARRANTIES

Provide metal roof system material and workmanship warranties meeting specified requirements. Provide revision or amendment to manufacturer's standard warranty as required to comply with the specified requirements.

1.8.1 Metal Roof Panel Manufacturer Warranty

Furnish the metal roof panel manufacturer's 20-year no dollar limit roof system materials and installation workmanship warranty, including flashing, components, trim, and accessories necessary for a watertight roof system construction. Make warranty directly to the Government, commencing at time of Government's acceptance of the roof work. The warranty must state that:

- a. If within the warranty period, the metal roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-watertight, shows evidence of moisture intrusion within the assembly, displaces, corrodes, perforates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the metal roof system and correction of defective workmanship is the responsibility of the metal roof panel manufacturer. All costs associated with the repair or replacement work are the responsibility of the metal roof panel manufacturer.
- b. If the manufacturer or his approved applicator fail to perform the repairs within 24 hours of notification, emergency temporary repairs performed by others does not void the warranty.

1.8.2 Manufacturer's Finish Warranty

Provide a manufacturer's no-dollar-limit 20 year warranty for the roofing system. Issue the warranty directly to the Government at the date of Government acceptance, warranting that the factory color finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of 8 when measured in accordance with ASTM D4214; or fade or change colors in excess of 5 NBS units as measured in accordance with ASTM D2244.

1.8.3 Metal Roof System Installer Warranty

Provide the "Contractors Twenty 20) Year No Penal Sum Warranty for Non-Structural Metal Roof System" attached at the end of this section. Provide a separate bond in an amount equal to the installed total material and installation roofing system cost in favor of the Government covering the installer's warranty responsibilities effective throughout the twenty 20) year warranty period.

1.8.4 Continuance of Warranty

Repair or replacement work that becomes necessary within the warranty period must be approved, as required, and accomplished in a manner so as to restore the integrity of the roof system assembly and validity of the metal roof system manufacturer warranty for the remainder of the manufacturer warranty period.

1.9 CONFORMANCE AND COMPATIBILITY

Provide the entire metal roofing and flashing system in accordance with specified and indicated requirements, including wind resistance requirements. Perform work not specifically addressed and any deviation from specified requirements in general accordance with recommendations of the MBMA RSDM, NRCA RoofMan, the metal panel manufacturer's published recommendations and details, and compatible with surrounding components and construction. Submit any deviation from specified or indicated requirements to the Contracting Officer for approval prior to installation.

PART 2 PRODUCTS

2.1 ROOF PANELS

2.1.1 Steel Sheet Panels

Roll-form steel sheet roof panels to the specified profile, with $f_y = 50$ ksi, 24 gauge and depth as indicated.

Provide steel panels with a minimum recycled content of 30 percent. Provide data indicating percentage of recycled content for steel roof panels.

Material must be plumb and true, and within the tolerances listed:

- a. Aluminum-Zinc alloy coated steel sheet conforming to ASTM A792/A792M and AISI SG03-3.
- b. Individual panels to have continuous length sufficient to cover the entire length of any unbroken roof slope with no joints or seams and formed without warping, waviness, or ripples that are not a part of the panel profile and free from damage to the finish coating system.
- c. Provide panels with thermal expansion and contraction consistent with the type of system specified, and the following profile:
 - (1) profile to be a 1-3/4 inch high standing seam, 18 inch coverage with mechanical crimping or snap-together seams with concealed clips and fasteners.

2.2 SUSTAINABILITY INFORMATION

Provide the following:

Environmental Product Declaration for Roof Panels
Material Ingredient Report for Roof Panels
Material Ingredient Optimization Report for Roof Panels

2.3 FACTORY FINISH AND COLOR PERFORMANCE REQUIREMENTS

All panels are to receive a factory applied polyvinylidene fluoride Kynar 500 finish consisting of a baked topcoat with a manufacturer's recommended prime coat conforming to the following:

- a. Metal Preparation: All metal is to have the surfaces carefully prepared for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion

coating, cold water rinsing, sealing with an acid rinse, and thorough drying.

- b. Prime Coating: A base coat of epoxy paint, specifically formulated to interact with the top-coat, is to be applied to the prepared surfaces by roll coating to a dry film thickness of 0.20 plus 0.05 mils. Oven cure the prime coat prior to application of the finish coat.
- c. Exterior Finish Coating: Apply the exterior finish coating over the primer by roll coating to a dry film thickness of 0.80 plus 0.05 mils (3.80 plus 0.05 mils for Vinyl Plastisol) for a total dry film thickness of 1.00 plus 0.10 mils (4.00 plus 0.10 mils for Vinyl Plastisol). Oven cure this exterior finish coat.
- d. Interior finish coating: Apply a wash coat on the reverse side over primer by roll coating to a dry film thickness of 0.30 plus 0.05 mils for a total dry film thickness of 0.50 plus 0.10 mils. Oven cure the wash coat.
- e. Color: The exterior finish chosen from the manufacturer's standard color chart.
- f. Physical Properties: Coating must conform to the industry and manufacturer's standard performance criteria as listed by the following certified test reports:

General:	ASTM D5894 and ASTM D4587
Abrasion:	ASTM D968
Adhesion:	ASTM D3359
Chalking:	ASTM D4214
Chemical Pollution:	ASTM D1308
Color Change and Conformity:	ASTM D2244
Creepage:	ASTM D1654
Cyclic Corrosion Test:	ASTM D5894
Flame Spread:	ASTM E84
Flexibility:	ASTM D522/D522M
Formability:	ASTM D522/D522M
Gloss at 60 and 85 degrees:	ASTM D523
Humidity:	ASTM D2247 and ASTM D714
Oxidation:	ASTM D610

Pencil Hardness:	ASTM D3363
Reverse Impact:	ASTM D2794
Salt Spray:	ASTM B117
Weatherometer:	ASTM G152, ASTM G153 and ASTM D822

2.3.1 Specular Gloss

Finished roof surfaces to have a specular gloss value of 30 plus or minus 5 at an angle of 60 degrees when measured in accordance with ASTM D523.

2.3.2 Energy and Cool Roof Performance

Provide a product that is Energy Star labeled and is produced and compatible with the requirements of this specification. Provide data identifying Energy Star label for metal roofing product. The roofing system will need to include a top surface finish that meets the criteria for Cool Roof Products. Provide data indicating initial or three-year aged Solar Reflectance Index (SRI).

2.4 MISCELLANEOUS METAL FRAMING

2.4.1 General

Provide cold formed metallic-coated steel sheet conforming to ASTM A653/A653M, AISI S100, unless otherwise indicated.

2.4.2 Fasteners and Miscellaneous Metal Framing

Provide compatible type, corrosion resistant, of sufficient size and length to penetrate the supporting element a minimum of one inch with other required properties to fasten miscellaneous metal framing members to substrates in accordance with the roof panel manufacturer's and ASCE 7 requirements.

2.4.2.1 Exposed Fasteners

Provide corrosion resistant stainless steel fasteners for roof panels, compatible with the sheet panel or flashing material and of the type and size recommended by the manufacturer to meet the performance requirements and design loads. Provide fasteners for accessories that are the manufacturer's standard. Provide an integral metal washer, matching the color of attached material with compressible sealing EPDM gasket approximately 3/32 inch thick for exposed fasteners.

2.4.2.2 Screws

Provide corrosion resistant screws, stainless steel of the type and size recommended by the manufacturer to meet the performance requirements.

2.4.2.3 Rivets

Provide closed-end type rivets, corrosion resistant where watertight connections are required.

2.4.2.4 Attachment Clips

Provide stainless steel, series 300 clips. Size, shape, thickness and capacity must meet the thickness and design load criteria specified.

2.4.3 Electrodes for Manual, Shielded Metal Arc Welding

Utilize electrodes for manual, shielded metal arc welding meeting the requirements of AWS D1.1/D1.1M, that are covered, mild-steel electrodes conforming to AWS A5.1/A5.1M.

2.5 ACCESSORIES

Provide accessories compatible with the metal roof panels. Sheet metal flashing, trim, metal closure strips, caps, and similar metal accessories must be not less than the minimum thicknesses specified for roof panels. Provide exposed metal accessories to match the panels furnished, except as otherwise indicated. Provide molded foam rib, ridge and other closure strips that are closed-cell or solid-cell synthetic rubber or neoprene premolded to match configuration of the panels and not absorb or retain water.

2.5.1 Pre-manufactured Accessories

Provide pre-manufactured accessories that are manufacturer's standard for intended purpose, compatible with the metal roof system and approved for use by the metal roof panel manufacturer.

2.5.1.1 Snow Retention System

Provide extruded aluminum snow retention system consisting of 1 inch by 1 inch square tubing and heavy-duty, non-penetrating attachments, compatible with roof panel profile. Provide clamps, set screws, block plates, end caps and other component parts that make up the snow retention system. Locate clamps and tubing as indicated on the drawings. Finish snow retention system to match the metal roof system.

2.5.2 Metal Closure Strips

Provide factory fabricated steel closure strips of the same gauge, color, finish and profile as the specified roof panel.

2.5.3 Rubber Closure Strips

Provide closed-cell, expanded cellular rubber closure strips conforming to ASTM D1056 and ASTM D1667, extruded or molded to the configuration of the specified roof panel profile and in lengths supplied by roof panel manufacturer.

2.6 JOINT SEALANTS

2.6.1 Sealants

Sealants are to be an approved gun type for use in hand or air pressure caulking guns at temperatures above 40 degrees F (or frost-free application at temperatures above 10 degrees F) with a minimum solid content of 85 percent of the total volume. Ensure sealant dries with a tough, durable surface skin which permits it to remain soft and pliable underneath, providing a weather tight joint. No migratory staining, in

conformance with to ASTM C792, is permitted on painted or unpainted metal, stone, glass, vinyl or wood.

Prime all joints to receive sealants with a compatible one-component or two-component primer as recommended by the roof panel manufacturer.

2.6.1.1 Shop Applied Sealants

Provide sealant for shop-applied caulking that is an approved gun grade, non-sag one-component polysulfide or silicone conforming to ASTM C792 and ASTM C920, Type II, with a curing time which ensures the sealants plasticity at the time of field erection. Color to match panel color.

2.6.1.2 Field Applied Sealants

Provide sealants for field-applied caulking that is an approved gun grade, non-sag on-component polysulfide or two component polyurethane with an initial maximum Shore A durometer hardness of 25, conforming to ASTM C920, Type II. Color to match panel color.

2.6.1.3 Tape Sealants

Provide pressure sensitive, 100 percent solid tape sealant with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the roof panel manufacturer.

2.6.2 Sheet Metal Flashing and Trim

2.6.2.1 Fabrication, General

Custom fabricate sheet metal flashing and trim to comply with recommendations within the SMACNA 1793 that apply to design, dimensions, metal type, and other characteristics of design indicated. Shop fabricate items to the greatest extent possible. Obtain and verify field measurements for accurate fit prior to shop fabrication. Fabricate flashing and trim without excessive oil canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

2.6.2.2 Roof Drainage Sheet Metal Fabrications

Gutters: Fabricate to cross section indicated, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required. Fabricate in minimum 96 inch long sections. Fabricate expansion joints and accessories from the same metal as gutters, unless otherwise indicated.

Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers of same material as downspouts and anchors.

2.7 INSULATION

Provide insulation, facer material and attachment compatible with metal roof system specified, as approved by the roof panel manufacturer, and conform to ASTM C552 (cellular glass) or ASTM C553 (fiber blankets).

2.8 UNDERLAYMENTS

2.8.1 Self-Adhering Modified Bitumen Underlayment

Provide self-adhering modified bitumen membrane underlayment material in compliance with ASTM D1970/D1970M, suitable for use as underlayment for metal roofing. Use membrane resistant to cyclical elevated temperatures for extended period of time in high heat service conditions. Provide membrane with integral non-tacking top surface of polyethylene film or other surface material to serve as separator between bituminous material and metal products to be applied above.

2.8.2 Three-Dimensional Mat Underlayment

Provide three-dimensional mat, 3/4" thick, made of continuous nylon filaments, entangled and fused, and suitable for use as drainage and ventilation between the metal roofing and water resistant underlayment. Provide Class A three-dimensional mat material, in compliance with ASTM E84.

2.9 GASKETS AND SEALING/INSULATING COMPOUNDS

Provide gaskets and sealing/insulating compounds that are nonabsorptive and suitable for insulating contact points of incompatible materials. Utilize sealing/insulating compounds that are non-running after drying.

2.10 FINISH REPAIR MATERIAL

Only use repair and touch-up paint supplied by the roof panel manufacturer and is compatible with the specified system.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the work. Ensure surfaces are suitable, dry and free of defects and projections which might affect the installation.

Examine primary and secondary roof framing to verify that rafters, purlins, angels, channels, and other structural support members for panels and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer, UL, ASTM, and ASCE 7 requirements.

Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking; and that installation is within flatness tolerances required by metal roof panel manufacturer.

Examine rough-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of panels prior to installation.

Submit a written report to the Contracting Officer, endorsed by the installer, listing conditions detrimental to the performance of the work. Proceed with installation only after defects have been corrected.

Do not install items that show visual evidence of biological growth.

3.2 INSTALLATION

Perform installation meeting specified requirements and in accordance with the manufacturer's installation instructions and approved shop drawings. Do not install damaged materials. Insulate dissimilar materials which are not compatible when contacting each other by means of gaskets or sealing/insulating compounds. Keep all exposed surfaces and edges clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Remove stained, discolored, or damaged materials from the site.

3.2.1 Preparation

Clean all substrate substances which may be harmful to roof panels including removing projections capable of interfering with roof panel attachment.

Install sub-purlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.

3.2.2 Underlayment

Install underlayment according to roof panel manufacturer's written recommendations and recommendation in NRCA "The NRCA Roofing and Waterproofing Manual".

3.2.2.1 Self-Adhering Sheet Underlayment

Install self-adhering sheet underlayment; wrinkle free on roof deck. Comply with low-temperature installation restrictions of manufacturer where applicable. Install at locations indicated on project drawings, lapped in a direction to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.

3.2.2.2 Three-Dimensional Mat Underlayment

Install three-dimensional mat underlayment loose, with wrinkles smoothed out. Attach per manufacturer's recommendations to assure that underlayment does not slide or tear during installation of metal roofing. Avoid overlapping the entangled filament mats to maintain an even underlayment thickness.

3.3 INSULATION INSTALLATION

Install insulation concurrently with metal roof panel installation, in thickness indicated, to cover entire roof, according to manufacturer's written instructions.

3.4 PROTECTION OF APPLIED MATERIALS

Do not permit storing, walking, wheeling, and trucking directly on applied roofing/insulation materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to applied roofing/insulation materials, and to distribute weight to conform to indicated live load limits of roof construction.

3.5 FASTENER INSTALLATION

Anchor metal roof panels and other components of the Work securely in place, using approved fasteners according to manufacturer's written instructions.

3.5.1 Welding

Perform procedures for manual, shielded metal-arc welding, the inspection and testing of welds made, and the methods used in correcting welding work in accordance with AWS D1.1/D1.1M.

3.6 FLASHING, TRIM, AND CLOSURE INSTALLATION

3.6.1 General Requirements

Comply with performance requirements, manufacturer's written installation instructions, and SMACNA 1793. Provide concealed fasteners where possible. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently water tight and weather resistant. Work is to be accomplished to form weather tight construction without waves, warps, buckles, fastening stresses or distortion, and to allow for expansion and contraction. Perform cutting, fitting, drilling, and other operations in connection with sheet metal required to accomplish the work in conformance with the manufacturers written instructions.

3.6.2 Metal Flashing

Install exposed metal flashing at building corners, rakes, eaves, junctions between metal siding and roofing, valleys and changes off slope or direction in metal roofing, building expansion joints and gutters.

Utilize exposed metal flashing that is the same material, color, and finish as the specified metal roofing panels. Furnish flashing in minimum 8 foot lengths. Exposed flashing must have 1 inch locked and blind soldered end joints, with expansion joints at intervals of no greater than 16 feet.

Fasten flashing at not more than 8 inches on center for roofs, except where flashing is held in place by the same screws used to secure panels. Bed exposed flashing and flashing subject to rain penetration in specified joint sealant. Isolate flashing which is in contact with dissimilar metals by means of the specified asphalt mastic material to prevent electrolytic deterioration.

Form drips to the profile indicated, with the edge folded back 1/2 inch to form a reinforced drip edge.

3.7 ROOF PANEL INSTALLATION

Provide metal roof panels of full length from eave to ridge or eave to wall as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels or other components of the Work securely in place, with provisions for thermal and structural movement in accordance with NRCA 0420.

Steel Roof Panels: Use stainless steel fasteners for exterior surfaces and galvanized fasteners for unexposed surfaces.

Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using approved fasteners according to manufacturer's written instructions. Provide all blocking and nailers as required.

Metal Protection: Where dissimilar metals contact each other or possibly corrosive substrates, protect against galvanic action by permanent separation as recommended by the metal roof panel manufacturer.

Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and required for weatherproof performance of metal roof panel system. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

3.7.1 Handling and Erection

Erect roofing system in accordance with the approved erection drawings, printed instructions and safety precautions of the manufacturer.

Do not subject panels to overloading, abuse, or undue impact. Do not apply bent, chipped, or defective panels. Replace and remove from the site any damaged panels at the Contractor's expense. Erect panels true, plumb, and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with indicated rake, eave, and curb overhang. Allow for thermal movement of the roofing, movement of the building structure, and provide permanent freedom from noise due to wind pressure.

Do not permit storage, walking, wheeling or trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to the installed roofing materials, and to distribute weight to conform to the indicated live load limits of the roof construction.

Lay roof panels with corrugations in the direction of the roof slope. Lap ends of exterior roofing not less than 8 inches; lap sides of standard exterior corrugated panels not less than 2-1/2 corrugations.

Field cutting of metal roof panels by torch is not permitted. Field cut only as recommended by manufacturer's written instructions.

3.7.2 Closure Strips

Install metal closure strips at open ends of metal ridge rolls; open ends of corrugated or ribbed pattern roofs, and at intersection of wall and roof, unless open ends are concealed with formed eave flashing; rake of metal roof unless open end has a formed flashing member; and in other required areas.

Install closure strips at intersection of the wall with metal roofing; top and bottom of metal siding; heads of wall openings; and in other required locations.

3.7.3 Workmanship

Make lines, arises, and angles sharp and true. Free exposed surfaces from

any visible wave, warp, buckle and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections which might affect the application. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and as necessary to make the work watertight.

3.8 SNOW RETENTION SYSTEM INSTALLATION

Attach heavy-duty, non-penetrating clamps to standing seams with set screws. Tighten set screws to comply with manufacturer's torque requirements. Verify clamps are secure, straight and level. Secure receiver channels, tubing, block plates and component parts with manufacturer's recommended fasteners. Verify installed system is secure, straight and level.

3.9 ACCEPTANCE PROVISIONS

3.9.1 Erection Tolerances

Erect metal roofing straight and true with plumb vertical lines correctly lapped and secured in accordance with the manufacturer's written instructions. Horizontal lines must not vary more than 1/8 inch in 40 feet.

3.9.2 Leakage Tests

Finished application of metal roofing is to be subject to inspection and test for leakage by the Contracting Officer or his designated representative, and Architect/Engineer. Inspection and tests will be conducted without cost to the Government.

Inspection and testing is to be made promptly after erection to permit correction of defects and removal/replacement of defective materials.

3.9.3 Repairs to Finish

Scratches, abrasions, and minor surface defects of finish may be repaired with the specified repair materials and as recommended by the metal roof panel manufacturer. Finished repaired surfaces must be uniform and free from variations of color and surface texture. Repaired metal surfaces that are not acceptable to the project requirements are to be immediately removed and replaced with new material.

3.9.4 Paint Finished Metal Roofing

Paint finished metal roofing will be tested for color stability by the Contracting Officer during the manufacturer's specified guarantee period. Remove and replace panels that indicate color changes, fading, or surface degradation, determined by visual examination with new panels at no expense to the Government. New panels will be subject to the specified tests for an additional year from the date of their installation.

3.10 CLEAN UP AND DISPOSAL

Clean exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from roofs. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces must be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating. Touch up scratches in panel finish with manufacturer supplied touch-up paint system to match panel finish. Treat exposed cut edges with manufacturer supplied system to match panel finish.

Collect all scrap/waste materials and place in containers. Promptly dispose of demolished and scrap materials. Do not allow scrap/waste materials to accumulate on-site; transport immediately from the government property and legally dispose of them.

3.11 FIELD QUALITY CONTROL

3.11.1 Manufacturer's Inspection

Manufacturer's technical representative must visit the site a minimum of three times during the installation for purposes of reviewing materials installation practices and adequacy of work in place. Make inspections during the first 20 squares of roof panel installation, at mid-point of the installation, and at substantial completion, at a minimum. Additional inspections are required for each 100 squares of total roof area with the exception that follow-up inspections of previously noted deficiencies or application errors must be performed as requested by the Contracting Officer. After each inspection, submit a report, signed by the manufacturer's technical representative to the Contracting Officer within 3 working days. Note in the report overall quality of work, deficiencies and any other concerns, and recommended corrective action.

Submit three signed copies of the manufacturer's field inspection reports to the Contracting Officer within one week of substantial completion.

3.12 INFORMATION CARD

For each roof, furnish a typewritten information card for facility records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 0.032 inch thick aluminum card for exterior display.

Make card 8 1/2 by 11 inches minimum, identifying facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, roof panel manufacturer and product name, type underlayment(s), date of completion; installing contractor identification and contact information; manufacturer warranty expiration, warranty reference number, and contact information. Install card at location as directed by the Contracting Officer and provide a paper copy to the Contracting Officer.

3.13 USACE WARRANTY

CONTRACTOR'S TWENTY (20) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOF SYSTEM

FACILITY DESCRIPTION _____

BUILDING NUMBER: _____

CORPS OF ENGINEERS CONTRACT NUMBER: _____

CONTRACTOR

CONTRACTOR: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

OWNER

OWNER: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

CONSTRUCTION AGENT

CONSTRUCTION AGENT: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

CONTRACTOR'S TWENTY (20) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOF SYSTEM
(continued)

THE NON-STRUCTURAL METAL ROOF SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY _____ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. THE NON-STRUCTURAL METAL ROOFING SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH UL 580. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHING INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE NON-STRUCTURAL METAL ROOFING SYSTEM.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE NON-STRUCTURAL METAL ROOF SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON _____ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

(Company President)

(Date)

CONTRACTOR'S TWENTY (20) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOFING SYSTEM
(continued)

THE CONTRACTOR MUST SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE NON-STRUCTURAL METAL ROOFING SYSTEM. SUBMIT ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR IS ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE NON-STRUCTURAL METAL ROOF DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. CONTRACTOR'S DESIGN MUST INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.
6. THIS WARRANTY APPLIES TO THE NON-STRUCTURAL METAL ROOFING SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

CONTRACTOR'S TWENTY (20) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOF SYSTEM
(continued)

**REPORTS OF LEAKS AND ROOF SYSTEM DEFICIENCIES MUST BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. INITIATE EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS IMMEDIATELY; SUBMIT A WRITTEN PLAN FOR APPROVAL TO REPAIR OR REPLACE THIS ROOF SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. COMMENCE ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE NON-STRUCTURAL METAL ROOF SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED, THE PARTIES SHALL, WITHIN TEN (10) DAYS, JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES MUST CONFER WITHIN TEN (10) DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE (1) NAME REMAINS. THE REMAINING PERSON IS THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED, ETC., WILL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT MUST PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

POST A FRAMED COPY OF THIS WARRANTY IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

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POLYVINYL-CHLORIDE ROOFING
02/13

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/SPRI ES-1 (2003) Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2010) Minimum Design Loads for Buildings and Other Structures

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSE/SAFE A10.24 (2014) Roofing - Safety Requirements of Low-Sloped Roofs

ASTM INTERNATIONAL (ASTM)

ASTM D4434/D4434M (2015) Standard Specification for Poly(Vinyl Chloride) Sheet Roofing

ASTM D6754/D6754M (2010) Standard Specification for Ketone Ethylene Ester Based Sheet Roofing

ASTM E108 (2011) Fire Tests of Roof Coverings

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/>

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA 3619 (2004) Quality Control Guidelines for Application of Polymer-Modified Bitumen Roofing

NRCA 3740 (2005) The NRCA Waterproofing Manual

SINGLE PLY ROOFING INDUSTRY (SPRI)

ANSI/SPRI RD-1 (2014) Performance Standard for Retrofit
Drains

UNDERWRITERS LABORATORIES (UL)

UL 790 (2004; Reprint Jul 2014) Standard Test
Methods for Fire Tests of Roof Coverings

1.2 SUMMARY

Mechanically fastened polyvinyl-chloride (PVC) roof membrane system applied over insulation substrate.

1.3 ASSEMBLY REQUIREMENTS

Roofing membrane sheet widths shall be consistent with membrane attachment methods and wind uplift requirements, and shall be as large as practical. In order to minimize joints and 3-way overlaps, prefabricated sheets are not accepted. Provide membrane which is free of defects and foreign material. Coordinate flashing work to permit continuous roof-surfacing operations. Insulation shall be applied and weatherproofed on the same day.

1.3.1 Fire Resistance

Complete roof system assembly:

- a. Class A rated in accordance with ASTM E108, FM 4470, or UL 790; and
- b. Be listed as Class I roof deck construction in FM APP GUIDE.

FM or UL approved components of the roof covering assembly shall bear the appropriate FM or UL label.

1.3.2 Wind Uplift Resistance

The complete roof system assembly shall be rated and installed to resist wind loads indicated and validated by uplift resistance testing in accordance with Factory Mutual (FM) test procedures. Do not install non-rated systems, except as approved by the Contracting Officer. Submit Engineering calculations, signed, sealed, and dated by a Registered Engineer, validating the wind resistance per ASCE 7, and ANSI/SPRI ES-1 if it is a non-rated roof system. Base wind uplift measurements on a design wind speed as indicated on drawings in accordance with ASCE 7 and other applicable building code requirements.

1.3.3 Solar Reflectance Index (SRI)

SRI measures the roof's ability to reject solar heat, defined such that a standard black (reflectance 0.05, emittance 0.90) is 0 and a standard white (reflectance 0.80, emittance 0.90) is 100. Use roofing materials having minimum appropriate SRI for more than 75 percent of roof surface (low slope (less than 2:12) SRI greater than 78; high slope (greater than 2:12) SRI greater than 29).

1.4 SUSTAINABILITY REPORTING

Materials in this technical specification may contribute towards contract compliance with sustainability requirements. See Section 01 33 29 SUSTAINABILITY REPORTING for project low-emitting materials, recycled content, and documentation requirements. Provide Solar Reflectance Index for Membrane.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

- Detail Drawings; G
- Roof Plan; G

SD-03 Product Data

- PVC Roofing Membrane; G
- Bonding Adhesive
- Flashing
- Membrane Fasteners and Plates
- Roof Insulation
- Pre-Manufactured Accessories
- Water Cutoffs
- Information Card
- Solar Reflectance Index for Membrane; S

SD-05 Design Data

- Wind Uplift Resistance; G

SD-07 Certificates

- Qualification of Manufacturer
- Qualifications of Applicator
- Qualification of Engineer of Record
- Wind Uplift Resistance
- Fire Resistance classification
- Minimum Polymer Thickness
- Sample Warranty; G

SD-08 Manufacturer's Instructions

- Application Method; G
- Membrane Flashing; G
- Perimeter Attachment
- Auxiliary Fasteners
- Pre-Manufactured Accessories
- Cold Weather; G

SD-11 Closeout Submittals

Documentation
Warranty; G
Information Card; G
Instructions to Government Personnel; G

1.6 QUALITY ASSURANCE

1.6.1 Qualification of Manufacturer

Polyvinyl-Chloride sheet roofing system manufacturer must have a minimum of 5 years experience in manufacturing PVC roofing products.

1.6.2 Qualifications of Applicator

Roofing system applicator must be approved, authorized, or licensed in writing by the PVC sheet roofing system manufacturer and have a minimum of five years experience as an approved, authorized, or licensed applicator with that manufacturer and be approved at a level capable of providing the specified warranty. Supply the names, locations and client contact information of five projects, within the previous three years, of similar size and scope that the applicator has constructed using the manufacturer's roofing products submitted for this project.

1.6.3 Qualification of Engineer of Record

Engineer of Record must be currently licensed within the jurisdiction of the project.

1.6.4 Conformance and Compatibility

The entire roofing and flashing system shall be in accordance with specified and indicated requirements, including fire and wind resistance.

1.6.5 Preroofing Conference

After approval of submittals and before performing roofing and insulation system installation work, hold a preroofing conference to review the following:

- a. Drawings, including roof plan, specifications and submittals related to the roof work.
- b. Roof system components installation;
- c. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roofing substrate, and roofing substrate, the name of the manufacturer's technical representatives, the frequency of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representative to roof manufacturer;
- d. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing; and
- e. Quality control(NRCA 3619) plan for the roof system installation;
- f. Safety requirements.

Coordinate prerooting conference scheduling with the Contracting Officer. The conference shall be attended by the Contractor, the Contracting Officer's designated personnel, personnel directly responsible for the installation of roofing and insulation, flashing and sheet metal work, mechanical and electrical work, other trades interfacing with the roof work, designated safety personnel trained to enforce and copy with ASSE/SAFE A10.24, and a representative of the roofing materials manufacturer. Before beginning roofing work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start of roof work.

1.7 DETAIL DRAWINGS

Submit roof plan depicting wind loads and boundaries of enhanced perimeter and corner attachments of roof system components, location of perimeter half-sheets, spacing of perimeter, corner, and infield fasteners, as applicable. The drawing shall reflect the project roof plan of each roof level and conditions indicated. Submit bids with approved detail drawings and specifications approved and furnished by the PVC membrane manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

1.8.1 Delivery

Deliver materials in the manufacturer's original, unopened containers and rolls with labels intact and legible. Mark and remove wet or damaged materials from the site. Where materials are covered by a referenced specification number, the container shall bear the specification number, type, class, and shelf life expiration date where applicable. Deliver materials in sufficient quantity to allow work to proceed without interruption.

1.8.2 Storage

Protect materials against moisture absorption and contamination or other damage. Avoid crushing or crinkling of roll materials. Store roll materials on end on clean raised platforms or pallets one level high in dry locations with adequate ventilation, such as an enclosed building or closed trailer. Do not store roll materials in buildings under construction until concrete, mortar, and plaster work is finished and dry. Maintain roll materials at temperatures above 50 degrees F for 24 hours immediately before application. Do not store materials outdoors unless approved by the Contracting Officer. Completely cover felts stored outdoors, on and off roof, with waterproof canvas protective covering. Do not use polyethylene sheet as a covering. Tie covering securely to pallets to make completely weatherproof. Provide sufficient ventilation to prevent condensation. Do not store more materials on roof than can be installed the same day and remove unused materials at end of each days work. Distribute materials temporarily stored on roof to stay within live load limits of the roof construction.

- a. Maintain a minimum distance of 35 foot for all stored flammable materials, including materials covered with shrink wraps, craft paper and/or tarps from all torch/welding applications.
- b. Immediately remove wet, contaminated or otherwise damaged or unsuitable materials from the site. Damaged materials may be marked by the Contracting Officer.

1.8.3 Handling

Prevent damage to edges and ends of roll materials. Do not install damaged materials in the work. Select and operate material handling equipment to prevent damage to materials or applied roofing.

1.9 ENVIRONMENTAL REQUIREMENTS

Do not install roofing system when air temperature is below 40 degrees F, during any form of precipitation, including fog, or when there is ice, frost, moisture, or any other visible dampness on the roof deck. Follow manufacturer's printed instructions for Cold Weather Installation.

1.10 SEQUENCING

Coordinate the work with other trades to ensure that components which are to be secured to or stripped into the roofing system are available and that permanent flashing and counterflashing in accordance with NRCA 3740, are installed as the work progresses. Ensure temporary protection measures are in place to preclude moisture intrusion or damage to installed materials. Application of roofing shall immediately follow application of insulation as a continuous operation. Coordinate roofing operations with insulation work so that all roof insulation applied each day is covered with roof membrane installation the same day.

1.11 WARRANTY

Provide roof system material and workmanship warranties. Provide revision or amendment to standard membrane manufacturer warranty as required to comply with the specified requirements. Minimum manufacturer warranty shall have no dollar limit, cover full system water-tightness, and shall have a minimum duration of 20 years. Submit sample certificate.

1.11.1 Roof Membrane Manufacturer Warranty

Furnish the roof membrane manufacturer's 20-year, no dollar limit roof system materials and installation workmanship warranty, including flashing, insulation, and accessories necessary for a watertight roof system construction. Provide warranty directly to the Government and commence warranty effective date at time of Government's acceptance of the roof work. The warranty must state that:

- a. If within the warranty period the roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-watertight, shows evidence of moisture intrusion within the assembly, splits, tears, cracks, delaminates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the roof system assembly and correction of defective workmanship are the responsibility of the roof membrane manufacturer. All costs associated with the repair or replacement work are the responsibility of the roof membrane manufacturer.
- b. When the manufacturer or his approved applicator fail to perform the repairs within 72 hours of notification, emergency temporary repairs performed by others does not void the warranty.

1.11.2 Roofing System Installer Warranty

The roof system installer shall warrant for a minimum period of two years that the roof system, as installed, is free from defects in installation workmanship, to include the roof membrane, flashing, insulation, accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Write the warranty directly to the Government. The roof system installer is responsible for correction of defective workmanship and replacement of damaged or affected materials. The roof system installer is responsible for all costs associated with the repair or replacement work.

1.11.3 Continuance of Warranty

Approve repair or replacement work that becomes necessary within the warranty period and accomplished in a manner so as to restore the integrity of the roof system assembly and validity of the roof membrane manufacturer warranty for the remainder of the manufacturer warranty period.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 PVC Roof Membrane

Provide a minimum polymer thickness 0.072 inch reinforced PVC as specified herein. Provide PVC system capable of obtaining 20 year warranties and as listed in the applicable wind uplift and fire rating classification listings.

Submit Data as required by Section 07 22 00 ROOF AND DECK INSULATION together with requirements of this section. Data shall include written acceptance by the roof membrane manufacturer of the insulation and other products and accessories to be provided by and warranted under the full system guarantee of the roof membrane manufacturer.

- a. Coordinate with other specification sections related to the roof work. Furnish a combination of specified materials that comprise a roof system acceptable to the roof membrane manufacturer and meeting specified requirements. Provide materials free of defects and suitable for the service and climatic conditions of the installation. All warranted roof system components shall be sourced from the PVC roof membrane manufacturer, including but not limited to all insulation, coverboards, accessories, adhesives and edge metal.
- b. For each roof, furnish a typewritten information card for facility records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 0.032 inch thick aluminum card for exterior display. Card shall be 8 1/2 by 11 inches minimum. Information card shall identify facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, membrane, number of plies, method of application, manufacturer, insulation and cover board system and thickness; presence of tapered insulation for primary drainage, presence of vapor retarder; date of completion; installing Contractor identification and contact information; membrane manufacturer warranty expiration, warranty reference number, and contact information. Install card at roof top or access location as directed by the

Contracting Officer and provide a paper copy to the Contracting Officer.

2.1.2 Bonding Adhesive

Provide PVC membrane manufacturer's low volatile organic compound (VOC) membrane adhesive, as supplied by roof membrane manufacturer, and recommended by the manufacturer's printed data for bonding of PVC membrane materials to acceptable insulation, wood, metal, concrete or other acceptable substrate materials. Bonding adhesive shall not be used to bond membrane materials to each other.

2.1.3 Water Cutoff Mastic/Water Block

As supplied by the roof membrane manufacturer and recommended by the manufacturer's printed data.

2.1.4 Membrane Flashing

Membrane flashing, including self-adhering membrane flashing, perimeter flashing, flashing around roof penetrations and prefabricated pipe seals, shall be minimum polymer thickness 0.072 inch reinforced PVC for 20year warranties, and shall be utilized as recommended and supplied by the roof membrane manufacturer or minimum 0.072 inch thick reinforced PVC roof membrane and flashing's for 20 year warranties. Submit certification from PVC membrane manufacturer that the proposed PVC membrane roofing product meets the minimum polymer thickness specified.

2.1.5 Membrane Fasteners and Plates

Coated, corrosion-resistant fasteners as recommended and supplied by the PVC roof membrane manufacturer and meeting the requirements of FM 4470 and FM RoofNav (www.roofnav.com) or FM APP GUIDE for Class I roof deck construction and the wind uplift resistance specified. Fasteners and Plates to be supplied and warranted for the substrate type(s) by PVC membrane manufacturer and recommended by PVC membrane manufacturer's printed data.

2.1.5.1 Stress Plates, Bar or Rail for Fasteners

Corrosion-resistant stress plates as recommended by the roof membrane manufacturer's printed instructions and meeting the requirements of FM 4470 must be utilized and must be supplied by PVC roof membrane manufacturer. Stress plates shall be formed to prevent dishing or cupping. Manufacturer-supplied anchoring bar or rails may be utilized for high wind conditions.

2.1.5.2 Auxiliary Fasteners

Corrosion resistance screws, nails, or anchors must be suitable for intended attachment purpose and be recommended and supplied for use by the PVC roof membrane manufacturer.

2.1.6 Pre-manufactured Accessories

Pre-manufactured accessories shall be manufacturer's standard for intended purpose, must comply with applicable specification section, be compatible with the membrane roof system and approved for use and supplied by the PVC roof membrane manufacturer.

2.1.7 Roof Insulation

Insulation system and facer material shall be compatible with membrane application specified and be approved and supplied by the PVC membrane roof manufacturer and as specified in Section 07 22 00 ROOF AND DECK INSULATION.

2.1.8 Wood Products

As specified in Section 06 10 00 ROUGH CARPENTRY, except that fire retardant treated materials shall not be in contact with PVC membrane or PVC accessory products, unless approved by the membrane manufacturer and the Contracting Officer.

2.2 Reinforced, PVC Membrane

Reinforced polyvinyl chloride (PVC) membrane shall contain fibers or scrim, and shall comply with ASTM D4434/D4434M, Type II, Grade I or Type III or Type IV, fleece backed, or ASTM D6754/D6754M, and in all cases shall provide 0.072 inch minimum thickness for mechanically fastened application. Notwithstanding the ASTM standards referenced, reinforced PVC roof membranes provided under this section shall have the minimum, labeled thickness specified. PVC membrane thickness specified herein is exclusive of backing material on the bottom of fleece-backed membrane. Principal polymer used in manufacture of the membrane sheet shall be PVC. Width and length of PVC membrane roofing sheet shall be consistent with membrane attachment methods and wind uplift requirements, and shall be as large as practical. In order to minimize joints and 3-way overlaps, prefabricated sheets are not accepted. Maximum reinforced PVC membrane roofing sheet dimensions to be the maximum width obtainable from PVC membrane roof manufacturer in order to minimize seams in the field of the roof. Initial RSI minimum 82 and three-year aged SRI minimum 64.

PART 3 EXECUTION

3.1 EXAMINATION

Ensure that the following conditions exist prior to application of the roofing materials:

- a. Drains, curbs, control joints, perimeter walls, roof penetrating components, and equipment supports are in place.
- b. Surfaces are rigid, clean, dry, smooth, and free from cracks, holes, and sharp changes in elevation.
- c. Substrate is sloped to provide positive drainage.
- d. Walls and vertical surfaces are constructed to receive counterflashing, and will permit mechanical fastening of the base flashing materials.
- e. Treated wood nailers are in place on non-nailable surfaces, to permit nailing of base flashing at minimum height of 8 inches above finished roofing surface.
- f. Pressure-preservative treated wood nailers are fastened in place at eaves, gable ends, openings, and intersections with vertical surfaces

for securing of membrane, edging strips, attachment flanges of sheet metal, and roof fixtures. Embedded nailers are flush with deck surfaces. Surface-applied nailers are the same thickness as the roof insulation.

- g. PVC materials are not in contact with fire retardant treated wood, except as approved by the PVC membrane roof manufacturer and Contracting Officer.
- h. Insulation boards are installed smoothly and evenly, and are not broken, cracked, or curled. There are no gaps in insulation board joints exceeding 1/4 inch in width. Insulation is attached as specified in Section 07 22 00 ROOF AND DECK INSULATION. Insulation is being roofed over on the same day the insulation is installed.

3.2 APPLICATION METHOD

Apply entire PVC membrane roofing utilizing mechanically fastened application methods. Apply roofing materials as specified herein unless approved otherwise by the Contracting Officer. Submit instructions including pattern and frequency of mechanical attachments required in the field for roof, corners, and perimeters to provide for the specified wind resistance

3.2.1 Special Precautions

- a. Do not dilute coatings or sealants unless specifically recommended by the material manufacturer's printed application instructions. Do not thin liquid materials or cleaners used for cleaning PVC sheet.
- b. Keep liquids in airtight containers, and keep containers closed except when removing materials.
- c. Use liquid components, including adhesives, within their shelf life period. Store adhesives at 60 to 80 degrees F prior to use. Avoid excessive adhesive application and adhesive spills, as they can be destructive to some thermoplastic sheets and insulations; follow adhesive manufacturer's printed application instructions. Mix and use liquid components in accordance with label directions and manufacturer's printed instructions.
- d. Provide clean, dry cloths or pads for applying membrane cleaners and cleaning of membrane.
- e. Do not use heat guns or open flame to expedite drying of adhesives or primers.
- f. Require workmen and others who walk on the membrane to wear clean, soft-soled shoes to avoid damage to roofing materials.
- g. Do not use equipment with sharp edges which could puncture the PVC membrane roofing sheet.
- h. Shut down air intakes and any related mechanical systems and seal open vents and air intakes when applying solvent-based materials in the area of the opening or intake. Coordinate shutdowns with the Contracting Officer.

3.2.2 PVC Roofing Membrane

Provide a watertight roof membrane sheet free of contaminants and defects that might affect serviceability. Provide a uniform, straight, and flat edge. Only felt-backed membrane shall be placed directly on concrete deck or other hard surface which may otherwise damage the membrane, absent the felt backing. Non-felt-backed PVC membrane roofing sheet shall not be placed directly on concrete deck or other hard surface which may damage the membrane. Membrane shall be overlapped a minimum of 3 inches at sides for adhered applications and 5.5-7 inches for mechanically fastened applications and minimum 4 inches at ends. Direction of laps shall allow water to flow over and not against the lap. Membrane joints shall be free of wrinkles and fishmouths. The entire length of hot-air-welded seams shall be probe-tested and corrected during the day of installation. Defective areas shall be re-welded. Wrinkles, fishmouths, or damaged areas shall be cut out and the area covered with membrane using a continuous hot-air-welded seam on all sides. Repairs shall be probe-tested for continuity. Hot-air-welded seams are to be accomplished in accordance with the PVC membrane roofing manufacturer's published requirements.

3.2.2.1 Nailing

Membrane shall be fastened to nailers in accordance with the membrane manufacturer's approved instructions. Unless otherwise specified, nails shall be staggered on 4 inch centers maximum; screws for sheet metal shall be staggered on 8 inch centers maximum; and a row of fasteners shall be at least 1/2 inch from edges of sheet metal.

3.2.2.2 Flashing

Roof edges, projections through the roof and changes in roof planes shall be flashed. The seam shall be sealed a minimum of 3 inches beyond the fasteners which attach the membrane to nailers. The installed flashing's shall be secured at the top of the flashing a maximum of 12 inches on centers under the counterflashing or cap. Where possible, prefabricated components shall be used for pipe seals and flashing accessories.

3.2.2.3 Expansion Joints

Expansion joints shall be covered using prefabricated covers or elastomeric flashing in accordance with the recommendations of the manufacturer.

3.2.2.4 Cutoffs

If work is terminated prior to weatherproofing the entire roof, the membrane shall be sealed to the roof deck. Flutes in metal decking shall be sealed off along the cutoff edge. Membrane shall be pulled free or cut to expose the insulation when resuming work and cut insulation sheets used for fill-in shall be removed. Asphalt or coal-tar products shall not be used for sealing.

3.2.3 Mechanically Fastened Membrane Application

Layout membrane and lap adjoining sheets in accordance with membrane manufacturer's printed instructions such that the minimum recommended seam width is maintained and to ensure that seam width is as required by tested assembly meeting specified wind resistance requirements. Account for

additional overlap required for placement of fasteners and plates or battens beyond the closed seam. Allow for sufficient membrane to form proper membrane terminations. Ensure membrane is free of wrinkles and ridges in the installation. Mechanically secure the membrane sheet with specified fasteners in the lap area. Space fasteners as required to provide the wind uplift resistance specified and in accordance with submitted fastener patterns for the field, corner, and perimeter roof areas. Set fasteners firm to plate or batten. Form field hot-air-welded seams and laps and/or coverstrips, as specified. Check all seams and ensure full/continuous lap seal.

3.2.4 Perimeter Attachment

Adhesive bond or mechanically secure roof membrane sheet at roof perimeter in a manner to comply with wind resistance requirements and in accordance with membrane manufacturer's printed application instructions. When adhesively bonding a mechanically fastened system in perimeter areas, the perimeter boundary of the adhesive bond shall be the same as the boundary required for additional perimeter mechanical fastening to meet wind resistance requirements.

3.2.5 Securement at Base Tie-In Conditions

Mechanically fasten the roof membrane at penetrations, at base of curbs and walls, and at all locations where the membrane turns and angles greater than 4 degrees (1:12). Space fasteners a maximum of 12 inches on center, except where more frequent attachment is required to meet specified wind resistance or where recommended by the roof membrane manufacturer. Cover over fasteners with a layer of flashing material. Hot-air-weld all seams of flashing material as recommended by the roof membrane manufacturer's printed data.

3.2.6 Pre-fabricated Curbs

3.2.6.1 Set-On Accessories

Where pipe or conduit blocking, supports and similar roof accessories, or isolated paver block, are set on the membrane, adhere reinforced membrane or walkpad material, as recommended by the roof membrane manufacturer, to bottom of accessories prior to setting on roofing membrane. Specific method of installing set-on accessories must permit normal movement due to expansion, contraction, vibration, and similar occurrences without damaging roofing membrane. Do not mechanically secure set-on accessories through roofing membrane into roof deck substrate.

3.3 FLASHINGS

Provide flashings in the angles formed at walls and other vertical surfaces and where required to make the work watertight, except where metal flashings are indicated.

3.3.1 General

Provide a one-ply flashing membrane, as specified for the system used, and install immediately after the roofing membrane is placed and prior to finish coating where a finish coating is required. Flashings must be stepped where vertical surfaces abut sloped roof surfaces. Provide sheet metal reglet in which sheet metal cap flashings are installed of not more than 16 inch nor less than 8 inch above the roofing surfaces. Exposed

joints and end laps of flashing membrane must be made and sealed in the manner required for roofing membrane.

3.3.2 Membrane Flashing

3.3.2.1 Installation

Install flashing and flashing accessories as the roof membrane is installed. Apply flashing to cleaned surfaces and as recommended by the roof membrane manufacturer and as specified. Utilize cured PVC membrane flashing and prefabricated accessory flashings to the maximum extent recommended by the roof membrane manufacturer. Limit uncured flashing material to reinforcing inside and outside corners and angle changes in plane of membrane, and to flashing scuppers, pourable sealer pockets, and other formed penetrations or unusually shaped conditions as recommended by the roof membrane manufacturer where the use of cured material is impractical. Extend base flashing not less than 8 inch above roofing surface and as necessary to provide for seaming overlap on roof membrane as recommended by the roof membrane manufacturer.

3.3.2.2 Sealing

Seal flashing membrane for a minimum of 3 inch on each side of fastening device used to anchor roof membrane to nailers. Completely adhere flashing sheets in place. Seam flashing membrane in the same manner as roof membrane, except as otherwise recommended by the membrane manufacturer's printed instructions and approved by the Contracting Officer. Reinforce all corners and angle transitions by applying uncured membrane to the area in accordance with roof membrane manufacturer recommendations. Mechanically fasten top edge of base flashing with manufacturer recommended termination bar fastened at maximum 12 inch on center. Install sheet metal flashing over the termination bar in the completed work. Mechanically fasten top edge of base flashing for all other terminations in a manner recommended by the roof membrane manufacturer. Apply membrane liner over top of exposed nailers and blocking and to overlap top edge of base flashing installation at curbs, parapet walls, expansion joints and as otherwise indicated to serve as waterproof lining under sheet metal flashing components.

3.3.3 Flashing at Roof Drain

Provide a tapered insulation sump into the drain bowl area. Do not exceed tapered slope of 18 degrees for unreinforced membrane and 5 degrees for reinforced membrane. Provide tapered insulation with surface suitable for adhering membrane in the drain sump area. Avoid field seams running through or within 24 inch of roof drain, or as otherwise recommended by the roof membrane manufacturer. Adhere the membrane to the tapered in the drain sump area. Apply water block mastic and extend membrane sheets over edge of drain bowl opening at the roof drain deck flange in accordance with membrane manufacturer's printed application instructions. Insure membrane free of wrinkles and folds in the drain area. Securely clamp membrane in the flashing clamping ring. Ensure membrane is cut to within 3/4 inch of inside rim of clamping ring to maintain drainage capacity. Do not cut back to bolt holes. Retrofit roof drains shall conform to ANSI/SPRI RD-1.

3.4 CORRECTION OF DEFICIENCIES

Where any form of deficiency is found, additional measures must be taken

as deemed necessary by the Contracting Officer to determine the extent of the deficiency and provide corrective action recommendations. Perform corrective action as directed by the Contracting Officer.

3.5 PROTECTION OF APPLIED ROOFING

At the end of the day's work and when precipitation is imminent, protect applied membrane roofing system from water intrusion.

3.5.1 Water Cutoffs

Straighten insulation line using loose-laid cut insulation sheets and seal the terminated edge of the roof membrane system in an effective manner. Remove the water cut-offs to expose the insulation when resuming work, and remove the insulation sheets used for fill-in.

3.5.2 Temporary Flashing for Permanent Roofing

Provide temporary flashing at drains, curbs, walls and other penetrations and terminations of roofing sheets until permanent flashings can be applied. Remove temporary flashing before applying permanent flashing.

3.5.3 Temporary Walkways, Runways, and Platforms

Do not permit storing, walking, wheeling, and trucking directly on applied roofing system. Provide temporary walkways, runways, and platforms of smooth clean boards, mats or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to live load limits of roof construction. Use rubber-tired equipment for roofing work.

3.6 FIELD QUALITY CONTROL

3.6.1 Construction Monitoring

During progress of the roof work, make visual inspections as necessary to ensure compliance with specified parameters. Additionally, verify the following:

- a. Equipment is in working order. Metering devices are accurate.
- b. Materials are not installed in adverse weather conditions.
- c. Substrates are in acceptable condition, in compliance with specification, prior to application of subsequent materials.
 - (1) Nailers and blocking are provided where and as needed.
 - (2) Insulation substrate is smooth, properly secured to its substrate, and without excessive gaps prior to membrane application.
 - (3) The proper number, type, and spacing of fasteners are installed.
 - (4) Materials comply with the specified requirements.
 - (5) All materials are properly stored, handled and protected from moisture or other damages. Liquid components are properly mixed prior to application.

- (6) Adhesives are applied uniformly to both mating surfaces and checked for proper set prior to bonding mating materials. Mechanical attachments are spaced as required, including additional fastening of membrane in corner and perimeter areas as required.
- (7) Membrane is properly overlapped.
- (8) Membrane seaming is as specified by PVC membrane manufacturer. All seams are checked at the end of each work day.
- (9) Applied membrane is inspected and repaired as necessary prior to paver installation.
- (10) Membrane is adhered without ridges, wrinkles, kinks, fishmouths.
- (11) Installer adheres to specified and detailed application parameters.
- (12) Associated flashing's and sheet metal are installed in a timely manner in accord with the specified requirements.
- (13) Paver ballast is within the specified weight range.
- (14) Temporary protection measures are in place at the end of each work shift.

3.6.2 Manufacturer's Inspection

Manufacturer's technical representative shall visit the site a minimum of once per week during the installation for purposes of reviewing materials installation practices and adequacy of work in place. Inspections shall occur during the first 20 squares of membrane installation and at substantial completion, at a minimum. Follow-up inspections of previously noted deficiencies or application errors shall be performed as requested by the Contracting Officer. After each inspection, a report, signed by the manufacturer's technical representative shall be submitted by the roofing Contractor to the Contracting Officer within 3 working days. The report shall note overall quality of work, deficiencies and any other concerns, and recommended corrective action.

3.7 CLEAN UP

Remove debris, scraps, containers and other rubbish and trash resulting from installation of the roofing system from job site each day.

3.8 INSTRUCTIONS TO GOVERNMENT PERSONNEL

Furnish written and verbal instructions on proper maintenance procedures to designated Government personnel. Furnish instructions by a competent representative of the roof membrane manufacturer and include a minimum of 4 hours on maintenance and emergency repair of the membrane. Include a demonstration of membrane repair, and give sources of required special tools. Furnish information on safety requirements during maintenance and emergency repair operations. Include copies of Safety Data Sheets for maintenance/repair materials.

3.9 ROOF DRAIN TEST

After completing roofing but prior to Government acceptance, perform the following test for watertightness. Plug roof drains and fill with water to edge of drain sump for 8 hours. Do not plug secondary overflow drains at the same time as adjacent primary drain. To ensure some drainage from roof, do not test all drains at same time. Measure water at beginning and end of the test period. When precipitation occurs during test period, repeat test. When water level falls, remove water, thoroughly dry, and inspect installation; repair or replace roofing at drain to provide for a properly installed watertight flashing seal. Repeat test until there is no water leakage.

-- End of Section --

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05/17

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-- End of Section Table of Contents --

SECTION 07 60 00

FLASHING AND SHEET METAL
05/17

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN WELDING SOCIETY (AWS)

AWS D1.2/D1.2M (2014) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A480/A480M (2017) Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

ASTM A653/A653M (2018) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM B209 (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B32 (2008; R 2014) Standard Specification for Solder Metal

ASTM B69 (2013) Standard Specification for Rolled Zinc

ASTM D4586/D4586M (2007; E 2012; R 2012) Asphalt Roof Cement, Asbestos-Free

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

SMACNA 1793 (2012) Architectural Sheet Metal Manual, 7th Edition

1.2 GENERAL REQUIREMENTS

Finished sheet metal assemblies must form a weathertight enclosure without waves, warps, buckles, fastening stresses or distortion, while allowing for expansion and contraction without damage to the system. The sheet metal installer is responsible for cutting, fitting, drilling, and other operations in connection with sheet metal modifications required to accommodate the work of other trades. Coordinate installation of sheet metal items used in conjunction with roofing with roofing work to permit continuous, uninterrupted roofing operations.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Gutters; G

Downspouts; G

Soffit Panels; G

Expansion Joints; G

Flashing for Roof Drains; G

Base Flashing; G

Counterflashing; G

Flashing at Roof Penetrations and Equipment Supports; G

Reglets; G

Copings; G

Drip Edges; G

SD-03 Product Data

Recycled Content; S

SD-04 Samples

Finish Samples; G

SD-07 Certificates

Certificates of Compliance; G

SD-08 Manufacturer's Instructions

Instructions for Installation; G

Quality Control Plan; G

SD-10 Operation and Maintenance Data

Cleaning and Maintenance; G

SD-11 Closeout Submittals

1.4 MISCELLANEOUS REQUIREMENTS

1.4.1 Product Data

Indicate thicknesses, dimensions, fastenings, anchoring methods, expansion joints, and other provisions necessary for thermal expansion and contraction. Scaled manufacturer's catalog data may be submitted for factory fabricated items.

1.4.2 Finish Samples

Submit two color charts and two finish sample chips from manufacturer's standard color and finish options for each type of finish indicated.

1.4.3 Operation and Maintenance Data

Submit detailed instructions for installation and quality control during installation, cleaning and maintenance, for each type of assembly indicated.

1.5 DELIVERY, HANDLING, AND STORAGE

Package and protect materials during shipment. Uncrate and inspect materials for damage, dampness, and wet-storage stains upon delivery to the job site. Remove from the site and replace damaged materials that cannot be restored to like-new condition. Handle sheet metal items to avoid damage to surfaces, edges, and ends. Store materials in dry, weather-tight, ventilated areas until installation.

PART 2 PRODUCTS

2.1 RECYCLED CONTENT

Provide products with recycled content and provide certificates of compliance in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

2.2 MATERIALS

Do not use lead, lead-coated metal, or galvanized steel. Use any metal listed by SMACNA 1793 for a particular item, unless otherwise indicated. Provide materials, thicknesses, and configurations in accordance with SMACNA 1793 for each material. Different items need not be of the same metal, except that contact between dissimilar metals must be avoided.

Furnish sheet metal items in 8 to 10 foot lengths. Single pieces less than 8 feet long may be used to connect to factory-fabricated inside and outside corners, and at ends of runs. Factory fabricate corner pieces with minimum 12 inch legs. Provide accessories and other items essential to complete the sheet metal installation. Provide accessories made of the same or compatible materials as the items to which they are applied. Fabricate sheet metal items of the materials specified below and to the gage, thickness, or weight shown in Table I at the end of this section. Provide sheet metal items with mill finish unless specified otherwise. Where more than one material is listed for a particular item in Table I, each is acceptable and may be used, except as follows:

2.2.1 Exposed Sheet Metal Items

Must be of the same material. Consider the following as exposed sheet metal: gutters, including hangers; downspouts; soffit panels and fasciae; cap, valley, steeped, base, and eave flashings and related accessories.

2.2.2 Drainage

Do not use copper for an exposed item if drainage from that item will pass over exposed masonry, stonework or other metal surfaces. In addition to the metals listed in Table I, lead-coated copper may be used for such items.

2.2.3 Lead Sheet

Provide in a minimum weight of 4 pounds per square foot.

2.2.4 Steel Sheet, Zinc-Coated (Galvanized)

Provide in accordance with ASTM A653/A653M.

2.2.5 Zinc Sheet and Strip

Provide in accordance with ASTM B69, Type I, a minimum of 0.024 inch thick.

2.2.6 Stainless Steel

Provide in accordance with ASTM A480/A480M, Type 302 or 304, 2D Finish, fully annealed, dead-soft temper.

2.2.7 Aluminum Alloy Sheet and Plate

Provide in accordance with ASTM B209 color as indicated on drawings form alloy, and temper appropriate for use.

2.2.7.1 Alclad

When fabricated of aluminum, fabricate the following items with Alclad 3003, Alclad 3004, or Alclad 3005, clad on both sides unless otherwise indicated.

- a. Gutters, downspouts, and hangers
- b. Gravel stops and fasciae
- c. Flashing

2.2.8 Finishes

Provide exposed exterior sheet metal and aluminum with a baked on, factory applied color coating of polyvinylidene fluoride (PVF2) or approved equal fluorocarbon coating. Dry film thickness of coatings must be 0.8 to 1.3 mils. Color to be selected from manufacturer's standard range of color choices. Field applications of color coatings are prohibited and will be rejected.

2.2.9 Solder

Provide in accordance with ASTM B32, 95-5 tin-antimony.

2.2.10 Reglets

2.2.10.1 Metal Reglets

Provide factory fabricated caulked type or friction type reglets with a minimum opening of 1/4 inch and a depth of 1-1/4 inch, as approved.

2.2.10.1.1 Caulked Reglets

Provide with rounded edges, temporary reinforcing cores, and accessories as required for securing to adjacent construction. Provide built-up mitered corner pieces for inside and outside corners.

2.2.10.1.2 Friction Reglets

Provide with flashing receiving slots not less than 5/8 inch deep, one inch jointing tongues, and upper and lower anchoring flanges installed at 24 inch maximum snap-lock type receiver.

2.2.11 SOFFIT PANELS

2.2.11.1 Steel Sheet

Roll-form steel soffit panels to the specified profile, with yield strength as required by the manufacturer, thickness and depth as indicated.

Where soffit panels are indicated to be vented, panels shall have manufacturer's standard uniform perforations to provide between 10 percent and 15 percent open air percentage for the soffit panel system. Material must be plumb and true, and within the tolerances listed:

- a. Aluminum-Zinc Alloy-coated Steel Sheet.
- b. Individual panels must be continuous length to cover the entire length of any unbroken soffit area with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.
- c. Provide panels with thermal expansion and contraction consistent with the type of system specified.
 1. Profile and coverage to be as indicated.
 2. Smooth, flat Surface Texture.

2.2.12 Fasteners

Use the same metal as, or a metal compatible with the item fastened. Use stainless steel fasteners to fasten dissimilar materials.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Workmanship

Make lines and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to

form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793, Architectural Sheet Metal Manual. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight. Join sheet metal items together as shown in Table II.

3.1.2 Nailing

Confine nailing of sheet metal generally to sheet metal having a maximum width of 18 inches. Confine nailing of flashing to one edge only. Space nails evenly not over 3 inch on center and approximately 1/2 inch from edge unless otherwise specified or indicated. Face nailing will not be permitted. Where sheet metal is applied to other than wood surfaces, include in shop drawings, the locations for sleepers and nailing strips required to secure the work.

3.1.3 Cleats

Provide cleats for sheet metal 18 inches and over in width. Space cleats evenly not over 12 inches on center unless otherwise specified or indicated. Unless otherwise specified, provide cleats of 2 inches wide by 3 inches long and of the same material and thickness as the sheet metal being installed. Secure one end of the cleat with two nails and the cleat folded back over the nailheads. Lock the other end into the seam. Where the fastening is to be made to concrete or masonry, use screws and drive in expansion shields set in concrete or masonry. Pre-tin cleats for soldered seams.

3.1.4 Bolts, Rivets, and Screws

Install bolts, rivets, and screws where indicated or required. Provide compatible washers where required to protect surface of sheet metal and to provide a watertight connection. Provide mechanically formed joints in aluminum sheets 0.040 inches or less in thickness.

3.1.5 Seams

Straight and uniform in width and height with no solder showing on the face.

3.1.5.1 Flat-lock Seams

Finish not less than 3/4 inch wide.

3.1.5.2 Lap Seams

Finish soldered seams not less than one inch wide. Overlap seams not soldered, not less than 3 inches.

3.1.5.3 Loose-Lock Expansion Seams

Not less than 3 inches wide; provide minimum one inch movement within the joint. Completely fill the joints with the specified sealant, applied at

not less than 1/8 inch thick bed.

3.1.5.4 Standing Seams

Not less than one inch high, double locked without solder.

3.1.5.5 Flat Seams

Make seams in the direction of the flow.

3.1.6 Soldering

Where soldering is specified, apply to copper, terne-coated stainless steel, zinc-coated steel, and stainless steel items. Pre-tin edges of sheet metal before soldering is begun. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

3.1.6.1 Edges

Scrape or wire-brush the edges of lead-coated material to be soldered to produce a bright surface. Flux brush the seams in before soldering. Treat with soldering acid flux the edges of stainless steel to be pre-tinned. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

3.1.7 Welding and Mechanical Fastening

Use welding for aluminum of thickness greater than 0.040 inch. Aluminum 0.040 inch or less in thickness must be butted and the space backed with formed flashing plate; or lock joined, mechanically fastened, and filled with sealant as recommended by the aluminum manufacturer.

3.1.7.1 Welding of Aluminum

Use welding of the inert gas, shield-arc type. For procedures, appearance and quality of welds, and the methods used in correcting welding work, conform to AWS D1.2/D1.2M.

3.1.7.2 Mechanical Fastening of Aluminum

Use No. 12, aluminum alloy, sheet metal screws or other suitable aluminum alloy or stainless steel fasteners. Drive fasteners in holes made with a No. 26 drill in securing side laps, end laps, and flashings. Space fasteners 12 inches maximum on center. Where end lap fasteners are required to improve closure, locate the end lap fasteners not more than 2 inches from the end of the overlapping sheet.

3.1.8 Protection from Contact with Dissimilar Materials

3.1.8.1 Copper or Copper-bearing Alloys

Paint with heavy-bodied bituminous paint surfaces in contact with dissimilar metal, or separate the surfaces by means of moistureproof building felts.

3.1.8.2 Aluminum

Do not allow aluminum surfaces in direct contact with other metals except

stainless steel, zinc, or zinc coating. Where aluminum contacts another metal, paint the dissimilar metal with a primer followed by two coats of aluminum paint. Where drainage from a dissimilar metal passes over aluminum, paint the dissimilar metal with a non-lead pigmented paint.

3.1.8.3 Metal Surfaces

Paint surfaces in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

3.1.8.4 Wood or Other Absorptive Materials

Paint surfaces that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

3.1.9 Expansion and Contraction

Provide expansion and contraction joints at not more than 32 foot intervals for aluminum and at not more than 40 foot intervals for other metals. Provide an additional joint where the distance between the last expansion joint and the end of the continuous run is more than half the required interval. Space joints evenly. Join extruded aluminum gravel stops and fasciae by expansion and contraction joints spaced not more than 12 feet apart.

3.1.10 Base Flashing

Lay the base flashings with each course of the roof covering, shingle fashion, where practicable, where sloped roofs abut chimneys, curbs, walls, or other vertical surfaces. Extend up vertical surfaces of the flashing not less than 8 inches and not less than 4 inches under the roof covering. Where finish wall coverings form a counterflashing, extend the vertical leg of the flashing up behind the applied wall covering not less than 6 inches. Overlap the flashing strips with the previously laid flashing not less than 3 inches. Fasten the strips at their upper edge to the deck. Horizontal flashing at vertical surfaces must extend vertically above the roof surface and fastened at their upper edge to the deck a minimum of 6 inches on center with large headed aluminum roofing nails a minimum of 2 inch lap of any surface. Solder end laps and provide for expansion and contraction. Extend the metal flashing over crickets at the up-slope side of curbs, and similar vertical surfaces extending through sloping roofs, the metal flashings. Extend the metal flashings onto the roof covering not less than 4.5 inches at the lower side of vertical surfaces extending through the roof decks. Install and fit the flashings so as to be completely weathertight. Provide factory-fabricated base flashing for interior and exterior corners. Do not use metal base flashing on built-up roofing.

3.1.11 Counterflashing

Except where indicated or specified otherwise, insert counterflashing in reglets located from 9 to 10 inches above roof decks, extend down vertical surfaces over upturned vertical leg of base flashings not less than 3 inches. Fold the exposed edges of counterflashings 1/2 inch. Where stepped counterflashings are required, they may be installed in short lengths a minimum 8 inches by 8 inches or may be of the preformed single piece type. Provide end laps in counterflashings not less than 3 inches

and make it weathertight with plastic cement. Do not make lengths of metal counterflashings exceed 10 feet. Form flashings to the required shapes before installation. Factory form corners not less than 12 inches from the angle. Secure the flashings in the reglets with lead wedges and space not more than 18 inches apart; on stair/elevator towers short runs, place wedges closer together. Fill caulked-type reglets or raked joints which receive counterflashing with caulking compound. Turn up the concealed edge of counterflashings built into masonry or concrete walls not less than 1/4 inch and extend not less than 2 inches into the walls. Install counterflashing to provide a spring action against base flashing.

3.1.12 Metal Reglets

Keep temporary cores in place during installation. Ensure factory fabricated caulked type or friction type, reglets have a minimum opening of 1/4 inch and a minimum depth of 1-1/4 inch, when installed.

3.1.12.1 Caulked Reglets

Wedge flashing in reglets with lead wedges every 18 inches, caulked full and solid with an approved compound.

3.1.12.2 Friction Reglets

Install flashing snap lock receivers at 24 inches on center maximum. When flashing has been inserted the full depth of the slot, caulk the slot, lock, and fill with sealant.

3.1.13 Metal Drip Edges

Provide a metal drip edge, designed to allow water run-off to drip free of underlying construction, at eaves and rakes prior to the application of roofing shingles. Apply directly at the eaves and over the underlay along the rakes. Extend back from the edge of the deck not more than 3 inches and secure with compatible nails spaced not more than 10 inches on center along upper edge.

3.1.14 Gutters

The hung type of shape indicated and supported on underside by brackets that permit free thermal movement of the gutter. Provide gutters in sizes indicated complete with mitered corners, end caps, outlets, brackets, and other accessories necessary for installation. Bead with hemmed edge or reinforce the outer edge of gutter with a stiffening bar not less than 3/4 by 3/16 inch of material compatible with gutter. Fabricate gutters in sections not less than 8 feet. Lap the sections a minimum of one inch in the direction of flow or provide with concealed splice plate 6 inches minimum. Join the gutters, other than aluminum, by riveted and soldered joints. Join aluminum gutters with riveted sealed joints. Provide expansion-type slip joints midway between outlets. Install gutters below slope line of the roof so that snow and ice can slide clear. Support gutters on adjustable hangers spaced not more than 30 inches on center, or by cleats spaced not less than 36 inches apart. Adjust gutters to slope uniformly to outlets, with high points occurring midway between outlets. Fabricate hangers and fastenings from compatible metals.

3.1.15 Downspouts

Space supports for downspouts according to the manufacturer's

recommendation for the substrate. Types, shapes and sizes are indicated. Provide complete including elbows and offsets. Provide downspouts in approximately 10 foot lengths. Provide end joints to telescope not less than 1/2 inch and lock longitudinal joints. Provide gutter outlets with wire ball strainers for each outlet. Provide strainers to fit tightly into outlets and be of the same material used for gutters. Keep downspouts not less than one inch away from walls. Fasten to the walls at top, bottom, and at an intermediate point not to exceed 5 feet on center with leader straps or concealed rack-and-pin type fasteners. Form straps and fasteners of metal compatible with the downspouts.

3.1.15.1 Terminations

Neatly fit into the drainage connection the downspouts terminating in drainage lines and fill the joints with a portland cement mortar cap sloped away from the downspout. Provide downspouts terminating in splash blocks with elbow-type fittings.

3.1.16 Flashing for Roof Drains

Provide a 30 inches square sheet indicated. Taper insulation to drain from 24 inches out. Set flashing on finished felts in a full bed of asphalt roof cement, ASTM D4586/D4586M. Heavily coat the drain flashing ring with asphalt roof cement. Clamp the roof membrane, flashing sheet, and stripping felt in the drain clamping ring. Secure clamps so that felts and drain flashing are free of wrinkles and folds.

3.1.17 Sheet Metal Covering on Flat, Sloped, or Curved Surfaces

Except as specified or indicated otherwise, cover and flash all minor flat, sloped, or curved surfaces such as crickets, bulkheads, dormers and small decks with metal sheets of the material used for flashing; maximum size of sheets, 16 by 18 inches. Fasten sheets to sheathing with metal cleats. Lock seams and solder. Lock aluminum seams as recommended by aluminum manufacturer. Provide an underlayment of roofing felt for all sheet metal covering.

3.1.18 Expansion Joints

Provide expansion joints for roofs, walls, and floors as indicated. Provide expansion joints in continuous sheet metal at 32 foot intervals for aluminum. Provide evenly spaced joints. Provide an additional joint where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing. Conform to the requirements of Table I.

3.1.19 Flashing at Roof Penetrations and Equipment Supports

Provide metal flashing for all pipes, ducts, and conduits projecting through the roof surface and for equipment supports, guy wire anchors, and similar items supported by or attached to the roof deck.

3.1.20 Single Pipe Vents

See Table I, footnote (d). Set flange of sleeve in bituminous plastic cement and nail 3 inches on center. Bend the top of sleeve over and extend down into the vent pipe a minimum of 2 inches. For long runs or long rises above the deck, where it is impractical to cover the vent pipe with lead, use a two-piece formed metal housing. Set metal housing with a

metal sleeve having a 4 inches roof flange in bituminous plastic cement and nailed 3 inches on center. Extend sleeve a minimum of 8 inches above the roof deck and lapped a minimum of 3 inches by a metal hood secured to the vent pipe by a draw band. Seal the area of hood in contact with vent pipe with an approved sealant.

3.1.21 Stepped Flashing

Provide stepped flashing where sloping roofs surfaced with shingles abut vertical surfaces. Place separate pieces of base flashing in alternate shingle courses.

3.1.22 Copings

Provide coping with locked and soldered seam. Terminate outer edges in edge strips. Install with sealed lap joints as indicated.

3.1.23 Soffit Panels

Provide full length metal soffit panels, as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

Erect panel system in accordance with the approved erection drawings, the printed instructions and safety precautions of the manufacturer.

Sheets are not to be subjected to overloading, abuse, or undue impact. Bent, chipped, or defective sheets shall not be applied.

Sheets must be erected true and plumb and in exact alignment with the horizontal and vertical edges of the building, securely anchored.

Work is to allow for thermal movement of the soffit panel, movement of the building structure, and to provide permanent freedom from noise due to wind pressure.

Field cutting metal soffit panels by torch is not permitted.

3.1.23.1 Steel Soffit Panels

Use stainless-steel fasteners.

3.1.23.2 Metal Protection

Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

3.1.24 Fastener Installation

Anchor metal soffit panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

3.2 PAINTING

Touch ups in the field may be applied only after metal substrates have been cleaned and pretreated in accordance with manufacturer's written instructions and products.

Field-paint sheet metal for separation of dissimilar materials.

3.2.1 Aluminum Surfaces

Clean with solvent and apply one coat of zinc-molybdate primer and one coat of aluminum paint.

3.3 CLEANING

Clean exposed sheet metal work at completion of installation. Remove grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris, and scrub-clean. Free the exposed metal surfaces of dents, creases, waves, scratch marks, and solder or weld marks.

3.4 REPAIRS TO FINISH

Scratches, abrasions, and minor surface defects of finish may be repaired in accordance with the manufacturer's printed instructions and as approved. Repair damaged surfaces caused by scratches, blemishes, and variations of color and surface texture. Replace items which cannot be repaired.

3.5 FIELD QUALITY CONTROL

Establish and maintain a Quality Control Plan for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Remove work that is not in compliance with the contract and replace or correct. Include quality control, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.
- b. Verification that specified material is provided and installed.
- c. Inspection of sheet metalwork, for proper size(s) and thickness(es), fastening and joining, and proper installation.

3.5.1 Procedure

Submit for approval prior to start of roofing work. Include a checklist of points to be observed. Document the actual quality control observations and inspections. Furnish a copy of the documentation to the Contracting Officer at the end of each day.

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES			
Sheet Metal Items	Aluminum, inch	Stainless Steel, inch	Zinc-Coated Steel, U.S. Std. Gage
Building Expansion Joints			
Cover	.032	.015	24
Waterstop-bellows or flanged, U-type.	-	.015	-
Covering on minor flat, pitched or curved surfaces	.040	.018	-
Downspouts and leaders	.032	.015	24
Downspout clips and anchors	.040 clip .125 anchor	-	-
Downspout straps, 2-inch	.060	.050	-
Strainers, wire diameter or gage	.144 diameter	.109 diameter	
Flashings:			
Base	.040	.018	24
Cap (Counter-flashing)	.032	.015	26
Spandrel beam	-	.010	-
Bond barrier	-	.015	-
Stepped	.032	.015	-
Roof drain			
Pipe vent sleeve (d)			
Coping	-	-	-
Gravel stops and fasciae:			

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES			
Sheet Metal Items	Aluminum, inch	Stainless Steel, inch	Zinc-Coated Steel, U.S. Std. Gage
Extrusions	.075	-	-
Sheets, smooth	.050	.018	24
Edge strip	.050	.025	-
Gutters:			
Gutter section	.032	.015	24
Hangers, dimensions	1 inch by .080 inch (c)	1 inch by .037 inch	-
Joint Cover plates (See Table II)	.032	.015	24
Reglets (c)	-	.010	-
(a) Brass.			
(b) May be lead weighing 4 pounds per square foot.			
(c) May be polyvinyl chloride.			
(d) 2.5 pound minimum lead sleeve with 4 inch flange. Where lead sleeve is impractical, refer to paragraph SINGLE PIPE VENTS for optional material.			

TABLE II. SHEET METAL JOINTS			
TYPE OF JOINT			
Item Designation	Copper, Terne-Coated Stainless Steel, Zinc-Coated Steel and Stainless Steel	Aluminum	Remarks
Joint cap for building expansion seam, cleated joint at roof	1.25 inch single lock, standing seam, cleated	1.25 inch single lock, standing	--
Flashings			
Base	One inch 3 inch lap for expansion joint	One inch flat locked, soldered; sealed; 3 inch lap for expansion joint	Aluminum manufacturer's recommended hard setting sealant for locked aluminum joints. Fill each metal expansion joint with a joint sealing compound.
Cap-in reglet	3 inch lap	3 inch lap	Seal groove with joint sealing compound.
Reglets	Butt joint	--	Seal reglet groove with joint sealing compound.
Eave	One inch flat locked, cleated. One inch loose locked, sealed expansion joint, cleated.	One inch flat locked, locked, cleated one inch loose locked, sealed expansion joints, cleated	Same as base flashing.
Stepped	3 inch lap	3 inch lap	--
Valley	6 inch lap cleated	6 inch lap cleated	--
Edge strip	Butt	Butt	--
Gravel stops:			

TABLE II. SHEET METAL JOINTS			
TYPE OF JOINT			
Item Designation	Copper, Terne-Coated Stainless Steel, Zinc-Coated Steel and Stainless Steel	Aluminum	Remarks
Extrusions	--	Butt with 1/2 inch space	Use sheet flashing beneath and a cover plate
Sheet, smooth	Butt with 1/4 inch space	Butt with 1/4 inch space	Use sheet flashing backup plate.
Sheet, corrugated	Butt with 1/4 inch space	Butt with 1/4 inch space	Use sheet flashing beneath and a cover plate or a combination unit
Gutters	1.5 inch lap, riveted and soldered	One inch flat locked riveted and sealed	Aluminum producers recommended hard setting sealant for locked aluminum joints.
(a) Provide a 3 inch lap elastomeric flashing with manufacturer's recommended sealant.			
(b) Seal Polyvinyl chloride reglet with manufacturer's recommended sealant.			

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SECTION 07 84 00

FIRESTOPPING
05/10

PART 1 GENERAL

1.1 SUMMARY

Furnish and install tested and listed firestopping systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.

- a. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.
- b. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.
- c. Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above and at the intersection of shaft assemblies and adjoining fire resistance rated assemblies.

1.2 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM E119	(2018c; E 2018) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E1399/E1399M	(1997; R 2017) Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
ASTM E1966	(2015) Fire-Resistive Joint Systems
ASTM E2307	(2015a) Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus
ASTM E814	(2013a; R 2017) Standard Test Method for Fire Tests of Penetration Firestop Systems
ASTM E84	(2018a) Standard Test Method for Surface

Burning Characteristics of Building
Materials

FM GLOBAL (FM)

FM APP GUIDE (updated on-line) Approval Guide
<http://www.approvalguide.com/>

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2015) International Building Code

UNDERWRITERS LABORATORIES (UL)

UL 1479 (2015) Fire Tests of Through-Penetration
Firestops

UL 2079 (2004; Reprint Dec 2014) Tests for Fire
Resistance of Building Joint Systems

UL 723 (2018) UL Standard for Safety Test for
Surface Burning Characteristics of
Building Materials

UL Fire Resistance (2014) Fire Resistance Directory

1.3 SEQUENCING

Coordinate the specified work with other trades. Apply firestopping materials, at penetrations of pipes and ducts, prior to insulating, unless insulation meets requirements specified for firestopping. Apply firestopping materials. at building joints and construction gaps, prior to completion of enclosing walls or assemblies. Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible. Firestop material shall be inspected and approved prior to final completion and enclosing of any assemblies that may conceal installed firestop.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping System; G

SD-03 Product Data

Firestopping Materials; G

SD-06 Test Reports

Inspection; G

SD-07 Certificates

Firestopping Materials
Installer Qualifications; G

1.5 QUALITY ASSURANCE

1.5.1 Installer

Engage a single experienced Installer for all project firestopping who is:

- a. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products in accordance with specified requirements. Submit documentation of this experience. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer installer qualifications on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures. The installer shall obtain from the manufacturer and submit written certification of training, and retain proof of certification for duration of firestop installation.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground, protected from damage and exposure to elements and temperatures in accordance with manufacturer requirements. Remove damaged or deteriorated materials from the site. Use materials within their indicated shelf life.

PART 2 PRODUCTS

2.1 FIRESTOPPING SYSTEM

Submit detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resistance or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal must indicate the firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are to receive firestopping, provide drawings that indicate location, "F" "T" and "L" ratings, and type of application.

Also, submit a written report indicating locations of and types of penetrations and types of firestopping used at each location; record type by UL list printed numbers.

2.2 FIRESTOPPING MATERIALS

Provide firestopping materials, supplied from a single domestic manufacturer, consisting of commercially manufactured, asbestos-free, nontoxic products FM APP GUIDE approved, or UL listed, for use with applicable construction and penetrating items, complying with the following minimum requirements:

2.2.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resistance or by a nationally recognized testing laboratory.

2.2.2 Toxicity

Material shall be nontoxic and carcinogen free to humans at all stages of application or during fire conditions and shall not contain hazardous chemicals or require harmful chemicals to clean material or equipment.

2.2.3 Fire Resistance Rating

Firestop systems shall be UL Fire Resistance listed or FM APP GUIDE approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected. Where required, firestop systems shall also have "T" rating at least equal to the fire-rated floor in which the openings are to be protected.

2.2.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph SUMMARY, shall provide "F", "T" and "L" fire resistance ratings in accordance with ASTM E814 or UL 1479. Fire resistance ratings shall be as follows:

2.2.3.1.1 Penetrations of Fire Resistance Rated Walls and Partitions

F Rating = Rating of wall or partition being penetrated.

2.2.3.1.2 Penetrations of Fire Resistance Rated Floors, Floor-Ceiling Assemblies and the Ceiling Membrane of Roof-Ceiling Assemblies

F Rating = rating of assembly being penetrated, T Rating = rating of assembly being penetrated. Where the penetrating item is outside of a wall cavity the F rating must be equal to the fire resistance rating of the floor penetrated, and the T rating shall be in accordance with the requirements of ICC IBC.

2.2.3.1.3 Penetrations of Fire and Smoke Resistance Rated Walls, Floors, Floor-Ceiling Assemblies, and the ceiling membrane of Roof-Ceiling Assemblies

F Rating = rating of assembly being penetrated, T Rating = rating of assembly being penetrated.

2.2.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph SUMMARY, and gaps such as those between floor slabs and curtain walls

shall be the same as the construction in which they occur. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E119, ASTM E1966 or UL 2079 to meet the required fire resistance rating. Curtain wall joints shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E2307 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E1399/E1399M or UL 2079. All joints at the intersection of the top of a fire resistance rated wall and the underside of a fire-rated floor, floor ceiling, or roof ceiling assembly shall provide a minimum class II movement capability.

2.2.4 Material Certification

Submit certificates attesting that firestopping material complies with the specified requirements. For all intumescent firestop materials used in through penetration systems, manufacturer shall provide certification of compliance with UL 1479.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping must be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement must be sound and capable of supporting device. Prepare surfaces as recommended by the manufacturer.

3.2 INSTALLATION

Completely fill void spaces with firestopping material regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 4 inches or more in any direction must be capable of supporting the same load as the floor is designed to support or be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Install firestopping in accordance with manufacturer's written instructions. Provide tested and listed firestop systems in the following locations, except in floor slabs on grade:

- a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.
- b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
- c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.
- d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
- e. Construction joints in floors and fire rated walls and partitions.
- f. Other locations where required to maintain fire resistance rating of the construction.

3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Replace thermal insulation with a material having equal thermal insulating and firestopping characteristics.

3.2.2 Data and Communication Cabling

Cabling for data and communication applications shall be sealed with re-enterable firestopping products.

3.2.2.1 Re-Enterable Devices

Firestopping devices shall be pre-manufactured modular devices, containing built-in self-sealing intumescent inserts. Firestopping devices shall allow for cable moves, additions or changes without the need to remove or replace any firestop materials. Devices must be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants; while maintaining "L" rating of <10 cfm/sf at 0 percent to 100 percent visual fill.

3.2.2.2 Re-Sealable Products

Provide firestopping pre-manufactured modular products, containing self-sealing intumescent inserts. Firestopping products shall allow for cable moves, additions or changes. Devices shall be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants.

3.3 INSPECTION

For all projects, the firestopped areas shall not be covered or enclosed until inspection is complete and approved by the Contracting Officer. Inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements. Submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; type shall be recorded by UL listed printed numbers.

3.3.1 Inspection Reports

Submit inspection report stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

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JOINT SEALANTS
08/16

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM C1193	(2013) Standard Guide for Use of Joint Sealants
ASTM C1311	(2014) Standard Specification for Solvent Release Agents
ASTM C1521	(2013) Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints
ASTM C509	(2006; R 2015) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C734	(2015) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C919	(2012; R 2017) Standard Practice for Use of Sealants in Acoustical Applications
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM D1056	(2014) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D217	(2017) Standard Test Methods for Cone Penetration of Lubricating Grease
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.00 37 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants; G

Primers; G

Bond Breakers; G

Backstops; G

SD-06 Test Reports

Field Adhesion; G

SD-07 Certificates

Indoor Air Quality; G

1.3 PRODUCT DATA

Include storage requirements, shelf life, curing time, instructions for mixing and application, and accessories. Provide manufacturer's Safety Data Sheets (SDS) for each solvent, primer and sealant material proposed.

1.4 ENVIRONMENTAL CONDITIONS

Apply sealant when the ambient temperature is between 40 and 90 degrees F.

1.5 DELIVERY AND STORAGE

Deliver materials to the jobsite in unopened manufacturers' sealed shipping containers, with brand name, date of manufacture, color, and material designation clearly marked thereon. Label elastomeric sealant containers to identify type, class, grade, and use. Handle and store materials in accordance with manufacturer's printed instructions. Prevent exposure to foreign materials or subjection to sustained temperatures exceeding 90 degrees F or lower than 0 degrees F. Keep materials and containers closed and separated from absorptive materials such as wood and insulation.

1.6 QUALITY ASSURANCE

1.6.1 Compatibility with Substrate

Verify that each sealant is compatible for use with each joint substrate in accordance with sealant manufacturer's printed recommendations for each application.

1.6.2 Joint Tolerance

Provide joint tolerances in accordance with manufacturer's printed instructions.

1.6.3 Mock-Up

Provide a mock-up of each type of sealant using materials, colors, and techniques approved for use on the project. Approved mock-ups may be incorporated into the Work.

1.6.4 Adhesion

Provide in accordance with ASTM C1193 or ASTM C1521.

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant products that have been tested, found suitable, and documented as such by the manufacturer for the particular substrates to which they will be applied.

2.1.1 Interior Sealants

Provide ASTM C920, Type S or M, Grade NS, Class 12.5, Use NT. Provide certification of indoor air quality for interior sealants. Location(s) and color(s) of sealant for the following. Note, color "as selected" refers to manufacturer's full range of color options

LOCATION	COLOR
a. Small voids between walls or partitions and adjacent lockers, casework, shelving, door frames, built-in or surface mounted equipment and fixtures, and similar items.	Match adjacent wall color
b. Perimeter of frames at doors, windows, and access panels which adjoin exposed interior concrete and masonry surfaces.	Match adjacent wall color
c. Joints of interior partitions which adjoin columns, pilasters, concrete walls, and exterior walls unless otherwise detailed.	Match adjacent wall color
d. Joints between edge members for acoustical tile and adjoining vertical surfaces.	Match adjacent wall color
e. Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.	Match adjacent wall color
f. Joints between ceramic tile; joints formed where non-planar tile surfaces meet.	Match grout
g. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.	Match grout
h. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.	Match adjacent wall color

2.1.2 Exterior Sealants

For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920,

Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows. Note, color "as selected" refers to manufacturer's full range of color options:

LOCATION	COLOR
a. Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	Match adjacent surface color
b. Masonry joints where shelf angles occur.	Match adjacent wall color
c. Expansion and control joints.	Match adjacent surface color
d. Interior face of expansion joints in exterior concrete or masonry walls where metal expansion joint covers are not required.	Match adjacent surface color
e. Voids where items pass through exterior walls.	Match adjacent surface color
f. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.	Match adjacent surface color
g. Metal-to-metal joints where sealant is indicated or specified.	Match adjacent surface color
h. Joints between ends of gravel stops, fasciae, copings, and adjacent walls.	Match adjacent surface color

2.1.3 Floor Joint Sealants

ASTM C920, Type S or M, Grade P, Class 25, Use T. Provide certification of indoor air quality for interior floor joint sealants. Provide location(s) and color(s) of sealant as follows. Note, color "as selected" refers to manufacturer's full range of color options:

LOCATION	COLOR
a. Seats of metal thresholds for exterior doors.	As selected

LOCATION	COLOR
b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.	Match adjacent surface color

2.1.4 Acoustical Sealants

Rubber or polymer based acoustical sealant in accordance with ASTM C919 to have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Provide non-staining acoustical sealant with a consistency of 250 to 310 when tested in accordance with ASTM D217. Acoustical sealant must remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734. Provide certification of indoor air quality for interior acoustical sealants.

2.1.5 Preformed Sealants

Provide preformed sealants of polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealants capable of sealing out moisture, air and dust when installed as recommended by the manufacturer. At temperatures from minus 30 to plus 160 degrees F, sealants must be non-bleeding and have no loss of adhesion.

2.1.5.1 Tape

Tape sealant: Provide cross section dimensions of per manufacturer's product installation requirements or as indicated on drawings.

2.1.5.2 Bead

Bead sealant: Provide cross section dimensions of per manufacturer's product installation requirements or as indicated on drawings.

2.1.5.3 Foam Strip

Provide foam strip of polyurethane foam with cross section dimensions as required to completely fill the joint condition. Provide foam strip capable of sealing out moisture, air, and dust when installed and compressed in accordance with manufacturer's printed instructions. Service temperature must be minus 40 to plus 275 degrees F. Furnish untreated strips with adhesive to hold them in place. Do not allow adhesive to stain or bleed onto adjacent finishes. Saturate treated strips with butylene waterproofing or impregnate with asphalt.

2.2 PRIMERS

Non-staining, quick drying type and consistency as recommended by the sealant manufacturer for the particular application. Provide primers for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

2.3 BOND BREAKERS

Type and consistency as recommended by the sealant manufacturer to prevent adhesion of the sealant to the backing or to the bottom of the joint. Provide bond breakers for interior applications that meet the indoor air

quality requirements of the paragraph SEALANTS above.

2.4 BACKSTOPS

Provide glass fiber roving, neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Provide 25 to 33 percent oversized backing for closed cell and 40 to 50 percent oversized backing for open cell material, unless otherwise indicated. Provide backstop material that is compatible with sealant. Do not use oakum or other types of absorptive materials as backstops.

2.4.1 Rubber

Provide in accordance with ASTM D1056, Type 2, closed cell, round cross section for cellular rubber sponge backing.

2.4.2 Synthetic Rubber

Provide in accordance with ASTM C509, Option I , Type I preformed rods or tubes for synthetic rubber backing.

2.4.3 Neoprene

Provide in accordance with ASTM D1056, closed cell expanded neoprene cord Type 2, Class C, for neoprene backing.

2.4.4 Butyl Rubber Based

Provide in accordance with ASTM C1311, from a single component, with solvent release. color as selected from manufacturer's full range of color choices.

2.4.5 Silicone Rubber Base

Provide in accordance with ASTM C920, from a single component, with solvent release, Non-sag, Type S, Grade NS, Class 25. Color as selected from manufacturer's full range of color choices.

2.5 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer and in accordance with environmental requirements herein. Protect adjacent aluminum and bronze surfaces from solvents. Provide solvents for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

Perform a field adhesion test in accordance with manufacturer's instructions and ASTM C1193, Method A or ASTM C1521, Method A, Tail Procedure. Remove sealants that fail adhesion testing; clean substrates, reapply sealants, and re-test. Test sealants adjacent to failed sealants. Submit field adhesion test report indicating tests, locations, dates, results, and remedial actions taken.

3.2 SURFACE PREPARATION

Prepare surfaces according to manufacturer's printed installation instructions. Clean surfaces from dirt, frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would destroy or impair adhesion. Remove oil and grease with solvent; thoroughly remove solvents prior to sealant installation. Wipe surfaces dry with clean cloths. When resealing an existing joint, remove existing caulk or sealant prior to applying new sealant. For surface types not listed below, provide in accordance with sealant manufacturer's printed instructions for each specific surface.

3.2.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finished work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue free solvent. Remove resulting debris and solvent residue prior to sealant installation.

3.2.2 Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive prior to sealant application. For removing protective coatings and final cleaning, use non-staining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

3.2.3 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, remove materials by sandblasting or wire brushing. Remove laitance, efflorescence and loose mortar from the joint cavity. Remove resulting debris prior to sealant installation.

3.2.4 Wood Surfaces

Ensure wood surfaces that will be in contact with sealants are free of splinters, sawdust and other loose particles.

3.3 SEALANT PREPARATION

Do not add liquids, solvents, or powders to sealants. Mix multicomponent elastomeric sealants in accordance with manufacturer's printed instructions.

3.4 APPLICATION

3.4.1 Joint Width-To-Depth Ratios

Acceptable Ratios:

JOINT WIDTH	JOINT DEPTH	
	Minimum	Maximum
For metal, glass, or other nonporous surfaces:		
1/4 inch (minimum)	1/4 inch	1/4 inch
over 1/4 inch	1/2 of width	Equal to width
For wood, concrete, or masonry:		
1/4 inch (minimum)	1/4 inch	1/4 inch
over 1/4 inch to 1/2 inch	1/4 inch	Equal to width
over 1/2 inch to 1 inch	1/2 inch	5/8 inch
Over 1 inch	prohibited	

Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding is prohibited at metal surfaces.

3.4.2 Unacceptable Sealant Use

Do not install sealants in lieu of other required building enclosure weatherproofing components such as flashing, drainage components, and joint closure accessories, or to close gaps between walls, floors, roofs, windows, and doors, that exceed acceptable installation tolerances. Remove sealants that have been used in an unacceptable manner and correct building enclosure deficiencies to comply with contract documents requirements.

3.4.3 Masking Tape

Place masking tape on the finished surface on one or both sides of joint cavities to protect adjacent finished surfaces from primer or sealant smears. Remove masking tape within 10 minutes of joint filling and tooling.

3.4.4 Backstops

Provide backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide joints in specified depths. Provide backstops where indicated and where backstops are not indicated but joint cavities exceed the acceptable maximum depths specified in JOINT WIDTH-TO-DEPTH RATIOS Table.

3.4.5 Primer

Clean out loose particles from joints immediately prior to application of. Apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's printed instructions. Do not apply primer to exposed finished surfaces.

3.4.6 Bond Breaker

Provide bond breakers to surfaces not intended to bond in accordance with, sealant manufacturer's printed instructions for each type of surface and sealant combination specified.

3.4.7 Sealants

Provide sealants compatible with the material(s) to which they are applied. Do not use a sealant that has exceeded its shelf life or has jelled and cannot be discharged in a continuous flow from the sealant gun. Apply sealants in accordance with the manufacturer's printed instructions with a gun having a nozzle that fits the joint width. Work sealant into joints so as to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Apply sealant uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply additional sealant, and tool smooth as specified. Apply sealer over sealants in accordance with the sealant manufacturer's printed instructions.

3.5 PROTECTION AND CLEANING

3.5.1 Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled and no residual tape marks remain.

3.5.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

- a. Masonry and Other Porous Surfaces: Immediately remove fresh sealant that has been smeared on adjacent masonry, rub clean with a solvent, and remove solvent residue, in accordance with sealant manufacturer's printed instructions. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding. Remove resulting debris.
- b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent moistened cloth. Remove solvent residue in accordance with solvent manufacturer's printed instructions.

-- End of Section --

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