



**US Army Corps
of Engineers®**
Wilmington District

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Construct SOF Group Headquarters Fort Bragg, NC

AMENDMENT 0002 Specifications

Specifications - Volume 1 of 4

September 2020



Mason & Hanger

A Day & Zimmermann Company

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VOLUME 1 of 3
Division 0 - 7

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Wilmington District

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SECTION 01 11 00

SUMMARY OF WORK
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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Field Location of Underground Utilities; G, RO

1.2 WORK COVERED BY CONTRACT DOCUMENTS

1.2.1 Project Description

The work includes the construction of one, 96,000 SF two-story building at Fort Bragg, NC. Associated sitework including earthwork, stormwater collection, retention and drainage, roadways and parking lots are included. Site communication work is included. Water, electrical power and site lighting and natural gas are provided by privatized utilities services with coordination with those service providers required by this project.

1.2.2 Location

The work is located at the Fort Bragg, NC. The exact location is indicated on the drawings.

1.3 EXISTING WORK

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

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

1.4 LOCATION OF UNDERGROUND UTILITIES

Obtain digging permits prior to start of excavation, and comply with Installation requirements for locating and marking underground utilities. Contact local utility locating service a minimum of 2 weeks prior to

excavating, to mark utilities, and within sufficient time required if work occurs on a Monday or after a Holiday. Verify existing utility locations indicated on contract drawings, within area of work. Location of existing utilities shall be included on the Record Drawings, refer to Section 01 78 00 CLOSEOUT SUBMITTALS

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

1.4.1 Notification Prior to Excavation

Notify the Contracting Officer at least 48 hours prior to starting excavation work.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

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WORK RESTRICTIONS

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PART 2 PRODUCTS

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SECTION 01 14 00

WORK RESTRICTIONS
09/19

PART 1 GENERAL

1.1 DEFINITIONS

- a. Access Roster: A list of all personnel (contractor, subcontractor, government, vendors, etc.) who have been vetted by the government and Site Security Manager (SSM), and are authorized to have access to the construction site.
- b. Cleared American Guard (CAG): SECRET security cleared personnel whose job is to control access of personnel and materials onto the construction site and into the Secure Area and Secure Storage Area. The CAG reports incidents to the Site Security Manager.
- c. Cleared Escort (CE): SECRET security cleared personnel whose job is to escort and monitor all uncleared workers in the Secure Area or Secure Storage Area. All uncleared personnel shall work within view of an escort.
- d. Cleared Personnel (CP): Cleared personnel are individuals listed on the Access Roster would have been validated by the SSM as having a SECRET security clearance or higher and are authorized to have access to the construction site.
- e. Daily Access Log: The daily log of all personnel who have accessed the construction site and Secure Area. The Daily Access Logs shall be recorded by the CAGs and/or local guards from the access control points.
- f. Local Guard (LG): Vetted, uncleared personnel whose job is to control access to the construction site during construction site work hours and conduct random inspections of the construction site after work hours, weekends, and holidays. The LGs work under the supervisor of a CAG.
- g. Secure Area (SA): The area on the second floor of the brigade headquarters that is comprised of Rooms 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 245, 246, 247, 248, 249, and 250.
- h. Secure Storage Area (SSA): A secure area within the fenced construction site for the temporary storage of building materials until required for installation within the Secure Area. The SSA shall be a steel CONNEX or Sea Land containers. The SSA containers shall have a GSA high security lock. Access to the SSA is limited to CAGs, Cleared Escorts, or other cleared personnel.
- i. Site Security Manager (SSM): The government official who has been designated as the person responsible for the overall management of construction security in accordance with ICS 705.1 and IC Tech Spec for ICS/ICD 705. The SSM shall have direct management and oversight of all CAGs, Local Guards, and Cleared Escorts.

- j. Uncleared Personnel (UP): All personnel who do not possess, at minimum, a validated SECRET security clearance, but have been vetted to access the construction site. All uncleared personnel working within the Secure Area must be escorted and observed by a Cleared Escort or CAG within the Secure Area or adjacent spaces.
- k. U.S. Citizen: A person born or naturalized as a United States Citizen.
- 1. U.S. Person: A person who has been lawfully admitted for permanent residence into the United States as defined in 8 U.S.C. 1101(a)(20) or who is a protected individual as defined by 8 U.S.C. 1324b(a)(3).
- m. Vetted/Vetting: The process of performing a background check on someone before offering them employment or allowing them access to the construction site. For this contract, vetting also includes the process of verifying U.S. Citizenship or legal residency within the United States and a National Criminal Background Check.

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

SD-01 Preconstruction Submittals

Construction Personnel; G

Contact Personnel

SD-07 Certificates

Daily Reports, Delivery Reports, and Daily Access Logs

Construction Vehicles

1.3 CONSTRUCTION PERSONNEL

- a. An Access Roster of all construction personnel requiring access to the construction site shall be provided to the Contracting Officer and SSM. This roster shall include a full name and clearance level of each worker (i.e., Cleared, Uncleared, U.S. Citizen, U.S. Persons). The SSM will verify cleared personnel security clearances.
- b. The Access Roster shall be maintained and updated by the Contractor until the new facility is accepted by the government. As new personnel are added or removed, an updated copy of the Access Roster shall be resubmitted to the Contracting Officer and SSM.
- c. The SSM will provide the Contractor with a list of all Government personnel authorized to access the construction site and Secure Area and to be included on the Access Roster.

1.4 CONTACT PERSONNEL

Submit a list of contact personnel for the Contractor and subcontractors including full names, addresses, and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, resubmit the list to the Contracting Officer and SSM. The list shall be marked and maintained, "For Official Use Only".

1.5 DAILY REPORTS, DELIVERY REPORTS, AND DAILY ACCESS LOGS

The contractor's Daily Reports, Material Delivery Reports, and Daily Access Logs shall be provided to the Contracting Officer and SSM at the end of each work day.

1.6 CONSTRUCTION VEHICLES

The Contractor shall submit a list of vehicles to be utilized within the construction site with the following information for each vehicle: Year/Make/Model/License Number/Registered Owner.

1.7 SPECIAL SCHEDULING REQUIREMENTS

Permission to interrupt any Activity roads, railroads, and/or utility service shall be requested in writing a minimum of 15 calendar days prior to the desired date of interruption.

1.8 CONTRACTOR ACCESS AND USE OF PREMISES

1.8.1 Activity Regulations

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

1.8.2 Base Passes

- a. Temporary passes are no longer available at Ft. Bragg. Contractors can apply for and obtain AIE II+ passes for fee if desired. If not, contractor is required to enter through search lanes at ACP each day. Large vehicles will be required to use Knox Street Truck Inspection Plaza regardless. Refer to PHYSICAL SECURITY ACCESS CONTROL for additional information on fees.
- b. Maintain strict accountability over passes. Immediately report, to the source of issue, any passes missing or lost, and the circumstances. If the Contractor has another active contract or one commencing immediately, employees' names may be transferred from one contract to the other. Final payment will not be effected until employees are transferred to another contract or the records are cleared. Furnish a signed letter, countersigned by the source of issue, stating that passes have been turned in.

1.8.3 No Smoking Policy

Smoking is prohibited within and closer than 50 feet outside of all

buildings on installations 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.

1.8.4 Emergency Response Requirement

The most appropriate protective action for certain emergencies is to take shelter. Personnel shall immediately seek shelter while an assessment is made of the threat and determinations are being made regarding subsequent actions such as "all clear" or selected building evacuations. The following procedures shall be put in place in the event of an emergency condition. Submit emergency response procedures for government approval prior to inclusion in Contractor's Safety Plan.

- a. NOTIFICATION: The primary means of alerting personnel shall be emergency alert signals. The alerting signal to seek shelter shall be three steady tones that last for thirty seconds separated by ten seconds of silence. The notification for "all clear" shall be three short tones repeated three times.
- b. SHELTERING: When personnel hear the alert signal, the area of work must be secured in a manner that will leave the site in safe condition. Personnel shall seek shelter in the nearest occupied building in calm and orderly manner. If possible, secure all windows and doors and shut off ventilation. If in a vehicle, park the vehicle so that it does not block the normally traveled portion of the road and proceed into the nearest occupied building.
- c. EVACUATION: In the event of an evacuation, personnel shall receive directions from team members of the Crowd Control Center (CCC) or the building custodian acting on the directions from the CCC. Contract personnel shall comply with instructions given at all times.

1.8.5 Working Hours

Regular working hours shall consist of a 9 hour period, between 7 a.m. and 4:00 p.m., Monday through Friday, excluding Government holidays.

1.8.6 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Make application at least 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 shall 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.

1.8.7 Utility Cutovers and Interruptions

- a. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in the paragraph "Work Outside Regular Hours."

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

1.9 EXTRAORDINARY SECURITY REQUIREMENTS

1.9.1 Identification Badges

The Contractor shall provide construction site photo identification badges. The SSM will approve the contractor's site identification methods and procedures for all personnel entering the construction area. Immediately report any instances of lost or stolen badges to the Contracting Officer and. SSM.

1.9.2 Citizenship Requirements

Design and construction conducted under this contract is restricted to U.S. companies using U.S. Citizens or U.S. persons. The free online program "E-Verify" shall be used to verify the status of all design and construction personnel. Copies of the E-Verify reports for all design and construction personnel shall be maintained by the Contractor and made available for inspection by the SSM. E-Verify service is available at www.uscis.gov.

1.9.3 Guard Services

The Contractor shall provide guard services during construction work hours, after hours, weekends, and holidays. During construction work hours, the Contractor shall provide a minimum of two guard personnel with at least one being a CAG. Contractor shall provide, as required, additional Local Guards and/or CAGs above the minimum to meet the work load demands as work within the construction site and Secure Area progresses to maintain schedule progress and work load. During after hours, weekends, and holidays, the Contractor shall provide one Local Guard for random inspection checks.

- a. Cleared American Guards. Cleared American Guards are required to provide oversight over access to the construction site and to maintain access control of the perimeter of the Secure Area and Secure Storage Area during construction work hours.
- b. Local Guards. Local Guards, under the oversight of a CAG, shall maintain access control of the construction site during construction hours and to conduct and record, at least every 2-3 hours, random inspection checks of the construction site after hours, weekends, and holidays. The random inspections checks shall be electronically verified/validated that the inspection checks were performed. Local

Guards cannot be used to perform access control for the Secure Area or Secure Storage Area.

- c. During construction work hours, the Local Guards or CAGs shall immediately notify -the SSM and Contracting Officer of any incidents. After hours, the initial notification shall be to local law enforcement agency followed immediately by notification to the SSM.
- d. Keys to the Secure Storage Area and Secure Area barrier shall be maintained by the CAG and SSM.

1.9.4 Physical Site Security

- a. Perimeter Security Fence. The Contractor shall install a temporary chain-link construction security fence around the construction site with lockable separate vehicle and personnel gates. The Secure Storage Area shall be located within the fenced construction area. The distance between the building and construction security fence is at the contractor's discretion, but must allow for safe construction equipment operations (concrete trucks, cranes, forklifts, etc.). Fencing shall be laid out in straight lines to permit unhampered observation. The fabric height will be a minimum of 6 foot.
- b. Fence Materials. Chain-link fences must be constructed with 9-gauge or heavier galvanized steel wire mesh with mesh openings not larger than 2 inches per side, and have twisted and barbed selvages at the top and the bottom. The wire must be taut and securely fastened to rigid metal or reinforced-concrete posts set in concrete. It must reach within 2 inches of hard ground or pavement. On soft ground, it must reach below the surface deep enough to compensate for shifting soil or sand.
- c. Gates and Entrances. Gates will be secured with GSA high security locks. Semi-active entrances, such as less frequently used vehicular gates, must be locked from the inside when not in use. Care must be afforded against the ability to crawl under gates.
- d. Utility openings. Any trenches or culverts through the perimeter, and any other below-grade chases 10 inches or more in diameter, including any existing passages, must have security measures equivalent to that of the perimeter. Access to any below grade chases must be secured to prevent unauthorized opening.
- e. Fence and Gate Maintenance. Any weaknesses or breaches in the fence as a result of weathering or damage must be reported to the SSM as soon as discovered, and must be repaired immediately. Any temporary repair measures must be replaced by permanent repairs within 24 hours. Any damage that may have been caused by intrusion must also be reported to the SSM immediately.

1.9.5 Access Control

- a. Construction Site Access.

(1) Rough grading, erosion control measures, utility infrastructure, etc. may commence prior to implementation of access control measures. Prior to any work within the building footprint, the perimeter security fences shall be erected and access control

measures enacted. Work outside the perimeter security fence is not restricted.

- (2) Access control measures shall be maintained by Local Guards and/or Cleared American Guards, who shall verify all personnel, materials, and equipment entering the site, and which shall be recorded in the daily Delivery Reports and Access Logs. Individuals not on the Access Roster shall be denied entry until approved by the SSM. Materials and equipment without prior approval by the SSM shall not be allowed to enter the site.
 - (3) It is recommended that the contractor's construction trailer be located outside of the perimeter security fence for visitor access and vetting prior to entering the site.
- b. Secure Area (Rooms 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 245, 246, 247, 248, 249, and 250.
- (1) The Site Security Manager will mandate when access control is to be implemented. Access control also includes any work within adjacent spaces within 2-feet of the Secure Area perimeter wall. Access shall be limited only to Cleared Personnel; no exceptions. Access control and Daily Access Log procedures into the Secure Area will be controlled by a CAG. The contractor shall provide Cleared Escorts to accompany all Uncleared Personnel. The contractor shall provide enough Cleared Escorts as required to maintain scheduled progress and when all workers cannot be visually observed by a single escort.
 - (2) Temporary Barriers. As soon as the SSM mandates access control for the Secure Area, contractor shall secure the perimeter wall with temporary plywood or OSB partition and doors, or permanent metal stud and gypsum board partitions with permanent doors. Temporary or permanent partitions and doors shall be able to show evidence of surreptitious entry. All temporary plywood or OSB partitions shall be fastened to framing from within the SA. All doors shall be installed so the hinges are on the inside to preclude removal of the screws or the use of chisels or cutting devices. Pins in exterior hinges shall be welded, flanged, or otherwise secured to make them non-removable. Doors shall be 12-gauge hollow metal or 1-3/4 inch solid wood. Doors shall be secured with a GSA high-security lock.
- c. Failure to Maintain Access Control. Failure to maintain strict access control by CAGs and Cleared Escorts could result in demolition by the Contractor and subsequent reconstruction of a part of the work. If so, the SSM will make the determination as to the extent of the demolition and reconstruction required; this work shall be performed at no cost to the government.
- d. Entry Approval. The Contractor shall comply with the Government Construction Security Plan per ICD/ICS 705 to include, but not limited to, required physical barriers and signs at all entry points listing prohibited items. The Contractor can expect random searches of personnel at entry and exit points. Failure to obtain entry approval for personnel, materials, or equipment will not affect the contract price or time of project completion.
- e. All tools and materials entering the Secure Area are subject to

inspection.

1.9.6 Construction Materials

- a. All materials for this project shall be procured by the contractor and stored within the construction site.
- b. All materials entering the construction site will have prior approval from the SSM and documentation of construction material will be maintained on file at the construction site.
- c. Random Selection. Bulk finish materials (drywall, floor tile, ceiling tile, etc.) will be randomly selected by the SSM for use in the Secure Area. The randomly selected materials shall immediately be stored within the SSA or the Secure Area itself.
- d. Secure Storage Area (SSA).
 - (1) Materials for the Secure Area that will not be immediately placed with the Secure area shall be stored within the SSA. The SSA shall be located within the perimeter security fence. The SSA may either be a separate secured fenced area, containers (CONEX, Sea Land), or permanent structure. The SSA shall be secured with a GSA high security lock.
 - (2) The SSA will remain locked when not being accessed. Only a CAG or Cleared Escort may provide access to the SSA and must remain with all Uncleared Personnel accessing the storage while it is unlocked. No personnel will be allowed to access the SSA without prior vetting by the SSM.

1.9.7 Additional Restrictions

- a. Cell Phones and Cameras. Personal cell phones and cameras are prohibited from the construction site. If found, personal cell phones and cameras may be confiscated by the SSM. A limited number of contractor's cell phones for safety purposes may be used, but shall be approved by the SMM. Cameras required for progress photos shall be approved by the SMM and Fort Bragg Security Office. No progress photos shall be posted on the internet.
- b. The use of construction site web cameras is not authorized for this project. In addition, it is a crime under 18 USC 795 to photograph or video defense installations without first obtaining the permission of the Commanding Officer of the military installation. It is a crime under 18 USC: 797 to reproduce, publish, sell or give away any photograph, picture or graphic reproduction of a defense installation without first obtaining permission of the Commanding Officer of the military installation. Failure to follow the stated requirements is grounds for removal from the installation and confiscation of unapproved or prohibited items.
- c. Work Requiring Security Clearance.
 - (1) All personnel performing any work within Secure Area shall either be Cleared Personnel or escorted by Cleared Escorts.
 - (2) All communications infrastructure designated to process information at higher classification levels (JWICS, TS/SCI,

Yellow, etc.) shall be installed by Cleared Personnel.

1.9.8 Security Procedures Compliance

The SSM will have complete access to the work site to ensure proper security procedures are maintained. The SSM will report any security inconsistencies or unauthorized work/materials found and any action taken to resolve the issue to the U.S. Army Corps of Engineers. The U.S. Army Corps of Engineers is authorized to hold the contract in abeyance pending resolution of any inconsistent security procedures based on the SSM's recommendation.

1.9.9 Temporary Facility Space

Contractor shall provide space sufficient for one person with a contractor supplied desk and chair within their temporary office facility for the SSM. The space is intended to be open area and not a private office, but will require 24/7 accessibility to facilitate partnering with contractor concerning access control and material segregation oversight.

1.9.10 Construction Plans and Documents

- a. All construction drawings and related documents maintained on-site shall be secured in a metal plan file or file cabinet and locked with a high security hasp and GSA approved padlock or GSA approved container. Unless noted otherwise, the electronic security systems drawings, specifications, shop drawings, submittals, etc. maintain on-site shall be treated as, "For Official Use Only (FOUO)". Under no circumstance should plans, diagrams, etc., that are identified for the construction of the Secure Area be sent or posted on unprotected information technology systems or Internet venues without file protection (i.e., password authentication, encrypted e-mails, etc.) measures approved by the SSM.
- b. The terms, "SCIF", "Sensitive Compartmented Information Facility", or ICS/ICD 705 shall not be used in any of the construction documents (drawings, specifications, shop drawings, etc.). The terms shall also be avoided in verbal conversations within the construction site.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

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PRICE AND PAYMENT PROCEDURES
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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1.2 SINGLE JOB PAYMENT ITEMS

Payment items for the work of this contract for which contract job payments will be made are listed in the BID PROPOSAL SCHEDULE and described below. All costs for items of work, which are not specifically mentioned to be included in a particular job or unit price payment item, are included in the listed job item most closely associated with the work involved. The job price and payment made for each item listed constitutes full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for which separate payment is not otherwise provided.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 CONTRACT COST BREAKDOWN

The Contractor must furnish within 30 days after the date of Notice to Proceed, and prior to the submission of its first partial payment estimate, a breakdown of its single job pay item or items which will be reviewed by the Contracting Officer as to propriety of distribution of the total cost to the various accounts. Any unbalanced items as between early and late payment items or other discrepancies will be revised by the Contracting Officer to agree with a reasonable cost of the work included in the various items. This contract cost breakdown will then be utilized as the basis for progress payments to the Contractor.

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ADMINISTRATIVE REQUIREMENTS
08/15

PART 1 GENERAL

1.1 REFERENCES

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

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

1.2 SUBMITTALS

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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Fort Bragg IGI&S Non-Disclosure/Data Sharing Agreement; G, RO

1.3 MINIMUM INSURANCE REQUIREMENTS

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

1.4 Fort Bragg IGI&S Non-Disclosure/Data Sharing Agreement

The Contractor shall prepare, sign, submit and adhere to the Fort Bragg IGI&S Non-Disclosure/Data Sharing Agreement attached to the end of this section.

1.5 SUPERVISION

1.5.1 Minimum Communication Requirements

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

1.5.2 Superintendent Qualifications

The project superintendent must have a minimum of 10 years experience in construction with at least 5 of those years as a superintendent on projects similar in size and complexity. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification and safety compliance. The individual must be capable of interpreting a critical path schedule and construction drawings. The qualification requirements for the alternate superintendent are the same as for the project superintendent. The Contracting Officer may request proof of the superintendent's qualifications at any point in the project if the performance of the superintendent is in question.

1.5.2.1 Duties

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

1.5.3 Non-Compliance Actions

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

1.6 PRECONSTRUCTION CONFERENCE

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

1.7 PARTNERING

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

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

meeting.

1.7.1 Formal Partnering

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

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

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

1.8 ELECTRONIC MAIL (E-MAIL) ADDRESS

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

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

PART 2 PRODUCTS

Not Used

PN87437, SOF Group Headquarters
Fort Bragg, North Carolina

Solicitation No. W912PM21R0001

PART 3 EXECUTION

Not Used

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NON-DISCLOSURE/DATA SHARING AGREEMENT

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Fort Bragg IGI&S Non-Disclosure/Data Sharing Agreement For Geographic Information System (GIS) Data



U.S. Army Installation Geospatial Information and Services (IGI&S) Information Assurance

Compliance with this agreement will ensure all activities undertaken and completed under this contract are recognized as in the best interests of the U.S. Army. All personnel associated with this contract will fully comply with this non-disclosure agreement's intent and spirit. Any violations of this agreement will be prosecuted to the full extent of the law.

I/We the undersigned, on behalf of the Requesting Organization listed below (hereafter referred to as the "Requester"), request release of GIS/CAD Data (collectively, the "Data") and understand and agree to the following:

All Data released with this agreement is for official use only.

- The Recipient agrees to accept these Data "as is" without any Government representation as to suitability for intended use or warranty whatsoever. This disclaimer does not affect any obligation the Government may have regarding Data specified in a contract for the performance of that contract.
- The Recipient agrees to indemnify and hold harmless the Government, its agents, and employees from every claim or liability, including attorneys fees, court costs, and expenses arising out of, or in any way related to, the misuse or unauthorized modification, reproduction, release, performance, display, or disclosure of Data received from the Government with restrictive legends by the Recipient or any person to whom the Recipient has released or disclosed the Data.
- Data shall remain under the control of the originating requestor or agency or its successor in function at all times
- Release/disclosure of Data to any party beyond the original requestor is prohibited. No non-governmental publication of the data by any means or analyses thereof is authorized.
- All Data that is released for off-site usage shall become the fully responsible of the below signed individual/company/organization. Additional requirements include:
 - Off-installation storage of information on laptop/notebook/desktop computers is prohibited except for official use only. Exceptions to this rule can only be approved with direct permission from the Installation Geospatial Information and Services (GI&S) Coordinator.
 - If the below signed individual ends his/her employment with the company/agency represented in this agreement, the company/agency must assign a new point of contact or the responsibilities of this agreement will default to that person's immediate supervisor.
- Any maps, reports or displays must be labeled with "For Official Use Only" and must acknowledge the originator of the data.
- The IGI&S Coordinator must approve all modifications to the Data if the Data is intended for on-installation storage and use. This includes, but is not limited to, direct GIS data changes, creation of new GIS datasets, and GIS dataset creation based on GIS analysis.
- Publication of any of the data or analyses thereof is prohibited without the expressed written consent of the IGI&S Coordinator. Any maps, reports or displays must acknowledge the originator of the data.
- The below signed individual/company agrees that upon completion of the use of the Data supplied pursuant to this agreement, the individual/company shall return all information certifying that all such data, any and all copies, reproductions, facsimiles, subsets, etc. have either been returned or destroyed.
- U.S. Department of Defense laws and regulations protect all data released and strict compliance of these regulations must be adhered to for this agreement. Information safeguarding requirements are per Executive Order 12958 (when applicable).
- All issues and questions pertaining to the data should be addressed through the IGI&S Coordinator, Kirk Rutkofske, GIO 910-907-3822 or kirk.rutkofske@us.army.mil.



**Fort Bragg IGI&S
Non-Disclosure/Data Sharing Agreement For
Geographic Information System (GIS) Data**



U.S. Army IGI&S Information Assurance

Requesting Organization: _____

Requestor Name: _____

Contract Number: _____

Signature: _____

Date: _____

PN87437, SOF Group Headquarters
Fort Bragg, North Carolina

Solicitation No. W912PM21R0001

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NON-DISCLOSURE/DATA SHARING AGREEMENT
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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 Contractor Quality Control approval information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

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

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.

2.1.2.1 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.

2.1.2.2 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 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.

3.3.4 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 of mechanical/electrical/information systems layout drawings.
- c. Long procurement activities
- d. Submission and approval of O & M manuals.
- e. Submission and approval of as-built drawings.
- f. Submission and approval of DD1354 data and installed equipment lists.
- g. Submission and approval of testing and air balance (TAB).
- h. Submission of TAB specialist design review report.
- i. Submission and approval of fire protection specialist.
- j. 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.
- k. Air and water balancing.
- l. Building commissioning - Functional Performance Testing.
- m. Controls testing plan submission.
- n. Controls testing.
- o. Performance Verification testing.
- p. Other systems testing, if required.
- q. Contractor's pre-final inspection.
- r. Correction of punch list from Contractor's pre-final inspection.
- s. Government's pre-final inspection.
- t. Correction of punch list from Government's pre-final inspection.
- u. Final inspection.

3.3.5 Government Activities

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

3.3.6 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 RMS 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.

3.3.6.1 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.

3.3.6.2 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).

3.3.6.3 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.

3.3.6.4 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.

3.3.6.5 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.

3.3.6.6 Phase of Work Coding (PHAS)

Assign Phase of Work Code to all activities. Examples of phase of work are 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.

3.3.6.7 Category of Work Coding (CATW)

Assign a Category of Work Code to all activities. Category of Work Codes include, but are not limited to 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.

3.3.6.8 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.

3.3.7 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.

3.3.7.1 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.

3.3.7.2 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.

3.3.7.3 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.

3.3.7.3.1 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.

3.3.7.3.2 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.

3.3.8 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.

3.3.9 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.

3.3.10 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.

3.3.11 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.

3.3.12 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.

3.3.13 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.

3.3.14 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.

3.3.15 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.

3.3.16 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.

3.3.17 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.

3.3.18 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).

3.3.18.1 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.

3.3.18.2 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.

3.3.19 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.

3.3.20 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.

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.

- 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 the responsibility of the Contractor and 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 3 set(s) of hardcopy reports. 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

Import the schedule data into the Resident Management System (RMS) and export the RMS 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 RMS of the application for progress payment.

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SECTION 01 33 00

SUBMITTAL PROCEDURES
08/18

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Submittal Information

The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

1.1.2 Project Type

The Contractor's Quality Control (CQC) System Manager are to check and approve all items before submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals 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.

The Contractor shall check and approve all items before submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals 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.

1.1.3 Submission of Submittals

Schedule and provide submittals requiring Government approval before acquiring the material or equipment covered thereby. Pick up and dispose of samples not incorporated into the work in accordance with manufacturer's Safety Data Sheets (SDS) and in compliance with existing laws and regulations.

1.2 DEFINITIONS

1.2.1 Submittal Descriptions (SD)

Submittal requirements are specified in the technical sections. Examples and descriptions of submittals identified by the Submittal Description (SD) numbers and titles follow:

SD-01 Preconstruction Submittals

Submittals that are required prior to or commencing with the start of work on site. Submittals that are required prior to or at the start of construction (work) or the next major phase of the construction on a multiphase contract.

Preconstruction Submittals include schedules and a tabular list of locations, features, and 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

Baseline Network Analysis Schedule (NAS)

Submittal Register

Schedule Of Prices Or Earned Value Report

Accident Prevention Plan Health And Safety Plan

Work Plan

Quality Control (QC) plan

Environmental Protection Plan

SD-02 Shop Drawings

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

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

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

SD-03 Product Data

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

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

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic

characteristics of a material or product and establish standards by which the work can be judged.

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

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

SD-05 Design Data

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

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. Unless specified in another section, testing must have been within three years of date of contract award for the project.

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

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

Investigation reports

Daily logs and checklists

Final acceptance test and operational test procedure

SD-07 Certificates

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

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

Confined space entry permits

Text of posted operating instructions

SD-08 Manufacturer's Instructions

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

SD-09 Manufacturer's Field Reports

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

Factory test reports.

SD-10 Operation and Maintenance Data

Data provided by the manufacturer, or the system provider, including manufacturer's help and product line documentation, necessary to maintain and install equipment, for operating and maintenance use by facility personnel.

Data required by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

Data 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.

Submittals required for Guiding Principle Validation (GPV) or Third Party Certification (TPC).

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

1.2.2 Approving Authority

Office or designated person authorized to approve the submittal.

1.2.3 Work

As used in this section, on-site and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction. In exception, excludes work to produce SD-01 submittals.

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 Notebook, in conformance to Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with this section.

SD-01 Preconstruction Submittals

Submittal Register; G

1.4 SUBMITTAL CLASSIFICATION

1.4.1 Government Approved (G)

Government approval is required for extensions of design, critical materials, variations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Government.

Government approval is required for any variations from the Solicitation or the Accepted Proposal and for other items as designated by the Government.

Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, submittals are considered to be "shop drawings."

1.4.2 For Information Only

Submittals not requiring Government approval will be for information only. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are not considered to be "shop drawings."

1.4.3 Sustainability Reporting Submittals (S)

Submittals for Guiding Principle Validation (GPV) or Third Party Certification (TPC) are indicated with an "S" designation. These submittals are for information only and for use as specified in Section 01 33 29.00 37 SUSTAINABILITY.

Schedule submittals for these items throughout the course of construction as provided; do not wait until closeout.

1.5 PREPARATION

1.5.1 Submittal Format

1.5.1.1 Format of SD-01 Preconstruction Submittals

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

Provide data in the unit of measure used in the contract documents.

1.5.1.2 Format for SD-02 Shop Drawings

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

- a. Include the nameplate data, size, and capacity on drawings. Also include applicable federal, military, industry, and technical society publication references.
- b. Dimension drawings, except diagrams and schematic drawings. Prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Present shop drawings sized 8 1/2 by 11 inches as part of the bound volume for submittals. Present larger drawings in sets. Submit an electronic copy of drawings in PDF format.

1.5.1.2.1 Drawing Identification

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

Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location next to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

Reserve a blank space, no smaller than 4 inches on the right-hand side of each sheet for the Government disposition stamp.

1.5.1.3 Format of SD-03 Product Data

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

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

1.5.1.3.1 Product Information

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

Provide product data in units used in the Contract documents. Where product data are included in preprinted catalogs with another unit, submit the dimensions in contract document units, on a separate sheet.

1.5.1.3.2 Standards

Where equipment or materials are specified to conform to industry or

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

1.5.1.3.3 Data Submission

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal that is marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of the construction effort.

Submit the manufacturer's instructions before installation.

1.5.1.4 Format of SD-04 Samples

1.5.1.4.1 Sample Characteristics

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

- a. Sample of Equipment or Device: Full size.
- b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.
- c. Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.
- d. Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.
- e. Sample Volume of Nonsolid Materials: Pint. Examples of nonsolid materials are sand and paint.
- f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.
- g. Sample Panel: 4 by 4 feet.
- h. Sample Installation: 100 square feet.

1.5.1.4.2 Sample Incorporation

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

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

1.5.1.4.3 Comparison Sample

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

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

1.5.1.5 Format of SD-05 Design Data

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

1.5.1.6 Format of SD-06 Test Reports

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

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

1.5.1.7 Format of SD-07 Certificates

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

1.5.1.8 Format of SD-08 Manufacturer's Instructions

Present manufacturer's instructions submittals for each section as a complete, bound volume. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry, and technical-society publication references. If supplemental information is needed to clarify the manufacturer's data, submit it as specified for SD-07 Certificates.

Submit the manufacturer's instructions before installation.

1.5.1.8.1 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified

organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.5.1.9 Format of SD-09 Manufacturer's Field Reports

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

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

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

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

1.5.1.11 Format of SD-11 Closeout Submittals

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

Provide data in the unit of measure used in the contract documents.

1.5.2 Source Drawings for Shop Drawings

1.5.2.1 Source Drawings

The entire set of source drawing files will not be provided to the Contractor. Request the specific Drawing Number for the preparation of shop drawings. Only those drawings requested to prepare shop drawings will be provided. These drawings are provided only after award.

1.5.2.2 Terms and Conditions

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

These electronic source drawing files are not construction documents. Differences may exist between the source drawing files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic source drawing files, nor does it make representation to the compatibility

of these files with the Contractor hardware or software. The Contractor is responsible for determining if any conflict exists. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished source drawing files, the signed and sealed construction documents govern. Use of these source drawing files does not relieve the Contractor of the duty to fully comply with the contract documents, including and without limitation the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction data related to this contract, remove all previous indication of ownership (seals, logos, signatures, initials and dates).

1.5.3 Electronic File Format

Provide submittals in electronic format, with the exception of material samples required for SD-04 Samples items. In addition to the electronic submittal, provide three hard copies of the submittals. Compile the submittal file as a single, complete document, to include the Transmittal Form described within. Name the electronic submittal file specifically according to its contents, and coordinate the file naming convention with the Contracting Officer. Electronic files must be of sufficient quality that all information is legible. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer. Generate PDF files from original documents with bookmarks so that the text included in the PDF file is searchable and can be copied. If documents are scanned, optical character resolution (OCR) routines are required. Index and bookmark files exceeding 30 pages to allow efficient navigation of the file. When required, the electronic file must include a valid electronic signature or a scan of a signature.

E-mail electronic submittal documents smaller than 10MB to an e-mail address as directed by the Contracting Officer. Provide electronic documents over 10 MB on an optical disc or through an electronic file sharing system such as the AMRDEC SAFE Web Application located at the following website: <https://safe.amrdec.army.mil/safe/>.

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of SD-01 Preconstruction Submittal Copies

Unless otherwise specified, submit three sets of administrative submittals.

1.6.2 Number of SD-03 Product Data Copies

Submit in compliance with quantity requirements specified for shop drawings.

1.6.3 Number of SD-04 Samples

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

c. Submit one sample installation, where directed.

d. Submit one sample of nonsolid materials.

1.6.4 Number of SD-10 Operation and Maintenance Data Copies

Submit three copies of O&M data to the Contracting Officer for review and approval.

1.6.5 Number of SD-11 Closeout Submittals Copies

Unless otherwise specified, submit three sets of administrative submittals.

1.7 INFORMATION ONLY SUBMITTALS

Submittals without a "G" designation must be certified by the QC manager and submitted to the Contracting Officer for information-only. Approval of the Contracting Officer is not required on information only submittals. The Contracting Officer will mark "receipt acknowledged" on submittals for information and will return only the transmittal cover sheet to the Contractor. Normally, submittals for information only will not be returned. However, the Government reserves the right to return unsatisfactory submittals and require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.8 PROJECT SUBMITTAL REGISTER AND DATABASE

A sample Project Submittal Register showing items of equipment and materials for when submittals are required by the specifications is provided as "SUBMITTAL REGISTER."

1.8.1 Submittal Management

Prepare and maintain a submittal register, as the work progresses. Use an electronic submittal register program furnished by the Government. Do not change data that is output in columns (c), (d), (e), and (f) as delivered by Government; retain data that is output in columns (a), (g), (h), and (i) as approved. As an attachment, provide a submittal register showing items of equipment and materials for which submittals are required by the specifications. 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 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM). 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 Number. and type, e.g., SD-02 Shop Drawings) required in each specification

section.

Column (e): Lists one principal paragraph in each 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 the project requirements.

Column (f): Lists the approving authority for each submittal.

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

1.8.2 Preconstruction Use of Submittal Register

Submit the submittal register as an electronic database, using the submittal management program furnished to Contractor. Include the QC plan and the project schedule. Verify that all submittals required for the project are listed and add missing submittals. Coordinate and complete the following fields on the register database 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 the approving authority to receive submittals.

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

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

1.8.3 Contractor Use of Submittal Register

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

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

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

Column (l) Date submittal transmitted.

Column (q) Date approval was received.

1.8.4 Approving Authority Use of Submittal Register

Update the following fields:

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (l) Date submittal was received.

Column (m) through (p) Dates of review actions.

Column (q) Date of return to Contractor.

1.8.5 Action Codes

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

1.8.5.1 Government Review Action Codes

"A" - "Approved as submitted"

"AN" - "Approved as noted"

"RR" - "Disapproved as submitted"; "Completed"

"NR" - "Not Reviewed"

"RA" - "Receipt Acknowledged"

1.8.5.2 Contractor Action Codes

DESIGN BID BUILD SUBMITTALS			
Submittal Classifications shown in UFGS Sections	Submittal Classification	Corresponding SpecsIntact Submittal Register Code which is populated in the SI Submittal Register. Software Limitations: (The software shows one character delineation in the SpecsIntact Submittal Register)	RMS - The following Submittal Classifications are populated in RMS when the SpecsIntact Submittal Data File is pulled into RMS)
G	Submittal requires Government Approval	G	GA
BLANK	Submittal is For Information Only (FIO)	BLANK	FIO
S	Submittal is for documentation of Sustainable requirements	S	S/FIO

1.8.6 Delivery of Copies

Submit an updated electronic copy of the submittal register to the Contracting Officer with each invoice request , unless a paper copy is requested by the Contracting Officer. Provide an updated Submittal

Register monthly regardless of whether an invoice is submitted.

1.9 VARIATIONS

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

1.9.1 Considering Variations

Discussion of variations with the Contracting Officer before submission will help ensure that functional and quality requirements are met and minimize rejections and resubmittals. When contemplating a variation that 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 variations may cause the Government to require rejection and removal of such work at no additional cost to the Government.

1.9.2 Proposing Variations

When proposing variation, deliver a 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. Include the DOR's written analysis and approval. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

Check the column "variation" of ENG Form 4025 for submittals that include variations proposed by the Contractor. Set forth in writing the reason for any variations and note such variations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted variations.

1.9.3 Warranting that Variations are Compatible

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

1.9.4 Review Schedule Extension

In addition to the normal submittal review period, a period of 14 calendar working days will be allowed for the Government to consider submittals with variations.

1.10 SCHEDULING

Schedule and submit concurrently product data and shop drawings covering component items forming a system or items that are interrelated. Submit pertinent certifications at the same time. No delay damages or time extensions will be allowed for time lost in late submittals. Allow an additional 14 calendar working days for review and approval of submittals for HVAC control systems.

a. Coordinate scheduling, sequencing, preparing, and processing of

submittals with performance of work so that work will not be delayed by submittal processing. The Contractor is responsible for additional time required for Government reviews resulting from required resubmittals. The review period for each resubmittal is the same as for the initial submittal.

- b. Submittals required by the contract documents are listed on the submittal register. If a submittal is listed in the submittal register but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but that have been omitted from the register or marked "N/A."
- c. Resubmit the submittal register and annotate it monthly with actual submission and approval dates. When all items on the register have been fully approved, no further resubmittal is required.

Contracting Officer review will be completed within 30 calendar working days after the date of submission.

1.11 GOVERNMENT APPROVING AUTHORITY

When the approving authority is the Contracting Officer, the Government will:

- a. Note the date on which the submittal was received from the QC manager.
- b. Review submittals for approval within the 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 comments and markings appropriate for the action indicated.

Upon completion of review of submittals requiring Government approval, stamp and date submittals. 1 copies of the submittal will be retained by the Contracting Officer and remaining copies of the submittal will be returned to the Contractor. If the Government performs a conformance review of other Designer of Record approved submittals, the submittals will be identified and returned, as described above.

1.11.1 Review Notations

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

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

is approved.

- d. Submittals marked "not reviewed" indicate that the 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.
- e. Submittals marked "receipt acknowledged" indicate that submittals have been received by the Government. This applies only to "information-only submittals" as previously defined.

1.12 DISAPPROVED SUBMITTALS

Make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications, give notice to the Contracting Officer as required under the FAR clause titled CHANGES. The Contractor is responsible for the dimensions and design of connection details and the construction of work. Failure to point out variations may cause the Government to require rejection and removal of such work at the Contractor's expense.

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

1.13 APPROVED SUBMITTALS

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

Approval or acceptance by the Government for a submittal does not relieve the Contractor of the responsibility for meeting the contract requirements or for any error that may exist, because under the Quality Control (QC) requirements of this contract, the Contractor is responsible for ensuring information contained within each submittal accurately conforms with the requirements of the contract documents.

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

1.14 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not to be construed to change or modify any contract requirements. Before submitting samples, provide assurance 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 that may be damaged

in testing, will be returned to the Contractor, at its expense, upon completion of the contract. Unapproved samples will also be returned to the Contractor at its expense, if so requested.

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

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 unless all required DOR approvals or required Government approvals have been obtained.

1.16 STAMPS

Certify the submittal data as follows on Form ENG 4025: "I certify that the above submitted items had been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.

____NAME OF CONTRACTOR _____ SIGNATURE OF CONTRACTOR

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 33 00

SUBMITTAL REGISTER

01/20

-- End of Section Table of Contents --

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

SOF Group Headquarters

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
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		01 11 00	SD-01 Preconstruction Submittals														
			Field Location of Underground Utilities	1.4	G RO												
		01 14 00	SD-01 Preconstruction Submittals														
			Construction Personnel	1.3	G												
			Contact Personnel	1.4													
			SD-07 Certificates														
			Daily Reports, Delivery Reports, and Daily Access Logs	1.5													
			Construction Vehicles	1.6													
		01 30 00	SD-01 Preconstruction Submittals														
			Fort Bragg IGI&S	1.4	G RO												
			Non-Disclosure/Data Sharing Agreement														
		01 32 01.00 37	SD-01 Preconstruction Submittals														
			Preliminary Project Schedule	3.4.1	G RO												
			Initial Project Schedule	3.4.2	G RO												
			Periodic Schedule Update	3.6.2	G RO												
		01 33 00	SD-01 Preconstruction Submittals														
			Submittal Register	1.8	G												
		01 33 29.00 37	SD-01 Preconstruction Submittals														
			SDD Implementation Plan	1.3	G RO												
			Preconstruction Meeting	3.1													
			SD-03 Product Data														
			Energy-using Equipment	1.6.2													
			SD-07 Certificates														

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		01 33 29.00 37	Pre-Closeout Meeting	3.1													
			SD-11 Closeout Submittals														
			SDD Notebook	1.4	G RO												
			Energy & Sustainability (E&S)	1.5.1													
			Record Card														
			Closeout Meeting	3.1													
		01 35 26	SD-01 Preconstruction Submittals														
			Accident Prevention Plan (APP)	1.7	G RO												
			SD-06 Test Reports														
			Monthly Exposure Reports	1.4													
			Notifications and Reports	1.12													
			Accident Reports	1.12.2	G RO												
			LHE Inspection Reports	1.12.3													
			SD-07 Certificates														
			Crane Operators/Riggers	1.6.1.4													
			Standard Lift Plan	1.7.2.2	G RO												
			Critical Lift Plan	1.7.2.3	G RO												
			Activity Hazard Analysis (AHA)	1.8													
			Confined Space Entry Permit	1.9.1													
			Hot Work Permit	1.9.1													
			Certificate of Compliance	1.12.4													
			License Certificates	1.14													
			Portable Gauge Operations	1.14.1	G RO												
			Planning Worksheet														
		01 45 00.00 10	SD-01 Preconstruction Submittals														

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		01 45 00.00 10	Contractor Quality Control (CQC) Plan	3.2	G RO												
			SD-06 Test Reports														
			Verification Statement	3.9.2													
		01 45 35	SD-06 Test Reports														
			Daily Reports	3.1.2													
			Biweekly Reports	3.1.1													
			SD-07 Certificates														
			Fabrication Plant	2.1													
			Steel Joist Institute Membership	2.1													
			Certificate of Compliance	2.1													
			Special Inspector	1.5	G												
			SD-11 Closeout Submittals														
			Comprehensive Final Report	3.1.2	G												
		01 50 00	SD-03 Product Data														
			Backflow Preventers	1.3	G												
			SD-06 Test Reports														
			Backflow Preventer Tests	2.5													
			SD-07 Certificates														
			Backflow Tester	1.3.1													
			Backflow Preventers	1.3													
		01 57 19	SD-01 Preconstruction Submittals														
			Preconstruction Survey	1.6.1													
			Solid Waste Management Permit	1.11	G												
			Regulatory Notifications	1.6.2	G												
			Environmental Protection Plan	1.7	G												

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		01 57 19	Stormwater Notice of Intent	3.2.1.2	G												
			Dirt and Dust Control Plan	1.7.9.1	G												
			Employee Training Records	1.6.5	G												
			Environmental Manager	1.6.4	G												
			Qualifications														
			SD-06 Test Reports														
			Inspection Reports	3.2.1.3													
			Solid Waste Management Report	3.7.2.1	G												
			SD-07 Certificates														
			Employee Training Records	1.6.5	G												
			Certificate of Competency	1.6.5.1													
			Erosion and Sediment Control	1.6.5													
			Inspector														
			SD-11 Closeout Submittals														
			Stormwater Pollution Prevention	3.2.1.4	G												
			Plan Compliance Notebook														
			Stormwater Notice of Termination	3.2.1.5	G												
			Waste Determination	3.7.1	G												
			Documentation														
			Disposal Documentation for	3.7.3.6	G												
			Hazardous and Regulated Waste														
			Assembled Employee Training	1.6.5	G												
			Records														
			Solid Waste Management Permit	1.11	G												
			Solid Waste Management Report	3.7.2.1	G												

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		01 57 19	Hazardous Waste/Debris Management	3.7.3.1	G												
			Regulatory Notifications	1.6.2	G												
			Sales Documentation	3.7.2.1	G												
		01 58 00	SD-02 Shop Drawings														
			Sign Legend Orders	1.3.1	G												
		01 74 19.00 37	SD-11 Closeout Submittals														
			Records	1.5													
		01 78 00	SD-03 Product Data														
			As-Built Record of Equipment and Materials	1.3.2													
			Warranty Management Plan	1.7.1													
			Warranty Tags	1.7.5													
			Final Cleaning	1.10													
			Spare Parts Data	1.4													
			SD-08 Manufacturer's Instructions														
			Preventative Maintenance	1.5													
			Condition Monitoring (Predictive Testing)	1.5													
			Inspection	1.5													
			Instructions	1.7.1													
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Manuals	1.9	G RO												
			SD-11 Closeout Submittals														

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		01 78 00	Record Drawings	1.3.1													
			Certification of EPA and USDA Designated Items	1.6	G RO												
			Form DD1354	1.11	G RO												
			Checklist for Form DD1354	1.11	G RO												
		01 78 23	SD-10 Operation and Maintenance Data														
			O&M Database	1.3	G												
			Training Plan	3.1.1	G												
			Training Outline	3.1.3	G												
			Training Content	3.1.2	G												
			SD-11 Closeout Submittals														
			Training Video Recording	3.1.4	G												
			Validation of Training Completion	3.1.6	G												
		01 78 24.00 10	SD-01 Preconstruction Submittals														
			Facility Data Project Execution Plan	1.5.1													
			SD-10 Operation and Maintenance Data														
			Facility Data Workbook, Construction Progress	3.1	G RE												
			Facility Document Set, Construction Progress	3.1	G RE												
			SD-11 Closeout Submittals														
			Facility Data Workbook, Construction Final	3.2	G RE												

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		01 78 24.00 10	Facility Document Set, Construction Final	1.5.3	G RE												
			Facility Document Set, Construction Final	3.2	G RE												
		01 91 00.00 37	SD-02 Shop Drawings														
			Control Drawings	1.11.2													
			SD-06 Test Reports														
			Filled out functional test readiness forms	3.7	G RO												
			Completed PFT checklists	3.1.3	G RO												
			Completed startup checklists	3.1.4.1	G RO												
			Completed PVT forms	3.7.4													
			Nonconformance and Approval in PFT checklists and Startup	3.1.5													
			Progress reports and test results	3.8													
			SD-07 Certificates														
			Calibration documentation	3.2													
			Calibration certification	3.2													
			SD-08 Manufacturer's Instructions														
			Startup and Checkout Plan	1.10													
			Checkout Forms	1.10													
			Test Procedures	1.10													
			SD-10 Operation and Maintenance Data														
			Training Plan	3.10.1	G RO												
			Training Documentation	3.10.3													

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		01 91 00.00 37	Training Verification	3.10.4													
			SD-11 Closeout Submittals														
			Deficiency Report and Resolution	3.8.1													
			Record														
			Deficiency Report and Resolution	3.8.4													
			Record														
		02 41 00	SD-01 Preconstruction Submittals														
			Demolition Plan	1.2.2	G RO												
			Existing Conditions	1.8													
			SD-07 Certificates														
			Notification	1.6	G RO												
			SD-11 Closeout Submittals														
			Receipts	3.3.2													
		03 11 13.00 10	SD-02 Shop Drawings														
			Formwork	2.2.1	G AE												
			Formwork	3.1.1	G AE												
			Form Removal Schedule	2.2.1	G AE												
			SD-03 Product Data														
			Form Materials	2.2													
			SD-04 Samples														
			Sample Panels	1.3	G												
			SD-05 Design Data														
			Calculations	2.1													
			SD-06 Test Reports														
			Inspection	3.2													
		03 15 00.00 10	SD-02 Shop Drawings														

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		03 15 00.00 10	Waterstops	2.3	G AE												
			SD-03 Product Data														
			Preformed Expansion Joint Filler	2.2													
			Waterstops	2.3													
			SD-04 Samples														
			Waterstops	2.3													
			SD-07 Certificates														
			Preformed Expansion Joint Filler	2.2													
			Waterstops	2.3													
		03 20 00.00 10	SD-02 Shop Drawings														
			Reinforcement	3.1	G AE												
			SD-03 Product Data														
			Reinforcing Steel	2.2	G AE												
			SD-06 Test Reports														
			Tests, Inspections, and Verifications	2.5	G AE												
			SD-07 Certificates														
			Reinforcing Steel	2.2													
			Qualified Welders	1.3.1													
		03 30 00.00 10	SD-01 Preconstruction Submittals														
			Quality Control Plan	1.5.2	G												
			Laboratory Accreditation	1.5.1													
			Sampling Plan	3.9.5.6	G												
			SD-03 Product Data														
			Recycled Content Products	Part 2													
			Cementitious Materials	2.2													

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		03 30 00.00 10	Vapor Barrier	2.8													
			Floor Finish	2.1.6													
			Chemical Admixtures	2.4													
			SD-05 Design Data														
			Mixture Proportions	2.1.1	G AE												
			Lightweight Aggregate Concrete	3.3													
			SD-06 Test Reports														
			Mixture Proportions	2.1.1	G AE												
			Testing and Inspection for CQC	3.9	G												
			Fly Ash	2.2.3													
			Ground Granulated Blast-Furnace (GGBF) Slag	2.2.6													
			Aggregates	2.3													
			Air Content	3.9.5.1													
			Slump	3.9.5.3													
			Compressive Strength	3.9.5.6													
			Water	2.5													
			SD-07 Certificates														
			Contractor Quality Control personnel	1.5													
			Ready-Mix Plant	3.2.1													
		03 35 00.00 10	SD-03 Product Data														
			Recycled Content Products	Part 2													
		03 39 00.00 10	SD-03 Product Data														
			Curing Materials	2.1													
			SD-06 Test Reports														

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		03 39 00.00 10	Testing and Inspection for CQC	3.2													
		03 42 13.00 10	SD-01 Preconstruction Submittals														
			Quality Control Procedures	1.3.2.2													
			SD-02 Shop Drawings														
			Standard Precast Units	2.1.1	G												
			Custom-Made Precast Units	2.1.2	G												
			Special Finishes	3.2.4.3													
			SD-03 Product Data														
			Standard Precast Units	2.1.1													
			Proprietary Precast Units	2.1.3													
			Embedded Items	3.1.3													
			Accessories	2.2.6													
			SD-05 Design Data														
			Design Calculations	2.1.2	G												
			Concrete Mix Proportions	2.1.5.1													
			SD-06 Test Reports														
			Test Reports	1.3.2.4													
			SD-07 Certificates														
			Quality Control Procedures	1.3.2.2													
			SD-11 Closeout Submittals														
			Recycled content for fly ash and pozzolan	2.2.1	S												
			Recycled content for Ground Iron Blast-Furnace Slag	2.2.1	S												
			Recycled content for Silica Fume	2.2.1	S												

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		03 42 13.00 10	Recycled content for Synthetic Fiber Reinforcement	2.2.1	S												
			Recycled content for steel	2.2.1	S												
		04 20 00	SD-02 Shop Drawings														
			Detail Drawings	3.4.1.1	G												
			SD-03 Product Data														
			Hot Weather Procedures	1.5.1	G												
			Cold Weather Procedures	1.5.2	G												
			Clay or Shale Brick	2.2.2	G												
			Cement	2.2.3.2.1	G												
			Cementitious Materials	2.4.1.1	G												
			Insulation	2.6.8	G												
			SD-04 Samples														
			Mock-Up Panel	1.3.1.1	G												
			Clay or Shale Brick	2.2.2	G												
			Concrete Masonry Units (CMU)	2.2.3.2	G												
			Admixtures for Masonry Mortar	2.4.1.3	G												
			Anchors, Ties, and Bar	2.6.2	G												
			Positioners														
			Joint Reinforcement	2.6.3	G												
			Clay Masonry Expansion-Joint	2.6.6	G												
			Materials														
			Insulation	2.6.8	G												
			SD-05 Design Data														
			Masonry Compressive Strength	2.1.2	G												
			Bracing Calculations	3.2.5	G												

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		04 20 00	SD-06 Test Reports														
			Efflorescence Test	2.2.2.1.4													
			Field Testing of Mortar	3.6.1.1													
			Field Testing of Grout	3.6.1.2													
			SD-07 Certificates														
			Special Masonry Inspector	1.3.2													
			Qualifications														
			Clay or Shale Brick	2.2.2													
			Concrete Masonry Units (CMU)	2.2.3.2													
			Precast Concrete Units	2.2.4													
			Cementitious Materials	2.4.1.1													
			Admixtures for Masonry Mortar	2.4.1.3													
			Admixtures for Grout	2.4.2.2													
			Anchors, Ties, and Bar	2.6.2													
			Positioners														
			Joint Reinforcement	2.6.3													
			Insulation	2.6.8													
			Insulation	2.6.8													
			SD-08 Manufacturer's Instructions														
			Admixtures for Masonry Mortar	2.4.1.3													
			Admixtures for Grout	2.4.2.2													
			SD-10 Operation and Maintenance														
			Data														
			Take-Back Program	3.8													
			SD-11 Closeout Submittals														
			Clay Units	2.2.2.1.3	S												

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		04 20 00	Recycled Content	2.2.3.2.2	S												
		05 12 00	SD-01 Preconstruction Submittals														
			Erection and Erection Bracing	1.5.1.1	G												
			Drawings														
			SD-02 Shop Drawings														
			Fabrication Drawings	1.5.2	G												
			SD-03 Product Data														
			Shop Primer	2.6.2													
			Welding Electrodes and Rods	2.4.1													
			Direct Tension Indicator Washers	2.3.4													
			Non-Shrink Grout	2.4.2													
			Recycled Content for Structural Steel	2.2.1	S												
			Recycled Content for Structural Steel Tubing	2.2.2	S												
			Recycled Content for Steel Pipe	2.2.3	S												
			SD-05 Design Data														
			Shoring and Temporary Bracing	1.5.2	G												
			SD-06 Test Reports														
			Class B Coating	2.6.2													
			Bolts, Nuts, and Washers	2.3													
			Weld Inspection Reports	3.7.1.2													
			Embrittlement Test Reports	3.7.2													
			SD-07 Certificates														
			Steel	2.2													
			Bolts, Nuts, and Washers	2.3													

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		05 12 00	Galvanizing	2.5													
			AISC Structural Steel Fabricator	1.3													
			Quality Certification														
			AISC Structural Steel Erector	1.3													
			Quality Certification														
			Welding Procedures and	1.5.4.1													
			Qualifications														
			Welding Electrodes and Rods	2.4.1													
			Certified Welding Inspector	3.7.1.1													
			Welding Procedure Specifications	3.4													
			(WPS)														
		05 30 00	SD-02 Shop Drawings														
			Fabrication Drawings	1.3.5	G												
			SD-03 Product Data														
			Accessories	2.2													
			Deck Units	2.1													
			Mechanical Fasteners	2.2.12													
			Touch-Up Paint	2.1.4													
			Welding Equipment	1.3.3													
			Welding Rods and Accessories	1.3.3													
			Recycled Content of Steel	2.1	S												
			Products														
			SD-04 Samples														
			Metal Roof Deck Units	2.1.1													
			SD-05 Design Data														
			Deck Units	2.1	G												

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		05 30 00	SD-07 Certificates														
			Powder-Actuated Tool Operator	1.3.2													
			Welder Qualifications	1.3.3													
			Welding Procedures	1.3.3													
			Fire Safety	1.3.4.1													
			Wind Storm Resistance	1.3.4.2													
			Manufacturer's Certificate	1.3.1													
			Stud Manufacture's Certification	2.2.8													
			Stud Manufacture's Test Reports	2.2.8													
		05 40 00	SD-02 Shop Drawings														
			Framing Components	1.6.1	G												
			SD-03 Product Data														
			Studs, Joists	2.1													
			Recycled Content of Steel Products	2.1	S												
			SD-05 Design Data														
			Metal Framing Calculations	1.6.2	G												
			SD-07 Certificates														
			Load-Bearing Cold-Formed Metal Framing	1.4													
			Welds	3.2.1													
		05 50 13	SD-02 Shop Drawings														
			Structural Steel Door Frames	2.8	G												
			Structural Steel Door Frames	2.8	G												
			Bollards/Pipe Guards	2.5	G												
			Metal Canopies	2.9	G												

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		05 50 13	Downspout Terminations	2.6	G												
			Recycled Content	2.1	S												
			Certificates of Compliance	2.1	G												
			Certified Mill	2.2	G												
		05 51 00	SD-02 Shop Drawings														
			Iron and Steel Hardware	2.1	G												
			Steel Shapes, Plates, Bars, and Strips	2.1	G												
			Metal Stair System	2.2.1	G												
			SD-03 Product Data														
			Structural-Steel Plates, Shapes, and Bars	2.4.1	G												
			Structural-Steel Tubing	2.4.2	G												
			Hot-Rolled Carbon Steel Bars	2.4.3	G												
			Cold-Rolled Carbon Steel Sheets	2.4.4	G												
			Galvanized Carbon Steel Sheets	2.4.5	G												
			Gray Iron Castings	2.4.6	G												
			Malleable Iron Castings	2.4.7	G												
			Concrete Inserts	2.3.3	G												
			Masonry Anchorage Devices	2.3.4	G												
			Protective Coating	2.2.3	G												
			Steel Pan Stairs	2.2.2	G												
			Steel Stairs	2.3.1	G												
			SD-07 Certificates														
			Welding Procedures	1.3.1	G												
			Welder Qualification	1.3.1	G												

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		05 51 00	SD-08 Manufacturer's Instructions														
			Structural-Steel Plates, Shapes, and Bars	2.4.1	G												
			Structural-Steel Tubing	2.4.2	G												
			Hot-Rolled Carbon Steel Bars	2.4.3	G												
			Cold-Rolled Carbon Steel Sheets	2.4.4	G												
			Galvanized Carbon Steel Sheets	2.4.5	G												
			Gray Iron Castings	2.4.6	G												
			Malleable Iron Castings	2.4.7	G												
			Protective Coating	2.2.3	G												
			Masonry Anchorage Devices	2.3.4	G												
		05 52 00	SD-02 Shop Drawings														
			Fabrication Drawings	1.2.1	G												
			Steel Shapes, Plates, Bars and Strips	3.2	G												
			SD-03 Product Data														
			Structural-Steel Plates, Shapes, and Bars	2.2.1	G												
			Structural-Steel Tubing	2.2.2	G												
			Steel Railings and Handrails	2.2.5	G												
			Anchorage and Fastening Systems	1.2.1	G												
			SD-07 Certificates														
			Welding Procedures	1.4.1	G												
			Welder Qualification	1.4.2	G												
			SD-08 Manufacturer's Instructions														

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		05 52 00	Installation Instructions	3.2													
		06 10 00	SD-02 Shop Drawings														
			Nailing Strips	2.2.1	G												
			SD-03 Product Data														
			Adhesives	2.4.4													
			SD-06 Test Reports														
			Preservative-treated	1.4.3													
			SD-07 Certificates														
			Certificates of Grade	1.10.1													
			Certified Sustainably Harvested	2.1.1	S												
			Virgin Lumber														
			Preservative Treatment	1.7													
			Indoor Air Quality for Aerosol	2.4.4	S												
			Adhesives														
			Indoor Air Quality for Non-aerosol	2.4.4	S												
			Adhesives														
			SD-10 Operation and Maintenance														
			Data														
			Take-back Program	3.5													
		06 20 00	SD-02 Shop Drawings														
			Detail Drawings Indicating All	1.3	G												
			Wood Assemblies														
			SD-03 Product Data														
			Wood Products	2.1	G												
			Fascias and Trim	2.2	G												
			Hardware and Accessories	2.5	G												

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		06 20 00	SD-07 Certificates														
			Certificates of Grade	1.7.1.1	G												
			Certified Sustainably Harvested	2.1.3	S												
			Wood for Trim and Frames														
			Certified Sustainably Harvested	2.1.5	S												
			Softwood Plywood														
			Certified Sustainably Harvested	2.1.6	S												
			Hardwood Plywood														
			Certified Sustainably Harvested	2.1.7	S												
			Hardboard														
			Indoor Air Quality for Hardwood	2.1.6	S												
			Plywood														
		06 41 16.00 10	SD-02 Shop Drawings														
			Shop Drawings	2.9													
			Installation	3.1													
			SD-03 Product Data														
			Wood Materials	2.1													
			Finish Schedule	2.9.8.3													
			Certification	1.5.2													
			SD-07 Certificates														
			Quality Assurance	1.5													
			Laminate Clad Casework	3.1													
			SD-11 Closeout Submittals														
			LEED Documentation	1.3													
		06 61 16	SD-02 Shop Drawings														
			Detail Drawings	1.5.2	G												

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		06 61 16	Installation	3.1	G												
			SD-03 Product Data														
			Solid Polymer Material	2.1													
			Qualifications	1.5.1													
			Fabrications	2.3													
			Certification	1.5.3													
			VOC Content	1.5.3													
			SD-04 Samples														
			Material	2.1	G												
			Counter and Vanity Tops	2.3.5	G												
			Window Stools	2.3.4	G												
			SD-06 Test Reports														
			Solid Polymer Material	2.1													
			SD-07 Certificates														
			Fabrications	2.3													
			Qualifications	1.5.1													
			SD-10 Operation and Maintenance														
			Data														
			Clean-up	3.2													
			SD-11 Closeout Submittals														
			LEED Documentation	1.3													
		07 05 23	SD-01 Preconstruction Submittals														
			Work Plan	1.4	G												
			SD-03 Product Data														
			Thermal Imaging Camera	2.2	G												
			SD-05 Design Data														

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		07 05 23	Envelope Surface Area Calculations	3.2	G												
			SD-07 Certificates														
			Pressure Test Agency	1.6.2.1													
			Thermographer Qualifications	1.6.2.2													
			Test Instruments	1.6.3													
			Date Of Last Calibration	1.6.3													
			SD-06 Test Reports														
			Pressure Test Procedures	3.5	G												
			Air Leakage Test Report	3.5.8	G												
			Diagnostic Test Report	3.6.5	G												
		07 21 13	SD-03 Product Data														
			Block or Board Insulation	2.1	G												
			Protection Board or Coatings	1.4	G												
			Accessories	2.3	G												
			SD-07 Certificates														
			Block or Board Insulation	2.1	G												
			Protection Board or Coating	2.2	G												
			Protection Board or Coating	3.4.5	G												
			Special Warranties	1.8	G												
			Special Warranties	1.8	G												
			SD-08 Manufacturer's Instructions														
			Block or Board Insulation	2.1													
			Adhesive	2.3.1													
			SD-11 Closeout Submittals														

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		07 21 13	Recycled Content for Block or Board Insulation	2.1.4	S												
			Indoor Air Quality For Block Or Board Insulation	2.1.5	S												
		07 21 16	SD-03 Product Data														
			Blanket Insulation	2.1													
			Recycled Content for Insulation Materials	2.1.2	S												
			Sill Sealer Insulation	2.2													
			Vapor Retarder	2.4													
			Pressure Sensitive Tape	2.5													
			Accessories	2.6													
			SD-07 Certificates														
			Indoor Air Quality for Insulation Materials	2.1.4	S												
			Indoor Air Quality for Adhesives	2.6.1	S												
			SD-08 Manufacturer's Instructions														
			Insulation	3.3.1													
			SD-11 Closeout Submittals														
			Recycled Content for Insulation Materials	2.1.2	S												
		07 24 00	SD-02 Shop Drawings														
			Shop Drawings	3.3	G												
			SD-03 Product Data														
			Sheathing Board	2.2													
			Thermal Insulation	2.5													

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		07 24 00	Adhesive	2.3													
			Mechanical Fasteners	2.4													
			Accessories	2.11													
			Base Coat	2.6													
			Portland Cement	2.7													
			Reinforcing Fabric	2.8													
			Finish Coat	2.9													
			Joint Sealant	2.12													
			Sealant Primer	2.10													
			Bond Breaker	2.13													
			Backer Rod	2.14													
			Insulation Board	1.4.5													
			Recycled Content for Insulation Materials	2.5.2	S												
			Warranty	1.7													
			SD-04 Samples														
			Sample Boards	1.2.3.7	G												
			Mock-up Installation of EIFS	1.2.1.4	G												
			SD-05 Design Data														
			Wind Load	1.2.1.2													
			Moisture Analysis	1.2.4													
			SD-06 Test Reports														
			Abrasion Resistance	1.2.3.1													
			Accelerated Weathering	1.2.3.2													
			Impact Resistance	1.2.2.3													
			Mildew Resistance	1.2.3.3													

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		07 24 00	Salt Spray Resistance	1.2.3.4													
			Vapor Transmission	1.2.4													
			Absorption-Freeze-Thaw	1.2.3.6													
			Wall Fire Test	1.2.1.3													
			Water Penetration	1.2.1.1													
			Water Resistance	1.2.3.5													
			Full Scale or Intermediate Scale Fire Test	1.2.1.3													
			Surface Burning Characteristics	1.2.2.1													
			Radiant Heat	1.2.2.2													
			Substrate	3.1													
			Wind Load	1.2.1.2													
			SD-07 Certificates														
			Qualifications of EIFS Manufacturer	1.4.1													
			Qualification of EIFS Installer	1.4.2													
			Qualification of Sealant Applicator	1.4.3													
			Qualifications of Third Party Inspector	1.4.4													
			Inspection Check List	3.5.1	G												
			SD-08 Manufacturer's Instructions														
			Installation	3.3													
			SD-10 Operation and Maintenance Data														
			EIFS	1.7													
		07 27 10.00 10	SD-06 Test Reports														

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		07 27 10.00 10	Design Review Report	1.8	G DO												
			Testing and Inspection	3.1.2	G RO												
			SD-07 Certificates														
			Air Barrier Inspector	1.7	G RO												
		07 27 19.01	SD-01 Preconstruction Submittals														
			Qualifications of Manufacturer	1.8.1	G												
			Qualifications of Installer	1.8.2	G												
			SD-02 Shop Drawings														
			Self-adhering Air Barrier	1.4	G												
			SD-03 Product Data														
			Self-adhering Air Barrier	1.4	G												
			Primers and Adhesives	2.3	G												
			Safety Data Sheets	1.4.2	G												
			SD-04 Samples														
			Self-adhering Air Barrier	1.4	G												
			SD-06 Test Reports														
			Field Peel Adhesion Test	1.6	G												
			Flame Propagation of Wall	1.4.4	G												
			Assemblies														
			Flame Spread and Smoke	1.4.4	G												
			Developed Index Ratings														
			Site Inspections and Testing	3.4.1	G												
			SD-07 Certificates														
			Self-adhering Air Barrier	1.4	G												
			Qualifications of Manufacturer	1.8.1	G												
			Qualifications of Installer	1.8.2	G												

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		07 27 19.01	SD-08 Manufacturer's Instructions														
			Self-adhering Air Barrier	1.4	G												
			Primers and Adhesives	2.3	G												
			SD-11 Closeout Submittals														
			Volatile Organic Compound (VOC) Content	2.1	S												
		07 27 26	SD-01 Preconstruction Submittals														
			Qualifications of Manufacturer	1.8.1	G												
			Qualifications of Installer	1.8.2	G												
			SD-02 Shop Drawings														
			Fluid-Applied Membrane Air Barrier	1.4	G												
			SD-03 Product Data														
			Fluid-Applied Membrane Air Barrier	1.4	G												
			Transition Membrane	2.3	G												
			Primers, Adhesives, and Mastics	2.2	G												
			Reinforcement	2.6	G												
			Safety Data Sheets	1.4.2	G												
			SD-06 Test Reports														
			Field Peel Adhesion Test	1.4.3	G												
			Flame Propagation of Wall Assemblies	1.4.3	G												
			Flame Spread and Smoke Developed Index Ratings	1.4.3	G												
			Site Inspections	3.4.1	G												

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		07 27 26	SD-07 Certificates														
			Fluid-Applied Membrane Air Barrier	1.4	G												
			Transition Membrane	2.3	G												
			Qualifications of Manufacturer	1.8.1	G												
			Qualifications of Installer	1.8.2	G												
			SD-08 Manufacturer's Instructions														
			Fluid-Applied Membrane Air Barrier	1.4	G												
			Transition Membrane	2.3	G												
			Primers, Adhesives, and Mastics	2.2	G												
		07 60 00	SD-02 Shop Drawings														
			Exposed Sheet Metal	2.2.1	G												
			Gutters	3.1.15	G												
			Downspouts	3.1.16	G												
			Expansion Joints	3.1.19	G												
			Base Flashing	3.1.11	G												
			Counterflashing	3.1.12	G												
			Flashing at Roof Penetrations and Equipment Supports	3.1.20	G												
			Drip Edges	3.1.14	G												
			Open Valley Flashing	3.1.17	G												
			Eave Flashing	3.1.18	G												
			Recycled Content	2.1	S												
			SD-04 Samples														
			Finish Samples	1.4.2	G												

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		07 60 00	SD-08 Manufacturer's Instructions														
			Instructions for Installation	1.4.3	G												
			Quality Control Plan	3.5	G												
			SD-10 Operation and Maintenance														
			Data														
			Cleaning and Maintenance	1.4.3	G												
		07 61 14.00 20	SD-02 Shop Drawings														
			Roofing	1.2.5	G												
			SD-03 Product Data														
			Roofing Panels	2.1	G												
			Recycled Content for Steel	2.1.1	S												
			Roofing Product														
			Attachment Clips	2.3													
			Closures	2.4.1													
			Accessories	2.4													
			Fasteners	2.4.2													
			Sealants	2.4.3													
			Warranty	1.7	G												
			SD-04 Samples														
			Panel	2.1													
			Accessories	2.4													
			Sealants	2.4.3													
			Intermediate Support	2.2													
			SD-05 Design Data														
			Design Calculations	1.5													
			SD-06 Test Reports														

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		07 61 14.00 20	Field Inspection	3.6													
			Structural Performance	1.3.3													
			Finish	1.6.6													
			SD-07 Certificates														
			Manufacturer's Technical	1.6.3													
			Representative														
			Installer's Qualifications	1.6.4													
			Coil Stock	2.1	G												
			SD-08 Manufacturer's Instructions														
			Installation	3.3	G												
			SD-11 Closeout Submittals														
			Information Card	3.8													
			Warranty	1.7													
		07 81 00	SD-03 Product Data														
			Fireproofing Material	3.3	G												
			SD-06 Test Reports														
			Fire Resistance Rating	1.2.2	G												
			SD-07 Certificates														
			Installer Qualifications	1.4.1	G												
			Surface Preparation Report	3.1	G												
			Manufacturer's Inspection Report	3.5.2	G												
		07 84 00	SD-02 Shop Drawings														
			Firestopping System	2.1	G												
			SD-03 Product Data														
			Firestopping Materials	2.2	G												
			SD-06 Test Reports														

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		07 84 00	Inspection	3.3	G												
			SD-07 Certificates														
			Inspector Qualifications	1.5.2													
			Firestopping Materials	2.2													
			Installer Qualifications	1.5.1	G												
		07 92 00	SD-03 Product Data														
			Sealants	2.1	G												
			Primers	2.2	G												
			Bond Breakers	2.3	G												
			Backstops	2.4	G												
			Field Adhesion	3.1	G												
			SD-07 Certificates														
			Indoor Air Quality For Interior	2.1.1	S												
			Sealants														
			Indoor Air Quality For Interior	2.1.3	S												
			Floor Joint Sealants														
			Indoor Air Quality For Interior	2.1.4	S												
			Acoustical Sealants														
		08 11 13	SD-02 Shop Drawings														
			Doors	2.1	G												
			Doors	2.1	G												
			Recycled Content for Steel Door	2.1	S												
			Product														
			Frames	2.7	G												
			Frames	2.7	G												

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		08 11 13	Recycled Content for Steel Frame Product	2.7	S												
			Accessories	2.5													
			Weatherstripping	2.9													
			SD-03 Product Data														
			Doors	2.1	G												
			Frames	2.7	G												
			Accessories	2.5													
			Weatherstripping	2.9													
		08 11 16	SD-02 Shop Drawings														
			Door and Frame Assembly	1.5.1	G												
			SD-04 Samples														
			Finish Samples	1.5.2	G												
			SD-05 Design Data														
			Design Analysis	1.5.3	G												
			Calculations	1.2.1	G												
			Air Infiltration	1.2.2	G												
			Water Penetration	1.2.3	G												
			Standard Airblast	1.2.1.1	G												
			NFRC Project Label Certificates for Fenestration	1.2.4	G												
			SD-08 Manufacturer's Instructions														
			Door and Frame Assembly	1.5.1	G												
			Adjustments, Cleaning, and Maintenance	1.5.5	G												

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		08 11 16	NFRC Project Label Certificates for Fenestration	1.2.4	G												
		08 14 00	SD-02 Shop Drawings														
			Doors	2.1	G												
			SD-03 Product Data														
			Doors	2.1	G												
			Recycled Content for Door Cores	2.1.1.1	S												
			Accessories	2.2													
			Warranty	1.5													
			Sound Transmission Class	2.1.2	G												
			Rating														
			SD-04 Samples														
			Doors	2.1													
			Door Finish Colors	2.3.6.2	G												
			SD-06 Test Reports														
			Cycle-Slam	2.4													
			Hinge Loading Resistance	2.4													
			SD-07 Certificates														
			Certificates of Grade	1.3.1													
			Certified Sustainably Harvested	2.1.1	S												
			Flush Wood Doors														
			Indoor Air Quality for	2.1.1.1	S												
			Particleboard and Agrifiber Door														
			Cores														
			SD-11 Closeout Submittals														
			Warranty	1.5													

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		08 33 23	SD-02 Shop Drawings														
			Overhead Coiling Doors	2.2.1	G												
			Counterbalancing Mechanism	2.2.3	G												
			Manual Door Operators	2.2.4	G												
			Electric Door Operators	2.2.5	G												
			Bottom Bars	2.2.1.2	G												
			Guides	2.1.1.1	G												
			Mounting Brackets	2.2.3.1	G												
			Overhead Drum	2.2.1.7	G												
			Hood	3.3.2	G												
			Installation Drawings	2.1.1.1	G												
			SD-03 Product Data														
			Overhead Coiling Doors	2.2.1	G												
			Hardware	2.2.2	G												
			Counterbalancing Mechanism	2.2.3	G												
			Manual Door Operators	2.2.4	G												
			Electric Door Operators	2.2.5	G												
			SD-05 Design Data														
			Overhead Coiling Doors	2.2.1	G												
			Hardware	2.2.2	G												
			Counterbalancing Mechanism	2.2.3	G												
			Manual Door Operators	2.2.4	G												
			Electric Door Operators	2.2.5	G												
			SD-10 Operation and Maintenance Data														

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		08 33 23	Operation and Maintenance Manuals	3.3.2	G												
			Devices	3.3.2	G												
			Procedures	3.3.2	G												
			Manufacture's Brochures	3.3.2	G												
			Parts Lists	3.3.2	G												
			SD-11 Closeout Submittals														
			Warranty	3.3.1	G												
		08 34 59	SD-02 Shop Drawings														
			Vault Door Unit	2.1	G												
			Day Gate	2.3	G												
			SD-03 Product Data														
			Vault Door and Frame	2.2													
			SD-07 Certificates														
			Vault Door and Frame	2.2													
			SD-08 Manufacturer's Instructions														
			Installation	3.1													
			SD-11 Closeout Submittals														
			LEED Documentation	1.2													
		08 34 73	SD-02 Shop Drawings														
			Hollow Metal Sound Retardant Doors	2.1	G												
			Wood Sound Retardant Doors	2.1	G												
			Door Frames	2.1	G												
			SD-03 Product Data														

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		08 34 73	Hollow Metal Sound Retardant Doors	2.1	G												
			Wood Sound Retardant Doors	2.1	G												
			Door Frames	2.1	G												
			Door Hardware	2.1	G												
			Thresholds	2.1	G												
			SD-06 Test Reports														
			Wind Loading Tests	2.4.4	G												
			Water Leakage Tests	2.4.4	G												
			Acoustical Tests	2.4.4	G												
			Air Infiltration Tests	2.4.4	G												
			Positive Pressure Tests	2.4.4	G												
			SD-07 Certificates														
			Hollow Metal Sound Retardant Doors	2.1	G												
			Wood Sound Retardant Doors	2.1	G												
			Door Frames	2.1	G												
			Door Hardware	2.1	G												
			Intumescent Seals, Gasketing and Door Bottoms	1.3.1.2	G												
			Thresholds	2.1	G												
		08 44 00	SD-02 Shop Drawings														
			Glazed Curtain Wall System	1.5													
			Installation Drawings	1.12													
			SD-03 Product Data														
			Glazed Curtain Wall System	1.5													

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		08 44 00	Preventive Maintenance and Inspection	1.13													
			Metals For Fabrication	2.2													
			Nonskinning Sealing Compound	2.3													
			Metal Accessories	2.4.1													
			Curtain-Wall Framing Members	2.5													
			Aluminum Doors and Frames	2.6													
			Curtain Wall Frame	2.7.1													
			Sealants and Caulkings	2.10													
			Curtain-Wall Installation Materials	2.11													
			Masonry Anchorage Devices	2.11.1													
			Warranties	1.8.1													
			Warranties	1.8.1													
			SD-05 Design Data														
			Calculations	1.3													
			Finish	2.4.3													
			Exposed-to-View Aluminum Finish	2.4.3													
			Seismic Calculations	1.5.6													
			SD-08 Manufacturer's Instructions														
			Glazed Curtain Wall System	1.5													
			SD-11 Closeout Submittals														
			Warranty	1.8													
		08 51 13	SD-02 Shop Drawings														
			Windows	2.1	G												
			Fabrication Drawings	1.10													

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		08 51 13	SD-03 Product Data														
			Windows	2.1	G												
			Hardware	2.2.7.1	G												
			Fasteners	2.2.3	G												
			Window performance	1.11	G												
			Mullions	2.3	G												
			Weatherstripping	2.2.2	G												
			Accessories	2.2.7	G												
			Adhesives	2.2.4													
			Thermal performance	1.11.5													
			Local/Regional Materials	1.7.1													
			SD-04 Samples														
			Finish Sample	1.4.2.1													
			Window Sample	1.4.2.2													
			SD-05 Design Data														
			Structural calculations for deflection	2.1	G												
			Design Analysis	1.4.3	G												
			SD-06 Test Reports														
			Minimum condensation resistance factor	1.4.4													
			Standard Airblast Test	1.11.2.3													
			SD-10 Operation and Maintenance Data														
			Windows	2.1	G												
			Plastic Identification	1.7.2													

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		08 71 00	SD-02 Shop Drawings														
			Manufacturer's Detail Drawings	1.3	G												
			Verification of Existing Conditions	1.3	G												
			Hardware Schedule	1.5	G												
			Keying System	2.4.11	G												
			SD-03 Product Data														
			Hardware Items	2.3	G												
			SD-08 Manufacturer's Instructions														
			Installation	3.1													
			SD-10 Operation and Maintenance Data														
			Hardware Schedule	1.5	G												
			SD-11 Closeout Submittals														
			Key Bitting	1.6.1													
		08 81 00	SD-02 Shop Drawings														
			Installation	3.3													
			SD-03 Product Data														
			Insulating Glass	1.6.1													
			Glazing Accessories	1.3													
			SD-04 Samples														
			Insulating Glass	1.6.1													
			Glazing Compound	2.3.2													
			Sealant	2.3.3.1													
			SD-07 Certificates														
			Insulating Glass	1.6.1													
			SD-08 Manufacturer's Instructions														

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		08 81 00	Setting and Sealing Materials	2.3													
			Glass Setting	3.2													
		08 91 00	SD-02 Shop Drawings														
			Wall louvers	1.4													
			Wall louvers	1.5													
			SD-03 Product Data														
			Metal Wall Louvers	2.2													
			SD-04 Samples														
			Wall louvers	1.4	G												
			Wall louvers	1.5	G												
		09 22 00	SD-02 Shop Drawings														
			Metal Support Systems	2.1	G												
			SD-03 Product Data														
			Metal Support Systems	2.1													
			Recycled Content for Metal	2.1	S												
			Support Systems														
		09 29 00	SD-03 Product Data														
			Cementitious Backer Units	2.1.6													
			Glass Mat Covered or Reinforced	2.1.3													
			Gypsum Sheathing														
			Glass Mat Covered or Reinforced	2.1.3.1													
			Gypsum Sheathing Sealant														
			Acoustically Enhanced Gypsum	2.1.4													
			Board														
			Abuse Resistant Gypsum Board	2.1.5													
			Accessories	2.1.9													

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		09 29 00	Gypsum Board	2.1.1													
			Recycled Content for Gypsum Board	2.1.1	S												
			Recycled Content for Paper Facing and Gypsum Cores	2.1.1	S												
			VOC Content of Joint Compound	2.1.7	S												
			SD-07 Certificates														
			Asbestos Free Materials	2.1	G												
			Indoor Air Quality for Gypsum Board	2.1.1	S												
		09 30 10	SD-02 Shop Drawings														
			Detail Drawings	3.2	G												
			SD-03 Product Data														
			Porcelain Tile	2.1.1	G												
			Glazed Wall Tile	2.1.2	G												
			Setting-Bed	2.2	G												
			Mortar, Grout, and Adhesive	2.4	G												
			SD-04 Samples														
			Tile	2.1	G												
			Accessories	2.1	G												
			Transition Strips	2.1	G												
			Transition Strips	2.6	G												
			Grout	2.4.3	G												
			SD-07 Certificates														
			Indoor Air Quality	1.3.1													
			SD-08 Manufacturer's Instructions														

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		09 30 10	Maintenance Instructions	3.7													
			SD-10 Operation and Maintenance Data														
			Installation	3.2	G												
			SD-11 Closeout Submittals														
			Recycled Content for Porcelain Tile	2.1.1	S												
			Recycled Content for Glazed Wall Tile	2.1.2	S												
			Indoor Air Quality for Adhesives	2.4	S												
			Indoor Air Quality for Sealants	2.4.7	S												
		09 51 00	SD-02 Shop Drawings														
			Approved Detail Drawings	2.1	G												
			SD-03 Product Data														
			Certifications	1.3	G												
			SD-04 Samples														
			Acoustical Units	2.2	G												
			SD-06 Test Reports														
			Ceiling Attenuation Class and Test	2.1.1	G												
			SD-07 Certificates														
			Indoor Air Quality	1.3.1													
			SD-11 Closeout Submittals														
			Recycled Content for Type IV Ceiling Tiles	2.2.1.1	S												

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		09 51 00	Indoor Air Quality for Type IV Ceiling Tiles	2.2.1.1	S												
		09 62 38	SD-03 Product Data														
			Static-Control Resilient Flooring Warranty	2.1 1.9	G												
			SD-04 Samples														
			Static-Control Resilient Flooring Moldings	2.1 2.2	G G												
			SD-06 Test Reports														
			Fire Resistance	2.5													
			Moisture, Alkalinity and Bond Testing	3.2 3.6													
			SD-07 Certificates														
			Indoor Air Quality	1.4.1													
			Qualifications of Applicator	1.6													
			SD-08 Manufacturer's Instructions														
			Static-Control Resilient Flooring	2.1	G												
			SD-10 Operation and Maintenance Data														
			Static-Control Resilient Flooring	2.1	G												
			SD-11 Closeout Submittals														
			Recycled content for Static-Dissipative Vinyl Tile	2.1.1	S												
			Indoor Air Quality for Static-Dissipative Vinyl Tile	2.1.1	S												
		09 65 00	SD-02 Shop Drawings														

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		09 65 00	Resilient Flooring and Accessories	2.8	G												
			SD-03 Product Data														
			Resilient Flooring and Accessories	2.8	G												
			Adhesives	2.4													
			Vinyl Composition Tile	2.1													
			Wall Base	2.2													
			Local/Regional Materials	1.2.3													
			Environmental Data	1.2.1													
			SD-04 Samples														
			Resilient Flooring and Accessories	2.8	G												
			SD-06 Test Reports														
			Moisture, Alkalinity and Bond Tests	3.3	G												
			SD-08 Manufacturer's Instructions														
			Surface Preparation	3.2	G												
			Installation	3.1	G												
			SD-10 Operation and Maintenance Data														
			Resilient Flooring and Accessories	2.8	G												
			SD-11 Closeout Submittals														
			LEED Documentation	1.3													
		09 65 66	SD-02 Shop Drawings														

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		09 65 66	Approved Detail Drawings	1.3.1	G												
			SD-03 Product Data														
			Installation	3.3													
			Indoor Air Quality for Rubber Sports Mat	2.1.1													
			SD-04 Samples														
			Flooring	1.3.7													
			SD-06 Test Reports														
			Laboratory Test Results	1.3.4													
			SD-07 Certificates														
			Indoor Air Quality for Rubber Sports Mat	2.1.1													
			SD-11 Closeout Submittals														
			Warranty	1.6													
		09 68 00	SD-02 Shop Drawings														
			Installation Drawings	3.4	G												
			Moldings	2.5	G												
			SD-03 Product Data														
			Carpet	2.2	G												
			Moldings	2.5	G												
			Physical Characteristics	2.2.2													
			SD-04 Samples														
			Carpet	2.2	G												
			Moldings	2.5	G												
			SD-06 Test Reports														
			Moisture and Alkalinity Tests	3.2	G												

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		09 68 00	SD-07 Certificates														
			Indoor Air Quality	1.3.1													
			SD-08 Manufacturer's Instructions														
			Surface Preparation	3.1													
			Installation	3.4													
			SD-10 Operation and Maintenance														
			Data														
			Carpet	2.2	G												
			Cleaning and Protection	3.5	G												
			Maintenance Service	3.7.2													
			SD-11 Closeout Submittals														
			Recycled Content for Carpeting	2.1.1	S												
			Recycled Content for Carpeting	2.2.1	S												
			Indoor Air Quality for Carpet	2.2.1	S												
			Indoor Air Quality for Non-Aerosol	2.4	S												
			Adhesives														
			Indoor Air Quality for Concrete	2.4	S												
			Primer														
			Warranty	1.6													
		09 68 13	SD-01 Preconstruction Submittals														
			Flooring	1.4	G												
			Proposed Substitutions	1.4	G												
			SD-03 Product Data														
			Warranties	1.5	G												
			Installation Instructions	3.3	G												
			Maintenance	3.5	G												

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		09 68 13	SD-06 Test Reports														
			Flammability	1.4	G												
			Other Testing Requirements	1.4	G												
		09 69 13	SD-02 Shop Drawings														
			Detailed Installation Drawings	2.2.2	G												
			SD-03 Product Data														
			Access Flooring System	2.1	G												
			Access Flooring System	2.5	G												
			Recycled Content of Access Flooring System	2.1.1	S												
			Indoor Air Quality For Pedestal Adhesive	2.1.5	S												
			SD-04 Samples														
			Floor Panels	2.2													
			Floor Covering	2.2.4	G												
			Panel Support System	2.3													
			Fascia	2.4	G												
			Steps and Ramps	2.5	G												
			Railings	2.6	G												
			SD-05 Design Data														
			Seismic Calculations	2.1.7													
			SD-06 Test Reports														
			Factory Tests	2.7													
			Electrical Resistance	3.2.2													
			Field Tests	3.2													
			SD-07 Certificates														

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		09 69 13	Compliance with ICC-ES AC300	2.1													
			Compliance with ICC IBC	2.1													
			Certificate of Compliance	2.1													
			Qualification of Manufacturer	1.4.1													
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Manuals	3.4	G												
			SD-11 Closeout Submittals														
			Lifting Device	2.2.7													
			Warranty	1.6													
		09 90 00	SD-03 Product Data														
			Coating	2.1	G DA												
			Manufacturer's Technical Data Sheets	2.1													
			SD-04 Samples														
			Color	1.10	G DA												
			SD-07 Certificates														
			Applicator's qualifications	1.3													
			SD-08 Manufacturer's Instructions														
			Application instructions	3.2.1													
			Mixing	3.6.2													
			Manufacturer's Material Safety Data Sheets	1.7.2													
			SD-10 Operation and Maintenance Data														

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		09 90 00	Coatings:	2.1	G DA												
		10 11 00	SD-03 Product Data														
			Visual Display Board	1.2	G												
			Projection Screen	2.4	G												
			SD-04 Samples														
			Aluminum	2.1.3	G												
			Porcelain Enamel	2.1.1	G												
			Materials	2.1	G												
			SD-07 Certificates														
			Indoor Air Quality	1.4.1													
			SD-11 Closeout Submittals														
			Indoor air quality for markerboards	2.2	S												
			Indoor air quality for tackboards	2.3	S												
			Indoor air quality for projection screen	2.4	S												
		10 14 00.10	SD-02 Shop Drawings														
			Approved Detail Drawings	3.1	G												
			SD-03 Product Data														
			Installation	3.1													
			Exterior Signage	1.2	G												
			Wind Load Requirements	1.2.1													
			SD-04 Samples														
			Exterior Signage	1.2	G												
			SD-10 Operation and Maintenance Data														

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		10 14 00.10	Protection and Cleaning	3.1.2	G												
		10 14 00.20	SD-02 Shop Drawings														
			Detail Drawings	1.4.2	G												
			SD-03 Product Data														
			Installation	3.1	G												
			Warranty	1.6	G												
			SD-04 Samples														
			Interior Signage	1.4.1	G												
			Software	1.3	G												
			SD-10 Operation and Maintenance														
			Data														
			Approved Manufacturer's	3.1	G												
			Instructions														
			Protection and Cleaning	3.1.2	G												
		10 21 13	SD-02 Shop Drawings														
			Fabrication Drawings	2.1													
			SD-03 Product Data														
			Cleaning and Maintenance	2.1													
			Instructions														
			Colors And Finishes	2.8													
			Galvanized Steel Sheet	2.2.1													
			Anchoring Devices and Fasteners	2.2.2													
			Hardware and Fittings	2.2.4													
			Brackets	2.2.3													
			Door Hardware	2.2.5													
			Pilaster Shoes	2.6													

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		10 21 13	Finishes	2.2.4.2	G												
			Recycled content for plastic, solid polyethylene partitions and screens	2.3	S												
			SD-04 Samples														
			Colors and Finishes	2.8	G												
			Hardware and Fittings	2.2.4													
			Anchoring Devices and Fasteners	2.2.2													
			SD-07 Certificates														
			Warranty	1.6													
		10 22 39	SD-01 Preconstruction Submittals														
			Manufacturer's Qualifications	2.1	G												
			Manufacturer's Sample Warranty	2.1													
			Statement of Code Compliance	2.1	G												
			Statement of Standards	2.1	G												
			Conformity														
			Verification of Field Measurements	2.1	G												
			SD-02 Shop Drawings														
			Installation	3.1	G												
			Layouts	3.1.1	G												
			Fabrication Drawings	2.1	G												
			SD-03 Product Data														
			Folding Panel Partitions	2.3	G												
			Installation Instructions	2.1	G												

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		10 22 39	Recycled Content For Steel Components	2.3.1													
			SD-04 Samples														
			Folding Panel Partitions	2.3	G												
			SD-06 Test Reports														
			Flame and Smoke Development Tests	2.1.2.1	G												
			SD-07 Certificates														
			Materials	2.2													
			Folding Panel Partitions	2.3													
			SD-10 Operation and Maintenance Data														
			Folding Panel Partitions	2.3													
		10 26 00	SD-02 Shop Drawings														
			Corner Guards	2.2	G												
			Wall Guards	2.1	G												
			Wall Guards	2.2	G												
			SD-03 Product Data														
			Corner Guards	2.2	G												
			Wall Guards	2.1	G												
			Wall Guards	2.2	G												
			SD-04 Samples														
			Finish	2.4	G												
			SD-06 Test Reports														
			Corner Guards	2.2													
			Wall Guards	2.1													

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		10 26 00	Wall Guards	2.2													
			SD-07 Certificates														
			Corner Guards	2.2													
			Wall Guards	2.1													
			Wall Guards	2.2													
			SD-11 Closeout Submittals														
			Recycled content for aluminum	2.2.1	S												
			component of corner guardsand														
			wall guards														
		10 28 13	SD-03 Product Data														
			Finishes	2.1.2	G												
			Accessory Items	2.2	G												
			Recycled content for stainless	2.1	S												
			steel toilet accessories														
			SD-04 Samples														
			Finishes	2.1.2	G												
			Accessory Items	2.2													
			SD-07 Certificates														
			Accessory Items	2.2													
		10 51 26	SD-02 Shop Drawings														
			locker dimensions	2.2	G												
			SD-03 Product Data														
			Warranty	1.5	G												
			SD-04 Samples														
			materials	2.1	G												
			materials	2.3	G												

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		10 51 26	SD-08 Manufacturer's Instructions														
			Installation	3.1	G												
		12 24 13	SD-02 Shop Drawings														
			Installation	3.2	G												
			SD-03 Product Data														
			Window Shades	2.1	G												
			SD-04 Samples														
			Window Shades	2.1	G												
			SD-06 Test Reports														
			Window Shades	2.1													
			SD-08 Manufacturer's Instructions														
			Window Shades	2.1													
			SD-10 Operation and Maintenance														
			Data														
			Window Shades	2.1													
			SD-11 Closeout Submittals														
			Warranty	1.6	G												
		12 48 13	SD-02 Shop Drawings														
			Installation Drawings	3.2	G												
			Detail Drawings	3.2	G												
			SD-03 Product Data														
			Entrance Floor Mats and Frames	2.1	G												
			Adhesives and Concrete Primers	2.2	G												
			SD-04 Samples														
			Entrance Floor Mats and Frames	2.1	G												
			SD-08 Manufacturer's Instructions														

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		12 48 13	Manufacturer's Instructions	3.2	G												
			SD-10 Operation and Maintenance														
			Data														
			Protection, Maintenance, and	3.2	G												
			Repair Information														
		13 48 00	SD-02 Shop Drawings														
			Bracing	3.1	G												
			SD-03 Product Data														
			Bracing	3.1	G												
		14 24 23	SD-02 Shop Drawings														
			Elevator	2.1	G												
			Wiring Diagrams	1.3.4	G												
			SD-03 Product Data														
			Elevator	2.1	G												
			Elevator Components	1.2.1	G												
			Elevator Components	1.2.2	G												
			Data Sheets	1.2.2	G												
			SD-05 Design Data														
			Heat Loads	1.2.3.2													
			Reaction Loads	1.2.3.1													
			SD-07 Certificates														
			Price Lists	1.3.2	G												
			Warranty	1.4													
			Endorsement Letter	1.3.1.1													
			Welders' Qualifications	1.2.4													
			Elevator Controller Certification	2.5.2.3	G												

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		14 24 23	SD-10 Operation and Maintenance Data														
			Elevator	2.1	G												
			Maintenance Control Program (MCP)	1.2.5	G												
			Software and Documentation	2.5.2.2	G												
		21 13 13.00 10	SD-02 Shop Drawings														
			Shop Drawings	1.4.3	G AE												
			As-Built Drawings	3.9													
			SD-03 Product Data														
			Fire Protection Related Submittals	1.4.1													
			Materials and Equipment	2.3	G AE												
			Spare Parts	1.6													
			Preliminary Tests	3.8	G AE												
			Final Acceptance Test	3.9	G AE												
			Onsite Training	3.10	G AE												
			Fire Protection Specialist	1.4.1	G AE												
			Sprinkler System Installer	1.4.2	G AE												
			SD-05 Design Data														
			Sway Bracing	1.4.3	G AE												
			Hydraulic Calculations	1.2.1.3	G AE												
			SD-06 Test Reports														
			Preliminary Test Report	3.8													
			Final Acceptance Test Report	3.9													
			SD-07 Certificates														

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		21 13 13.00 10	Inspection by Fire Protection Specialist	3.3													
			SD-10 Operation and Maintenance Data														
			Operating and Maintenance Manuals	3.10	G AE												
		22 00 00	SD-03 Product Data														
			Fixtures	2.4													
			Flush Valve Water Closets	2.4.1													
			WaterSense Label for Flush Valve Water Closet	2.4.1	S												
			Flush Valve Urinals	2.4.2													
			WaterSense Label for Urinal	2.4.2	S												
			Wall Hung Lavatories	2.4.3													
			Countertop Lavatories	2.4.4													
			WaterSense Label for Lavatory Faucet	2.4.3	S												
			Kitchen Sinks	2.4.5													
			Drinking-Water Coolers	2.4.6	G												
			WaterSense Label for Showerhead	2.4.8	S												
			Water Heaters	2.8	G												
			Energy Star Label for Gas Instantaneous Water Heater	2.9	S												
			Pumps	2.9	G												
			Backflow Prevention Assemblies	3.9.1.1	G												

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		22 00 00	Shower Faucets	2.4.8	G												
			Vibration-Absorbing Features	3.4	G												
			SD-06 Test Reports														
			Tests, Flushing and Disinfection	3.9													
			Test of Backflow Prevention	3.9.1.1	G												
			Assemblies														
			SD-07 Certificates														
			Materials and Equipment	1.3													
		23 00 00	SD-03 Product Data														
			Insulated Nonmetallic Flexible	2.10.1.1													
			Duct Runouts														
			Duct Connectors	2.10.1.1													
			Duct Access Doors	2.10.2													
			Fire Dampers	2.10.3													
			Manual Balancing Dampers	2.10.4													
			Diffusers	2.10.6.1													
			Registers and Grilles	2.10.6.2													
			Louvers	2.10.7													
			Panel Type Power Wall	2.11.1.3													
			Ventilators														
			Ceiling Exhaust Fans	2.11.1.4													
			Air Handling Units	2.12	G												
			Variable Volume, Single Duct	2.13.1.1													
			Terminal Units														
			Reheat Units	2.13.1.2													
			Energy Recovery Devices	2.14	G												

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		23 00 00	ERV-1	2.12.2													
			HRV-1	2.12.3													
			SD-06 Test Reports														
			Performance Tests	3.13													
			Damper Acceptance Test	3.11													
			SD-07 Certificates														
			Ozone Depleting Substances	1.4.3													
			SD-08 Manufacturer's Instructions														
			Manufacturer's Installation	3.3													
			Instructions														
			Operation and Maintenance	3.15.2													
			Training														
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance	3.15.1													
			Manuals														
			Fire Dampers	2.10.3													
			Manual Balancing Dampers	2.10.4													
			Panel Type Power Wall	2.11.1.3													
			Ventilators														
			Ceiling Exhaust Fans	2.11.1.4													
			Air Handling Units	2.12													
			Variable Volume, Single Duct	2.13.1.1													
			Terminal Units														
			Energy Recovery Devices	2.14													
			ERV-1	2.12.2													

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		23 00 00	HRV-1	2.12.3													
			SD-11 Closeout Submittals														
			Energy Efficient Equipment	2.1.1	S												
			Reduce Volatile Organic Compounds (VOC)	2.1.2	S												
			Indoor Air Quality During Construction	3.1	S												
			Ozone Depleting Substances for Refrigerants	2.1.3	S												
		23 05 15	SD-01 Preconstruction Submittals														
			Material, Equipment, and Fixture Lists	1.2													
			SD-02 Shop Drawings														
			Coordination Drawings	1.2													
			SD-03 Product Data														
			Pipe and Fittings	2.2													
			Piping Specialties	2.3													
			Valves	2.4													
			Miscellaneous Materials	2.5													
			Supporting Elements	2.6													
			SD-05 Design Data														
			Pipe and Fittings	2.2													
			Piping Specialties	2.3													
			Valves	2.4													
			SD-06 Test Reports														
			Hydrostatic Tests	3.1													

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		23 05 15	Air Tests	3.1													
			Valve-Operating Tests	3.1													
			Drainage Tests	3.1													
			Non-Destructive Electric Tests	3.1													
			System Operation Tests	3.1													
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Manuals	3.11													
		23 05 93	SD-01 Preconstruction Submittals														
			Independent TAB Agency and Personnel Qualifications	1.5.1													
			TAB Design Review Report	1.5.3	G AE												
			TAB Design Review Report	1.6.1.1	G AE												
			TAB Firm	1.5.8.1	G AE												
			TAB Team Assistants	1.2													
			TAB Team Engineer	1.2													
			TAB Specialist	1.5.8.2													
			TAB Team Field Leader	1.2													
			SD-02 Shop Drawings														
			TAB Schematic Drawings and Report Forms	1.3.3													
			SD-03 Product Data														
			Equipment and Performance Data	1.3													
			TAB Related HVAC Submittals	1.5.1.3													

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		23 05 93	TAB Related HVAC Submittals	1.5.8.4													
			TAB Procedures	1.5.6													
			Calibration	1.5.6													
			Systems Readiness Check	1.3.3													
			TAB Execution	1.5.9													
			TAB Verification	1.5.9.3													
			SD-06 Test Reports														
			Completed Pre-Final DALT Report	3.3.5													
			Certified Final DALT Report	3.3.8													
			Prerequisite HVAC Work Checkout List	1.5.4													
			Prerequisite HVAC Work Checkout List	1.5.4													
			Prerequisite HVAC Work Checkout List	1.5.4													
			Proportional Balancing	3.8													
			Season 1	3.8													
			Season 2	3.8													
			TAB Design Review Report	1.5.3													
			TAB Design Review Report	1.6.1.1													
			TAB Report for Season 1	1.5.10.2													
			TAB Report for Season 2	1.5.10.2													
			SD-07 Certificates														
			Independent TAB Agency and Personnel Qualifications	1.5.1													

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		23 05 93	DALT and TAB Submittal and Work Schedule	1.5.3													
			DALT and TAB Submittal and Work Schedule	1.6.1													
			TAB Pre-Field Engineering Report	1.5.4													
			TAB Pre-Field Engineering Report	1.6.1.3													
			Instrument Calibration Certificates	1.5.5													
			DALT and TAB Procedures Summary	3.8													
			Completed Pre-Final DALT Work Checklist	3.8													
			Advance Notice of Pre-Final DALT Field Work	3.3.2													
			Proportional Balancing	3.8													
			Season 1	3.8													
			Season 2	3.8													
			TAB Firm	1.5.8.1													
			Design Review Report	1.3.3	G AE												
			Pre-field DALT Preliminary Notification	1.6.1.2													
			Advanced Notice for Season 1 TAB Field Work	1.6.1													

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		23 05 93	Prerequisite HVAC Work Check	1.6.1													
			Out List For Season 1														
		23 07 00	SD-02 Shop Drawings														
			MICA Plates	3.2.2.4													
			Pipe Insulation Systems	2.4													
			Pipe Insulation Systems	3.2													
			Duct Insulation Systems	3.3													
			Equipment Insulation Systems	3.4													
			SD-03 Product Data														
			Pipe Insulation Systems	2.4													
			Pipe Insulation Systems	3.2													
			Duct Insulation Systems	3.3													
			Equipment Insulation Systems	3.4													
			SD-08 Manufacturer's Instructions														
			Pipe Insulation Systems	2.4													
			Pipe Insulation Systems	3.2													
			Duct Insulation Systems	3.3													
			Equipment Insulation Systems	3.4													
			SD-11 Closeout Submittals														
			Reduce Volatile Organic	2.1.1	S												
			Compounds (VOC)														
			Recycled Content	2.1.2	S												
		23 09 00	SD-03 Product Data														
			Programming Software	1.8.1	G												
			Controller Application Programs	1.8.2	G												
			Configuration Software	1.5	G												

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ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASS S I F I C A T I O N A / E R E V I W R	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
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		23 09 00	Manufacturer's Product Data	2.2	G												
			Final LNS Database	3.5.4	G												
			LNS Plug-ins	1.8.3	G												
			SD-06 Test Reports														
			Start-Up Testing Report	3.4.2	G												
			PVT Procedures	3.5.1	G												
			PVT Report	3.5.3	G												
			Pre-Construction Quality Control (QC) Checklist	1.9.1	G												
			Post-Construction Quality Control (QC) Checklist	1.9.2	G												
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance (O&M) Instructions	3.6	G												
			Training Documentation	3.8.1	G												
			SD-11 Closeout Submittals														
			Enclosure Keys	2.5	G												
			Closeout Quality Control (QC) Checklist	1.9.3	G												
		23 11 25	SD-02 Shop Drawings														
			Gas Piping System	1.5.3	G												
			Gas Piping System	2.2	G												
			Gas Piping System	3.3	G												
			SD-03 Product Data														
			Pipe and Fittings	1.6.1	G												

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		23 11 25	Gas Equipment Connectors	1.5.3	G												
			Gas Piping System	1.5.3	G												
			Gas Piping System	2.2	G												
			Gas Piping System	3.3	G												
			Pipe Coating Materials	2.1	G												
			Pressure Regulators	2.6	G												
			Risers	2.4	G												
			Transition Fittings	2.2.10	G												
			Valves	2.3	G												
			Warning and Identification Tape	2.2.6	G												
			SD-06 Test Reports														
			Testing	3.18	G												
			Pressure Tests	3.18.1	G												
			Test with Gas	3.18.2	G												
			SD-07 Certificates														
			Welders Procedures and Qualifications	1.5.1	G												
			Assigned Number, Letter, or Symbol	1.5.1	G												
			SD-08 Manufacturer's Instructions														
			PE Pipe and Fittings	1.5.2	G												
			Pipe Coating Materials	2.1	G												
			SD-10 Operation and Maintenance Data														
			Gas Facility System and Equipment Operation	1.3.1	G												

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		23 11 25	Gas Facility System Maintenance	1.3.2	G												
			Gas Facility Equipment	1.3.3	G												
			Maintenance														
		23 52 00	SD-02 Shop Drawings														
			Detail Drawings	1.5													
			SD-03 Product Data														
			Materials and Equipment	2.1.1													
			Spare Parts	1.5													
			Water Treatment System	2.13													
			Boiler Water Treatment	2.13													
			Heating System Tests	3.9													
			Unit Heaters	2.7													
			Welding	1.3													
			Qualifications	3.9													
			Field Instructions	3.11													
			Tests	3.4													
			SD-06 Test Reports														
			Heating System Tests	3.9													
			Water Treatment Testing	3.9.1													
			SD-07 Certificates														
			Bolts	2.9.7.3													
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance	3.11	G												
			Instructions														
			Water Treatment System	2.13	G												

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		23 52 00	SD-11 Closeout Submittals														
			Indoor Air Quality During Construction	3.10.2	S												
		23 64 10	SD-03 Product Data														
			Water Chillers	2.5	G AE												
			Posted Instructions	3.2.3													
			Verification of Dimensions	1.5.1													
			System Performance Tests	3.6													
			SD-06 Test Reports														
			System Performance Tests	3.6													
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Manuals	3.7													
			SD-11 Closeout Submittals														
			Energy Efficient Equipment for Chillers	2.1.1	S												
			Indoor Air Quality During Construction	3.1.1	S												
			Ozone Depleting Substances	2.1.2	S												
		23 64 26	SD-03 Product Data														
			Grooved Mechanical Connections For Steel	2.2.2.4													
			Grooved Mechanical Connections For Copper	2.3.3													
			Water Temperature Mixing Valve	2.4.8													

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		23 64 26	Water Temperature Regulating Valves	2.4.9													
			Water Pressure Reducing Valve	2.4.10													
			Pressure Relief Valve	2.4.11													
			Combination Pressure and Temperature Relief Valves	2.4.12													
			Pumps	2.6													
			Combination Strainer and Pump Suction Diffuser	2.5.3													
			Expansion Tanks	2.7													
			Air Separator Tanks	2.8													
			Water Treatment Systems	2.9													
			SD-06 Test Reports														
			Piping Welds NDE Report	3.1.1.3													
			Pressure Tests Reports	3.4.2													
			SD-07 Certificates														
			Employer's Record Documents (For Welding)	3.1.1.1													
			Welding Procedures and Qualifications	3.1.1.2													
			SD-08 Manufacturer's Instructions														
			Lesson plan for the Instruction Course	3.5													
			SD-10 Operation and Maintenance Data														
			Water Treatment Systems	2.9													

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		23 64 26	Water Temperature Mixing Valve	2.4.8													
			Water Temperature Regulating Valves	2.4.9													
			Water Pressure Reducing Valve	2.4.10													
			Pressure Relief Valve	2.4.11													
			Combination Pressure and Temperature Relief Valves	2.4.12													
			Pumps	2.6													
			Combination Strainer and Pump Suction Diffuser	2.5.3													
			Expansion Tanks	2.7													
			Air Separator Tanks	2.8													
		23 81 00.00 20	SD-02 Shop Drawings														
			Field-Assembled Refrigerant Piping	2.6.2													
			Control System Wiring Diagrams	1.4.2													
			SD-03 Product Data														
			Heat Pumps	2.2													
			Air Conditioners	2.3													
			Thermostats	2.3.7													
			Refrigerant	1.5													
			Refrigerant Piping and Accessories	2.6													
			SD-06 Test Reports														
			Start-Up and Initial Operational Tests	3.8.3													

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		23 81 00.00 20	SD-08 Manufacturer's Instructions														
			Heat Pumps	2.2													
			Air Conditioners	2.3													
			Thermostats	2.3.7													
			Refrigerant Piping and Accessories	2.6													
			SD-10 Operation and Maintenance Data														
			Heat Pumps	2.2													
			Air Conditioners	2.3													
			Thermostats	2.3.7													
			SD-11 Closeout Submittals														
			Posted Operating Instructions	1.4.4													
			Energy Efficient Equipment for Unitary Air Conditioning Equipment	2.1.1	S												
			Ozone Depleting Substances	2.1.2	S												
			Indoor Air Quality During Construction	3.1.1	S												
		25 05 11.01	SD-01 Preconstruction Submittals														
			Device Account Lock Exception Request	3.1.2.2	G												
			Multiple IP Connection Device Request	3.8	G												
			Contractor Computer Cybersecurity Compliance Statements	1.10.1.4	G												

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		25 05 11.01	Contractor Temporary Network Cybersecurity Compliance Statements	1.10.6	G												
			SD-02 Shop Drawings														
			User Interface Banner Schedule	3.1.3.1	G												
			Network Communication Report	1.8.1	G												
			Cybersecurity Riser Diagram	1.8.4	G												
			Control System Inventory Report	1.8.2	G												
			SD-03 Product Data														
			Control System Cybersecurity Documentation	1.8.5	G												
			SD-07 Certificates														
			Software Licenses	1.9	G												
			SD-11 Closeout Submittals														
			Password Summary Report	3.5.2.2.4	G												
			Software Recovery And Reconstitution Images	1.8.3	G												
			Device Audit Record Upload Software	3.2.2.1	G												
			Example		G												
		25 05 11.02	SD-01 Preconstruction Submittals														
			Wireless Communication Request	3.1.5.3	G												
			Device Account Lock Exception Request	3.1.2.2	G												

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		25 05 11.02	Contractor Computer Cybersecurity Compliance Statements	1.10.1.4	G												
			Contractor Temporary Network Cybersecurity Compliance Statements	1.10.6	G												
			SD-02 Shop Drawings														
			User Interface Banner Schedule	3.1.3.1	G												
			Network Communication Report	1.8.1	G												
			Cybersecurity Riser Diagram	1.8.4	G												
			Control System Inventory Report	1.8.2	G												
			SD-03 Product Data														
			Control System Cybersecurity Documentation	1.8.5	G												
			SD-06 Test Reports														
			Wireless Communication Test Report	3.1.5.4	G												
			SD-07 Certificates														
			Software Licenses	1.9	G												
			SD-11 Closeout Submittals														
			Password Summary Report	3.5.2.2.4	G												
			Software Recovery And Reconstitution Images	1.8.3	G												
			Device Audit Record Upload Software	3.2.2.1	G												
			Example		G												

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		26 05 00.00 40	SD-02 Shop Drawings														
			Marking Strips	3.2.10.1	G												
			SD-03 Product Data														
			Conduits and Raceways	2.1.1	G												
			Wire and Cable	2.2.1	G												
			Splices and Connectors	3.2.9	G												
			Switches	2.2.3	G												
			Receptacles	2.2.5	G												
			Outlet Boxes, Pull Boxes and Junction Boxes	2.1.4	G												
			Circuit Breakers	2.1.5.1	G												
			Panelboards	2.1.5	G												
			Dry-Type Distribution	2.1.6	G												
			Transformers														
			Device Plates	2.2.2	G												
			SD-06 Test Reports														
			Continuity Test	3.6	G												
			Phase-Rotation Tests	3.6	G												
			Insulation Resistance Test	3.6	G												
			600-Volt Wiring Test	3.6	G												
			Transformer Tests	3.6	G												
			Ground-Fault Receptacle Test	3.6	G												
			Insulation-Resistance Test	3.6	G												
			SD-08 Manufacturer's Instructions														
			Manufacturer's Instructions	3.1													
		26 09 23.00 40	SD-02 Shop Drawings														

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		26 09 23.00 40	Lighting System Drawings	2.1	G												
			SD-03 Product Data														
			Installation Instructions	3.1	G												
			Dimming Controls	2.2.2	G												
			Light Level Sensor	2.2.3	G												
			Lighting Contactor	2.2.4	G												
			Time Switch	2.2.5	G												
			Photocell Switch	2.2.6	G												
			Occupancy Sensors	2.2.7	G												
			SD-06 Test Reports														
			System Operation Tests	3.3													
			SD-10 Operation and Maintenance														
			Data														
			Lighting Control System, Data	3.4													
			Package 5														
		26 20 00	SD-02 Shop Drawings														
			Panelboards	2.11	G												
			Transformers	2.14	G												
			Cable trays	2.3	G												
			SD-03 Product Data														
			Receptacles	2.10	G												
			Circuit breakers	2.11.3	G												
			Switches	2.9	G												
			Transformers	2.14	G												
			Enclosed circuit breakers	2.12	G												
			Motor controllers	2.16	G												

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		26 20 00	Grounding Busbar	2.20.3	G												
			Surge protective devices	2.25	G												
			SD-06 Test Reports														
			600-volt wiring test	3.5.2	G												
			Grounding system test	3.5.5	G												
			Transformer tests	3.5.3	G												
			Ground-fault receptacle test	3.5.4	G												
			SD-09 Manufacturer's Field														
			Reports														
			Transformer factory tests	2.27.1													
			SD-10 Operation and Maintenance														
			Data														
			Electrical Systems	1.5.1	G												
		26 24 13	SD-02 Shop Drawings														
			Switchboard Drawings	1.4.2	G												
			SD-03 Product Data														
			Switchboard	2.2	G												
			SD-06 Test Reports														
			Switchboard Design Tests	2.5.2	G												
			Switchboard Production Tests	2.5.3	G												
			Acceptance Checks and Tests	3.4.1	G												
			SD-07 Certificates														
			Cybersecurity Equipment	2.5.4	G												
			Certification														
			Cybersecurity Installation	3.4.1.7	G												
			Certification														

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		26 24 13	SD-10 Operation and Maintenance Data														
			Switchboard Operation and Maintenance	1.5.1	G												
			SD-11 Closeout Submittals														
			Assembled Operation and Maintenance Manuals	1.5.2	G												
			Equipment Test Schedule	2.5.1	G												
			Service Entrance Available Fault Current Label	2.8	G												
		26 28 01.00 10	SD-03 Product Data														
			Fault Current Analysis	2.11													
			Protective Device Coordination Study	2.11													
			Equipment	2.1													
			System Coordinator	1.3.1													
			Protective Relays	3.3.5													
			Installation	3.2													
			SD-06 Test Reports														
			Field Testing	3.3													
		26 29 23	SD-02 Shop Drawings														
			Schematic Diagrams	1.5.1	G												
			Interconnecting Diagrams	1.5.2	G												
			Installation Drawings	1.5.3	G												
			SD-03 Product Data														
			Variable Frequency Drives	2.1	G												

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		26 29 23	Wires and Cables	2.3													
			Equipment Schedule	1.5.4													
			SD-06 Test Reports														
			VFD Test	3.2.1													
			Performance Verification Tests	3.2.2													
			Endurance Test	3.2.3													
			SD-08 Manufacturer's Instructions														
			Installation instructions	1.5.5													
			SD-09 Manufacturer's Field														
			Reports														
			VFD Factory Test Plan	2.5.1	G												
			Factory test results	1.5.6													
			SD-10 Operation and Maintenance														
			Data														
			Variable Frequency Drives	2.1													
		26 32 33.00 10	SD-02 Shop Drawings														
			UPS System	2.1													
			Installation	3.2													
			SD-03 Product Data														
			Spare Parts	1.6													
			Field Training	3.5	G												
			SD-06 Test Reports														
			Factory Testing	2.15													
			Field Supervision, Startup and	3.3													
			Testing														

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		26 32 33.00 10	SD-10 Operation and Maintenance Data														
			Operating and Maintenance Manuals	3.5	G												
		26 36 00.00 10	SD-02 Shop Drawings														
			Detail Drawings	1.3.1													
			Equipment	2.1													
			Installation	3.1													
			SD-03 Product Data														
			Equipment	2.1													
			SD-06 Test Reports														
			Testing	2.6	G												
			SD-07 Certificates														
			Equipment	2.1													
			Switching Equipment	1.3.2													
			SD-10 Operation and Maintenance Data														
			Switching Equipment	1.3.2	G												
			Instructions	3.2	G												
		26 41 00	SD-02 Shop Drawings														
			Overall lightning protection system	1.4.1.1	G												
			Each major component	1.4.1.2	G												
			SD-06 Test Reports														
			Lightning Protection and Grounding System Test Plan	1.4.3	G												

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		26 41 00	Lightning Protection and Grounding System Test	3.4.1	G												
			SD-07 Certificates														
			Lightning Protection System Installers Documentation	1.2.3	G												
			Component UL Listed and Labeled	1.4.2	G												
			Lightning protection system inspection certificate	1.4.4	G												
			Roof manufacturer's warranty	3.1.1	G												
		26 51 00	SD-02 Shop Drawings														
			Luminaire Drawings	1.5.1	G												
			Occupancy/Vacancy Sensor Coverage Layout	1.5.2	G												
			SD-03 Product Data														
			Luminaires	2.2	G												
			Light Sources	2.4	G												
			Drivers, Ballasts and Generators	2.3	G												
			LED Luminaire Warranty	1.6.1	G												
			Luminaire Design Data	1.5.4	G												
			Vacancy Sensors	2.5.3.2	G												
			Dimming Controllers (Dimmers)	2.5.2	G												
			Timeswitch	2.5.4	G												
			Exit Signs	2.6.1	G												
			Emergency Lighting Unit (EBU)	2.6.2	G												
			LED Emergency Drivers	2.6.3	G												

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		26 51 00	Occupancy Sensors	2.5.3.1	G												
			Ambient Light Level Sensor	3.1.8	G												
			SD-06 Test Reports														
			LED Luminaire - IES LM-79 Test Report	1.5.5	G												
			LED Light Source - IES LM-80 Test Report	1.5.6	G												
			LED Light Source - IES TM-21 Test Report	1.5.7	G												
			Occupancy/Vacancy Sensor Verification Tests	1.5.8	G												
			SD-07 Certificates														
			Luminaire Useful Life Certificate	1.6.1.1	G												
			LED Driver and Dimming Switch Compatibility Certificate	1.5.3	G												
		27 05 14.00 10	SD-02 Shop Drawings														
			Cable TV Premises Distribution System	1.2	G												
			SD-03 Product Data														
			Spare Parts	1.7													
			Test Plan	3.4	G												
			Qualifications	1.4													
			SD-06 Test Reports														
			Testing	3.4													
			SD-07 Certificates														
			Materials and Equipment	2.1													

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		27 05 14.00 10	SD-08 Manufacturer's Instructions														
			Manufacturer's	3.1.2													
			Recommendations														
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance	3.5	G												
			Manuals														
		27 05 29.00 10	SD-02 Shop Drawings														
			PDS Design	1.3.3	G												
			PDS Design Technical Review	1.3.4	G												
			PDS Design Approval	1.3.5	G												
			SD-03 Product Data														
			PDS Hardened Carrier	1.5.3													
			SD-04 Samples														
			PDS Carrier Surface Mounted	2.1.1													
			SD-11 Closeout Submittals														
			User Drop Box	3.3.2.1													
			Other Enclosures	3.3.2.2													
		27 10 00	SD-02 Shop Drawings														
			Telecommunications drawings	1.6.1.1													
			Telecommunications Space	1.6.1.2	G AE												
			Drawings														
			SD-03 Product Data														
			Telecommunications cabling	2.3													
			Patch panels	2.4.6													

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		27 10 00	Telecommunications	2.5													
			outlet/connector assemblies														
			Equipment support frame	2.4.2													
			Connector blocks	2.4.4													
			Spare Parts	1.10.3													
			SD-06 Test Reports														
			Telecommunications cabling	3.5.1													
			testing														
			SD-07 Certificates														
			Telecommunications Contractor	1.6.2.1													
			Key Personnel	1.6.2.2													
			Manufacturer Qualifications	1.6.2.3													
			Test plan	1.6.3													
			SD-09 Manufacturer's Field														
			Reports														
			Factory reel tests	2.10.1													
			SD-10 Operation and Maintenance														
			Data														
			Telecommunications cabling and	1.10.1													
			pathway system														
			SD-11 Closeout Submittals														
			Record Documentation	1.10.2													
		27 51 16	SD-01 Preconstruction Submittals														
			Qualifications	1.7	G												
			SD-02 Shop Drawings														
			Detail Drawings	2.1.3	G												

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		27 51 16	System Layout	1.2.1	G												
			System Design	2.1.4	G												
			SD-03 Product Data														
			Spare Parts	1.9													
			SD-06 Test Reports														
			Approved Test Procedures	3.5	G												
			Acceptance Tests	3.5													
			Accreditation	1.6	G												
			SD-07 Certificates														
			Components	2.2													
			SD-10 Operation and Maintenance Data														
			Audio Visual System	2.1	G												
		28 08 10	SD-05 Design Data														
			Test Plan	3.1	G												
			SD-06 Test Reports														
			Draft Test Report	3.2.2													
			Final Test Report	3.4	G												
			SD-07 Certificates														
			Qualifications	1.4.1													
		28 10 05	SD-02 Shop Drawings														
			ESS Components	1.3.3.1	G												
			Overall System Schematic	1.3.3.2	G												
			SD-03 Product Data														
			Premise Control Unit	2.3.6	G												
			Detection Sensors	2.3.7	G												

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		28 10 05	Access Control Unit	2.4.4	G												
			Access Control Devices	2.4.5	G												
			Cameras	2.5.1	G												
			Camera Lenses	2.5.1.2	G												
			Camera Housing and Mounts	2.5.1.3	G												
			Video Recording	2.5.4.3	G												
			Communications Interface	2.7	G												
			Devices														
			Network Switch	2.7.4	G												
			Video and ESS Transmission	2.7.5	G												
			Uninterruptible Power Supply	2.9.1	G												
			(UPS)														
			Component Enclosure	2.11	G												
			Equipment Rack	2.12	G												
			SD-05 Design Data														
			Backup Battery Capacity	1.5.1	G												
			Calculations														
			Throughput Rates	2.4.2	G												
			CCTV Storage Calculations	1.5.2													
			SD-07 Certificates														
			Contractor Qualifications	1.3.4.1	G												
			Instructor Qualifications	1.3.4.2	G												
			Data Encryption	2.7.3	G												
			SD-10 Operation and Maintenance														
			Data														
			Training Plan	3.6.1	G												

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		28 10 05	Training Content	3.6	G												
			ESS Components	1.3.3.1	G												
			ESS Software	1.6	G												
			SD-11 Closeout Submittals														
			As-Built Drawings	1.7	G												
		28 31 76	SD-02 Shop Drawings														
			Nameplates	2.1.2	G AE												
			Instructions	2.13.10	G AE												
			Wiring Diagrams	3.2.1	G AE												
			System Layout	1.2.1	G AE												
			System Operation	2.3	G AE												
			Notification Appliances	2.18	G AE												
			Amplifiers	2.14	G AE												
			SD-03 Product Data														
			Technical Data And Computer Software	1.6	G AE												
			Fire Alarm Control Unit and Mass Notification Control Unit (FMCP)	2.13	G AE												
			LCD, LED Display Unit (VDU)	2.15	G AE												
			Terminal Cabinets	3.2.2	G AE												
			Manual Stations	2.17	G AE												
			Transmitters	2.21	G AE												
			Batteries	2.12.1	G AE												
			Battery Chargers	2.12.2	G AE												
			Smoke Sensors	2.9	G AE												
			Heat Detectors	2.10	G AE												

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		28 31 76	Notification Appliances	2.18	G AE												
			Addressable Interface Devices	2.7	G AE												
			Amplifiers	2.14	G AE												
			Tone Generators	2.14	G AE												
			Digitalized Voice Generators	2.14	G AE												
			Radio Transmitter and Interface Panels	2.21.1	G AE												
			Digital Alarm Communicator Transmitter (DACT)	2.21.2	G AE												
			Local Operating Console (LOC)	1.4.4	G AE												
			SD-05 Design Data														
			Battery Power	2.12.1.2	G AE												
			Battery Chargers	2.12.2	G AE												
			SD-06 Test Reports														
			Field Quality Control	3.5													
			Testing Procedures	3.5.1	G AE												
			Smoke Sensor Testing	2.9.3	G AE												
			SD-07 Certificates														
			Installer	1.7.1.4													
			Formal Inspection and Tests	3.5.2.2													
			Final Testing	3.5.2.3													
			SD-09 Manufacturer's Field Reports														
			System Operation	2.3	G AE												
			Fire Alarm/Mass Notification System	1.7.2.2													

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		28 31 76	SD-10 Operation and Maintenance Data														
			Operation and Maintenance (O&M) Instructions	3.8	G AE												
			Instruction of Government Employees	3.6	G AE												
			SD-11 Closeout Submittals														
			As-Built Drawings	3.5.2.4													
		31 00 00	SD-01 Preconstruction Submittals														
			Shoring	3.5	G												
			Dewatering Work Plan	1.4.3	G												
			SD-03 Product Data														
			Utilization of Excavated Materials	3.9	G												
			Rock Excavation	1.4.1.2													
			Opening of any Excavation or Borrow Pit	3.4													
			Shoulder Construction	3.15													
			SD-06 Test Reports														
			Testing	3.18													
			Borrow Site Testing	2.1													
			SD-07 Certificates														
			Testing	3.18													
		31 05 22	SD-04 Samples														
			Geotextiles	2.2.1													
			SD-06 Test Reports														
			Geotextiles	2.2.1													

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		31 05 22	Site Verification	2.2.2													
			SD-07 Certificates														
			Geotextiles	2.2.1													
			Needle Punched Geotextile	2.2.1.3													
		31 11 00	SD-01 Preconstruction Submittals														
			Herbicide Application Plan	3.1.1													
			SD-03 Product Data														
			Nonsaleable Materials	3.4.2	G												
			Herbicides	1.3.2	G												
			SD-04 Samples														
			Tree Wound Paint	2.1.1													
			SD-07 Certificates														
			Qualifications	1.3.2	G												
			SD-11 Closeout Submittals														
			Pest Management Report	3.5.1													
		31 31 16.13	SD-03 Product Data														
			Termiticide Application Plan	3.3.6	G RO												
			Termiticides	2.1													
			Foundation Exterior	3.3.3													
			Utilities and Vents	3.3.4													
			Crawl and Plenum Air Spaces	3.3.5													
			Verification of Measurement	3.1													
			Application Equipment	3.4.1													
			Warranty	1.6													
			SD-04 Samples														
			Termiticides	2.1													

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		31 31 16.13	SD-06 Test Reports														
			Equipment Calibration and Tank Measurement	3.4.1													
			Soil Moisture	1.5.1													
			Quality Assurance	1.3													
			SD-07 Certificates														
			Qualifications	1.3.1													
		32 01 19	SD-03 Product Data														
			Manufacturer's	3.1.2.3	G												
			Recommendations														
			Equipment	3.1													
			SD-04 Samples														
			Materials	1.3.1	G												
			SD-06 Test Reports														
			Certified Copies of the Test Reports	1.3.1	G												
		32 05 33	SD-01 Preconstruction Submittals														
			Integrated Pest Management Plan	2.4	G												
			SD-03 Product Data														
			Fertilizer	2.1	G												
			Mulches Topdressing	2.3													
			Organic Mulch Materials	2.3.1													
			SD-07 Certificates														
			Maintenance Inspection Report	3.5.1													
			Plant Quantities	3.5.2	G												

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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 189.1 (2014; ERTA 3/2015, 4/2017, 3/2018,
3/2019) Standard for the Design of
High-Performance Green Buildings Except
Low-Rise Residential Buildings

U.S. DEPARTMENT OF AGRICULTURE (USDA)

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

U.S. DEPARTMENT OF ENERGY (DOE)

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

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

40 CFR 247 Comprehensive Procurement Guideline for
Products Containing Recovered Materials

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED BDC (2013) Leadership in Energy and
Environmental Design(tm) Building Design
and Construction (LEED-NC)

LEED BDC Ref Guide (2013) USGBC LEED Reference Guide for
Building Design and Construction, v4

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

SD-01 Preconstruction Submittals

SDD Implementation Plan; G, RO
Preconstruction Meeting minutes

SD-03 Product Data

Energy-using Equipment

SD-07 Certificates

Pre-Closeout Meeting minutes

SD-11 Closeout Submittals

SDD Notebook; G, RO
Energy & Sustainability (E&S) Record Card
Closeout Meeting minutes

1.3 SDD IMPLEMENTATION PLAN

Submit the SDD Implementation Plan within 30 days after notice to proceed. The plan, when completed, shall provide a detailed description of the activities that relate to accomplishing project SDD requirements, including construction practices, procurement practices, and proposed submittals and documentation for each LEED credit. Plan shall also include the following:

- a. Name of the individual on the Contractor's staff responsible for ensuring the required LEED BDC credits and prerequisites are earned; ensuring required documentation is complete and correct; serving as LEED Online Administrator; and coordinating with other contractors. A responsible LEED BDC Accredited Professional shall be identified.
- b. Copy of proposed contract with Commissioning Authority.
- c. Contractor-developed spreadsheets to be used for tracking LEED credits.
- d. List of the plans required for LEED credits. Proposed submittal date for each plan. These shall be added to the SDD Implementation Plan as they are completed.

1.4 SDD NOTEBOOK

Prepare a comprehensive notebook documenting compliance for each LEED credit identified in Table 1 and the other SDD requirements in this section. SDD Notebook shall be formatted to match Table 1 and tabbed for each credit and prerequisite. Documentation in the notebook shall contain up-to-date information through the previous month's work and shall remain available on the jobsite for review. The Notebook may be maintained and available for reference electronically if preferred. Do not permit completed pages to be altered. If the Contractor fails to maintain the SDD Notebook as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the Notebook. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of the Notebook. Submit one original hard copy and one electronic version on CD of the notebook at project closeout. Notebook shall include the following:

- a. This Section, including Table 1 and attachments
- b. Approved SDD Implementation Plan and meeting minutes

- c. Refrigerant list (see paragraph Ozone Depleting Substances below)
- d. Energy-using equipment product data
- e. Report and Certification of EPA and USDA Designated Items per Section 01 78 00 CLOSEOUT SUBMITTALS
- f. Required LEED documentation as defined by USACE LEED-NC v4 Submittals for Unregistered Projects (13 June 2017)
- g. Backup/support documentation to support credit compliance (whether requested during certification or not)
- i. LEED documentation by the DOR that is furnished by the Government for inclusion in the Notebook.
- j. Closeout meeting minutes
- k. Completed E&S Record Card

1.5 AGENCY REPORTING

1.5.1 Energy & Sustainability (E&S) Record Card

Provide completed E&S Record Card at Beneficial Occupancy as an attachment to DD1354 Real Property Record submittal and include in SDD Notebook. Send completed E&S Record Card by e-mail to USACE Project Manager at Beneficial Occupancy. Comply with SAS Instructions for Completion of Energy & Sustainability Record Card posted at <http://www.sas.usace.army.mil/About/DivisionsandOffices/EngineeringDivision/EngineeringDesignCriteria.aspx> (a sample E&S Record Card is available at this website). Obtain partially completed original excel file for each building from Government Project Manager.

1.6 FEDERAL MANDATES

1.6.1 Commissioning

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

1.6.2 Energy Efficient Products

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

Submit product data demonstrating compliance for all energy-using equipment and include in SDD Notebook.

1.6.3 Indoor Water Use

Provide only water-consuming products that are EPA WaterSense labeled, or the most efficient water fixtures available that meet the requirements of

ASHRAE 189.1 Section 6.3.2, when EPA WaterSense products are not available. Provide the following documentation:

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

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

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

Provide certifications or labels that demonstrate compliance with cited requirements.

1.6.5 Indoor Air Quality During Construction

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

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

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

1.6.6 Recycled Content

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

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

1.6.7 Bio-Based Products

Provide products and material composed of the highest percentage of

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

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

- a. USDA BioPreferred label for each product; for bio-based products used on project but not listed with BioPreferred program, provide bio-based content and percentage.
- b. In order to complete compliance with FAR 52.223-2 Affirmative Procurement of Biobased Products Under Service and Construction Contracts, refer to submittal requirement for biobased products in Section 01 78 00.

1.6.8 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 19.00 37 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT.

1.7 AFFIRMATIVE PROCUREMENT

Government procurement policy is to acquire, in a cost-effective manner, items containing the highest percentage of recovered (recycled) 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 with a specified percent range of recovered materials in their CPG program. The U.S. Department of Agriculture (USDA) has designated certain items with a specific percentage range of biobased content in their BiopREFERRED program. These items, when incorporated into the work under this contract, shall contain at least the specified percentage of 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 2 or more sources).
- d. The product is only available at an unreasonable price (compared with a comparable non-recycled content/non-biobased product).

Designated products are indicated in some specification sections. More information on designated products can be found at www.biopREFERRED.gov and www3.epa.gov/epawaste/conservation/tools.cpg. See Section 01 78 00 CLOSEOUT SUBMITTALS for Contractor certification and reporting requirements for designated products.

1.8 LEED

1.8.1 General

This Specification includes an overview of the project LEED requirements and technical requirements for LEED credits not specified elsewhere. Where the term "LEED credit" is used, it refers to both LEED credits and LEED prerequisites.

1.8.2 LEED Project Composition

This LEED project is a single building and site. The LEED Project Boundary is coincident with construction limits.

1.8.3 Required LEED Achievement

This project has been designed, and shall be developed, for a sustainable achievement level of silver in accordance with LEED BDC v4. Table 1 (see Paragraph Table) identifies the LEED credit items that are designed into or otherwise required for this project. No variations or substitutions to the LEED credits identified for this Contract shall be allowed without written consent from the Contracting Officer. If there are problems meeting the full requirements of a LEED credit identified for this project in Table 1, bring this to the attention of the Contracting Officer immediately.

1.8.4 LEED Certification

This project will not be registered at LEED Online or apply for LEED certification. Validation of credits earned will be accomplished by the Government. Content of construction documentation shall be in accordance with USACE LEED-NC v4 Submittals for Unregistered Projects (13 June 2017). Documentation shall not use LEED Online Forms.

1.8.5 Design and Construction Credit Responsibilities

Some LEED BDC credits are inherent in the design provided and require no further submittal or documentation. For these credits, notify the Contracting Officer in advance of selection of specified material or use of permissible construction methods that may result in compromise or loss of a required LEED credit. Some LEED credits are dependent on Contractor material selections or construction practices.

LEED credits identified in Table 1 not inherent in the design provided shall be the responsibility of and documented by the Contractor. Table 1 provides a general summary of applicable credits. Detailed technical and submittal requirements are contained in the LEED BDC Ref Guide and in the technical Sections (though not specifically identified in each occurrence).

When submittals pertaining to LEED compliance are required in the Contract, these submittals shall be separable from the other submitted data and a copy shall be included in the SDD Notebook in addition to the distribution indicated in the submittal register.

1.9 LEED CREDITS

LEED credits as identified in Table 1 shall be incorporated and documented as required by the Contract documents and in full compliance with the LEED

BDC Ref Guide. LEED credits not identified elsewhere in the Contract documents and those requiring further instruction are specified below. Refer to the LEED BDC Ref Guide for further definitions and requirements.

1.9.1 Materials and Resources Credit - Construction and Demolition Waste Management

Project requirement is that a minimum of 75 percent of demolition and construction waste generated within the LEED boundary shall be diverted from landfill and incineration. Diverted materials must include at least four material streams. See Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS and Section 01 74 19.00 37 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT for additional information and requirements. Government Installation waste reporting differs from LEED waste diversion reporting in that it includes Contract work outside the LEED boundary and requires reporting of disposition of all waste, including waste that is excluded from diversion calculations.

1.9.2 Materials and Resources Credits - Building Product Disclosure and Optimization (BPDO) Environmental Product Declarations

The product-related materials and resources credits have been rewritten in LEED v4. Refer to LEED BDC Ref Guide for more information. LEED v4.1 credit substitutions may be pursued as an option by the contractor, which may offer lower thresholds for compliance in some credits.

The required scope of the Materials and Resources credits is permanently installed building products, excluding mechanical, plumbing, electrical (MEP) and specialty equipment, items purchased for temporary use on the project, and furniture. These items may be included, provided they are also included in tall three cost-based credits, MR Environmental Product Declarations, MR Sourcing of Raw Materials and MR Material Ingredients.

Use of the LEED BPDO calculator (available at <https://www.usgbc.org/resources/bpdo-calculator>) is acceptable for documentation of this credit. Input actual costs and track cumulative calculations for this credit. Include completed spreadsheet in SDD Notebook.

1.9.3 Purchasing Plan

Prepare a materials purchasing plan, using the LEED BPDO calculator referenced in section 1.9.2 above, filled in with proposed materials, estimated costs, credit-specific data, and LEED calculations in order to determine if the planned materials can be expected to achieve the project LEED goals. Plan shall be coordinated with and match required measurement indicated in the TPC (LEED) checklist. Submit purchasing plan before purchasing the materials.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 COORDINATION MEETINGS

There shall be three onsite coordination meetings. The meetings shall be attended by Contractor's designated individual responsible for SDD

documentation, Government representative, and Installation representative. Make a set of Contract Drawings and Specifications available for review at each meeting as well as an updated SDD Notebook. Prepare and submit the minutes for each meeting.

a. The first is a preconstruction meeting to review the SDD Implementation Plan. The requirements for this meeting may be fulfilled during the coordination and mutual understanding meeting outlined in Section 01 45 00.00 10 QUALITY CONTROL.

b. The second is a pre-closeout meeting to review SDD Notebook for completeness and identify outstanding issues relating to final LEED score and documentation requirements.

c. The third is a closeout meeting to review the final SDD Notebook. At closeout meeting, a final LEED score for the project will be determined based on review of project performance and documentation. For projects requiring LEED certification, the closeout meeting takes place after certification.

3.2 TABLE

LEED BDC credits identified in Table 1 below are Contract requirements and shall be incorporated in full compliance with the LEED BDC Ref Guide.

TABLE 1: Required LEED Points and Prerequisites

CREDIT NAME	POINTS
LT Sensitive Land Protection	1 pt
SS Construction Activity Pollution Prevention	prereq
SS Site Assessment	1 pt
SS Rainwater Management	3 pts
SS Light Pollution Reduction	1 pt
WE Outdoor Water Use Reduction	prereq
WE Indoor Water Use Reduction	prereq
WE Building-Level Water Metering	prereq
WE Outdoor Water Use Reduction	2 pts
WE Indoor Water Use Reduction	2 pts
WE Water Metering	1 pt
EA Fundamental Commissioning and Verification	prereq
EA Minimum Energy Performance	prereq
EA Building-Level Energy Metering	prereq
EA Fundamental Refrigerant Management	prereq
EA Enhanced Commissioning	5 pts
EA Optimize Energy Performance	10 pts
EA Advanced Energy Metering	1 pt
MR Storage and Collection of Recyclables	prereq
MR Construction and Demolition Waste Management Planning	
MR BPDO - Environmental Product Declarations	2 pts
MR BPDO - Sourcing of Raw Materials	2 pts
MR BPDO - Material Ingredients	2 pts
MR Construction and Demolition Waste Management	2 pts
IEQ Minimum Indoor Air Quality Performance	prereq
IEQ Environmental Tobacco Smoke Control	prereq
IEQ Enhanced Indoor Air Quality Strategies	1 pt
IEQ Low-Emitting Materials	3 pts
IEQ Construction Indoor Air Quality Management Plan	1 pt
IEQ Indoor Air Quality Assessment	1 pt
IEQ Interior Lighting	1 pt

<u>CREDIT NAME</u>	<u>POINTS</u>
ID Purchasing - Lamps (aka Low Mercury Lighting)	1 pt
ID LEED Accredited Professional	1 pt
Regional Priority - Optimize Energy Performance	1 pt

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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 SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.22	(2007; R 2017) Safety Requirements for Rope-Guided and Non-Guided Workers' Hoists
ASSE/SAFE A10.34	(2001; R 2012) Protection of the Public on or Adjacent to Construction Sites
ASSE/SAFE A10.44	(2014) Control of Energy Sources (Lockout/Tagout) for Construction and Demolition Operations
ASSE/SAFE Z244.1	(2003; R 2014) Control of Hazardous Energy Lockout/Tagout and Alternative Methods
ASSE/SAFE Z359.0	(2012) Definitions and Nomenclature Used for Fall Protection and Fall Arrest
ASSE/SAFE Z359.1	(2016) The Fall Protection Code
ASSE/SAFE Z359.11	(2014) Safety Requirements for Full Body Harnesses
ASSE/SAFE Z359.12	(2009) Connecting Components for Personal Fall Arrest Systems
ASSE/SAFE Z359.13	(2013) Personal Energy Absorbers and Energy Absorbing Lanyards
ASSE/SAFE Z359.14	(2014) Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems
ASSE/SAFE Z359.15	(2014) Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems
ASSE/SAFE Z359.2	(2017) Minimum Requirements for a Comprehensive Managed Fall Protection Program
ASSE/SAFE Z359.3	(2017) Safety Requirements for Lanyards and Positioning Lanyards

ASSE/SAFE Z359.4	(2013) Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components
ASSE/SAFE Z359.6	(2016) Specifications and Design Requirements for Active Fall Protection Systems
ASSE/SAFE Z359.7	(2011) Qualification and Verification Testing of Fall Protection Products

ASME INTERNATIONAL (ASME)

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

ASTM INTERNATIONAL (ASTM)

ASTM F855	(2015) Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment
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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 241	(2013; Errata 2015) Standard for Safeguarding Construction, Alteration, and Demolition Operations

NFPA 51B	(2014) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2017; 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) National Electrical Code
NFPA 70E	(2018; TIA 18-1; TIA 81-2) Standard for Electrical Safety in the Workplace

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

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

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual
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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 1926.1400	Cranes and Derricks in Construction
29 CFR 1926.16	Rules of Construction
29 CFR 1926.450	Scaffolds
29 CFR 1926.500	Fall Protection

29 CFR 1926.552	Material Hoists, Personal Hoists, and Elevators
29 CFR 1926.553	Base-Mounted Drum Hoists
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 ASSE/SAFE Z359.0, who has been designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the fall protection program, who through training, knowledge and experience in fall protection and rescue systems and equipment, is capable of identifying, evaluating and addressing existing and potential fall hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

1.2.6 Competent Person, Scaffolding

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

1.2.7 Competent Person (CP) Trainer

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

1.2.8 High Risk Activities

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

1.2.9 High Visibility Accident

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

1.2.10 Load Handling Equipment (LHE)

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

1.2.11 Medical Treatment

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

1.2.12 Near Miss

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

1.2.13 Operating Envelope

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

1.2.14 Qualified Person (QP)

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

1.2.15 Qualified Person, Fall Protection (QP for FP)

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

1.2.16 USACE Property and Equipment

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

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

A LHE accident occurs when any one or more of the eight elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; or collision, including unplanned contact between the load, crane, or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents, even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, or roll over). Document an LHE mishap 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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G, RO

SD-06 Test Reports

Monthly Exposure Reports

Notifications and Reports

Accident Reports; G, RO

LHE Inspection Reports

SD-07 Certificates

Crane Operators/Riggers

Standard Lift Plan; G, RO

Critical Lift Plan; G, RO

Activity Hazard Analysis (AHA)

Confined Space Entry Permit

Hot Work Permit

Certificate of Compliance

License Certificates

Portable Gauge Operations Planning Worksheet; G, RO

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 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.

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

Individuals qualified to instruct the 40 hour contract safety awareness course, or portions thereof, must meet the definition of a Competent Person Trainer, and, at a minimum, possess a working knowledge of the following subject areas: EM 385-1-1, Electrical Standards, Lockout/Tagout, Fall Protection, Confined Space Entry for Construction; Excavation, Trenching and Soil Mechanics, and Scaffolds in accordance with 29 CFR 1926.450, Subpart L.

Instructors are required to:

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

1.6.1.4 Crane Operators/Riggers

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

1.6.2 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 SSO are subject to dismissal if the above duties are not being effectively carried out. If Superintendent, QC Manager, or SSO 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 ASSE/SAFE 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 ASSE/SAFE Z359.2, be site specific, and address all fall hazards in the work place and during different phases of construction. Address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 6 feet. A competent person or qualified person for fall protection must prepare and sign the plan documentation. Include 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 ASSE/SAFE Z359.2, and include in the FP&P Plan and as part of the APP. Include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility.

1.7.2.7 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, ASSE/SAFE Z244.1, and ASSE/SAFE 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.

1.8 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 DFOW. The Government reserves the right to require the Contractor to revise and resubmit the AHA if it fails to effectively identify the work sequences, specific anticipated hazards, site conditions, equipment, materials, personnel and the control measures to be implemented.

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

1.8.1 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 SSHO must maintain a signature log on site for every AHA. Provide employees whose primary language is other than English, with an interpreter to ensure a clear understanding of the AHA and its contents.

1.9 DISPLAY OF SAFETY INFORMATION

1.9.1 Safety Bulletin Board

Within one calendar day(s) 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 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: 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.

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 and Public Utilities 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 HECF 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, ASSE/SAFE 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 ASSE/SAFE 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 ASSE/SAFE 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, ASSE/SAFE Z359.0, ASSE/SAFE Z359.1, ASSE/SAFE Z359.2, ASSE/SAFE Z359.3, ASSE/SAFE Z359.4, ASSE/SAFE Z359.6, ASSE/SAFE Z359.7, ASSE/SAFE Z359.11, ASSE/SAFE Z359.12, ASSE/SAFE Z359.13, ASSE/SAFE Z359.14, and ASSE/SAFE Z359.15.

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

3.5.3 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, ASSE/SAFE Z359.2, and ASSE/SAFE 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 AWPs must be operated, inspected, and maintained as specified in the operating manual for the equipment and delineated in the AHA. Operators of AWPs must be designated as qualified operators by the Prime Contractor. Maintain proof of qualifications on site for review and include in the AHA.

3.7 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. 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 ASSE/SAFE A10.22.
- b. Rigging gear must comply with applicable ASME/OSHA standards
- c. When used on telecommunication towers, base mounted drum hoists must comply with TIA-1019, TIA-222, ASME B30.7, 29 CFR 1926.552, and 29 CFR 1926.553.

- d. When used to hoist personnel, the AHA must include a written standard operating procedure. Operators must have a physical examination in accordance with EM 385-1-1 Section 16.B.05 and trained, at a minimum, in accordance with EM 385-1-1 Section 16.U and 16.T. The base mounted drum hoist must also comply with OSHA Instruction CPL 02-01-056 and ASME B30.23.
- e. Material and personnel must not be hoisted simultaneously.
- f. Personnel cage must be marked with the capacity (in number of persons) and load limit in pounds.
- g. Construction equipment must not be used for hoisting material or personnel or with trolley/tag lines. Construction equipment may be used for towing and assisting with anchoring guy lines.

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

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

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

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 CONCRETE PIPE ASSOCIATION (ACPA)
8445 Freeport Parkway, Suite 350
Irving, TX 75063-2595
Ph: 972-506-7216
Fax: 972-506-7682
E-mail: info@concrete-pipe.org
Internet: <http://www.concrete-pipe.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 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 RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION
(AREMA)
4501 Forbes Blvd., Suite 130
Lanham, MD 20706

Ph: 301-459-3200
Fax: 301-459-8077
E-mail: bcaruso@arema.org
Internet: <http://www.arema.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 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 SAFETY ENGINEERS (ASSE/SAFE)
1800 East Oakton Street
Des Plaines, IL 60018
Ph: 847-699-2929
Internet: <http://www.asse.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
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U.S. DEPARTMENT OF ENERGY (DOE)
1000 Independence Avenue Southwest
Washington, D.C. 20585
Internet: www.eere.energy.gov

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20004
Ph: 202-272-0167
Internet: <http://www2.epa.gov/libraries>
--- Some EPA documents are available only from:
National Technical Information Service (NTIS)
5301 Shawnee Road
Alexandria, VA 22312
Ph: 703-605-6050 or 1-688-584-8332
Fax: 703-605-6900
E-mail: info@ntis.gov
Internet: <http://www.ntis.gov>

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)
Order for sale documents from:
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U.S. Government Printing Office (GPO)
710 North Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800
Fax: 202-512-2104
E-mail: contactcenter@gpo.gov

Internet: <http://www.gpoaccess.gov>
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Federal Aviation Administration
Department of Transportation
800 Independence Avenue, SW
Washington, DC 20591
Ph: 1-866-835-5322
Internet: <http://www.faa.gov>

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)
445 12th Street SW
Washington, DC 20554
Ph: 888-225-5322
TTY: 888-835-5322
Fax: 866-418-0232
Internet: <http://www.fcc.gov>
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Washington, DC 20401-0001
Ph: 202-512-1800
Fax: 866-418-0232
E-mail: gpoweb@gpo.gov
Internet: <http://www.gpoaccess.gov/>

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)
FHWA, Office of Safety
1200 New Jersey Ave., SE
Washington, DC 20590
Ph: 202-366-4000
Internet: <http://www.fhwa.dot.gov>
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U. S. Government Printing Office (GPO)
710 North Capitol Street, NW
Washington, DC 20401
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Fax: 202-512-2104
E-mail: contactcenter@gpo.gov
Internet: <http://www.gpoaccess.gov>

U.S. GENERAL SERVICES ADMINISTRATION (GSA)
General Services Administration
1275 First St. NE
Washington, DC 20417
Ph: 202-501-1231
Internet: <http://www.gsaelibrary.gsa.gov/ElibMain/home.do>
Obtain documents from:
Acquisition Streamlining and Standardization Information System
(ASSIST)
Internet: <https://assist.dla.mil/online/start/>; account
registration required

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

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

UL ENVIRONMENT (ULE)
2211 Newmarket Parkway, Suite 106
Marietta, GA 30067
Ph: 770-933-0638
Fax: 770-980-0072
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>

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>

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA)
507 First Street
Woodland, CA 95695

PN87437, SOF Group Headquarters
Fort Bragg, North Carolina

Solicitation No. W912PM21R0001

Ph: 530-661-9591 or 800-550-7889
Fax: 530-661-9586
E-mail: info@wmmpa.com
Internet: <http://www.wmmpa.com>

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

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PN87437, SOF Group Headquarters
Fort Bragg, North Carolina

Solicitation No. W912PM21R0001

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QUALITY CONTROL
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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 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 the Testing and/or Inspection of Materials Used in Construction

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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Contractor Quality Control (CQC) Plan; G, RO

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 construction operations, both onsite and offsite, and be keyed to the proposed 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 30 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, 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, offsite fabricators, suppliers, and purchasing agents. These procedures must be in accordance with Section 01 33 00 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 design and 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. Submit the CQC Plan a minimum of 10 calendar days prior to the

Coordination Meeting. 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 10 years construction experience on construction similar to this Contract or a construction person with a minimum of 15 years in related work. 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, civil, structural, architectural, submittals clerk. 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 personnel'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
Civil	Graduate Civil Engineer or Construction Manager with 2 years experience in the type of work being performed on this project or technician with 5 yrs related experience
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
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
Structural	Graduate Civil Engineer (with Structural Track or Focus) or Construction Manager with 2 years experience or person 5 years of experience supervising structural features of work in the field with a construction company
Architectural	Graduate Architect with 2 years experience or person with 5 years related experience

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 Naval Facilities Engineering Command and 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 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 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 72 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 72 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 of \$500 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 72 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 SAMPLE FORMS

Sample forms enclosed at the end of this section.

3.11 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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SECTION 01 45 00.15 10

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 MEASUREMENT AND PAYMENT

The work of this section is not measured for payment. The Contractor is responsible for the work of this section, without any direct compensation other than the payment received for contract items.

1.3 CONTRACT ADMINISTRATION

The Government will use the Resident Management System (RMS) to assist in its monitoring and administration of this contract. The Government accesses the system using the Government Mode of RMS (RMS GM) and the Contractor accesses the system using the Contractor Mode (RMS CM). The term RMS will be used in the remainder of this section for both RMS GM and RMS CM. The joint Government-Contractor use of RMS facilitates electronic exchange of information and overall management of the contract. The Contractor accesses RMS to record, maintain, input, track, and electronically share information with the Government throughout the contract period in the following areas:

- Administration
- Finances
- Quality Control
- Submittal Monitoring
- Scheduling
- Closeout
- Import/Export of Data

1.3.1 Correspondence and Electronic Communications

For ease and speed of communications, exchange correspondence and other documents in electronic format to the maximum extent feasible. Some correspondence, including pay requests and payrolls, are also to be provided in paper format with original signatures. Paper documents will govern, in the event of discrepancy with the electronic version.

1.3.2 Other Factors

Other portions of this document have a direct relationship to the

reporting accomplished through RMS. Particular attention is directed to FAR 52.236-15 Schedules for Construction Contracts; FAR 52.232-27 Prompt Payment for Construction Contracts; FAR 52.232-5 Payments Under Fixed-Priced Construction Contracts; Section 01 32 01.00 10 PROJECT SCHEDULE; Section 01 33 00 SUBMITTAL PROCEDURES; Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS; and Section 01 45 00.00 10 QUALITY CONTROL.

1.4 RMS SOFTWARE

RMS is a Windows-based program that can be run on a Windows-based PC meeting the requirements as specified in paragraph SYSTEM REQUIREMENTS. Download, install and be able to utilize the latest version of the RMS software within 7 calendar days of receipt of the Notice to Proceed. RMS software, user manuals, access and installation instructions, program updates and training information are available from the RMS website (<http://rmsdocumentation.com>). The Government and the Contractor will have different access authorities to the same contract database through RMS. The common database will be updated automatically each time a user finalizes an entry or change.

1.5 SYSTEM REQUIREMENTS

The following is the recommended system configuration to run the Contractor Mode RMS for full utilization of all features for all types and sizes of contracts. Smaller, less complicated, projects may not require the configuration levels described below. Required configuration also noted below.

Recommended RMS System Requirements	
Hardware	
Windows-based PC	1.7 GHz i3; AMD A6 3650 GHz or higher processor (REQUIRED)
RAM	8 GB
Hard drive disk	100 GB space for sole use by RMS 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 (REQUIRED)
Word Processing software	Viewer for MS Word 2013, MS Excel 2013 or newer (REQUIRED)

Recommended RMS System Requirements	
E-mail	MAPI compatible (REQUIRED)
Virus protection software	Regularly upgraded with all issued Manufacturer's updates and is able to detect most zero day viruses (REQUIRED)

1.6 CONTRACT DATABASE - GOVERNMENT

The Government will enter the basic contract award data in RMS prior to granting the Contractor access. The Government entries into RMS will generally be related to submittal reviews, correspondence status, and Quality Assurance (QA) comments, as well as other miscellaneous administrative information.

1.7 CONTRACT DATABASE - CONTRACTOR

Contractor entries into RMS establish, maintain, and update data throughout the duration of the contract. Contractor entries generally include prime and subcontractor information, daily reports, submittals, RFI's, schedule updates and payment requests. RMS includes the ability to import attachments and export reports in many of the modules, including submittals. The Contractor responsibilities for entries in RMS typically include the following items:

1.7.1 Administration

1.7.1.1 Contractor Information

Enter all current Contractor administrative data and information into RMS within 7 calendar days of receiving access to the contract in RMS. This includes, but is not limited to, Contractor's name, address, telephone numbers, management staff, and other required items.

1.7.1.2 Subcontractor Information

Enter all missing subcontractor administrative data and information into RMS CM within 7 calendar days of receiving access to the contract in RMS or within 7 calendar days of the signing of the subcontractor agreement for agreements signed at a later date. This includes name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor is listed separately for each trade to be performed.

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" or "RFP".

1.7.1.4 Equipment

Enter and maintain 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 Reports

Track the status of the project utilizing the reports available in RMS. The value of these reports is reflective of the quality of the data input. These reports include the Progress Payment Request worksheet, Quality Control (QC) comments, Submittal Register Status, and Three-Phase Control worksheets.

1.7.1.6 Request For Information (RFI)

Create and track all Requests For Information (RFI) in the RMS Administration Module for Government review and response.

1.7.2 Finances

1.7.2.1 Pay Activity Data

Develop and enter a list of pay activities in conjunction with the project 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 assigned to a CLIN equals the amount of each CLIN.

1.7.2.2 Payment Requests

Prepare all progress payment requests using RMS. Update the work completed under the contract at least monthly, measured as percent or as specific quantities. After the update, generate a payment request and prompt payment certification using RMS. Submit the signed prompt payment certification and payment request as well as supporting data either electronically or by hard copy. Unless waived by the Contracting Officer, a signed paper copy of the approved payment certification and request is also required and will govern in the event of discrepancy with the electronic version.

1.7.3 Quality Control (QC)

Enter and track implementation of the 3-phase QC Control System, QC testing, transferred and installed property and warranties in RMS. Prepare daily reports, identify and track deficiencies, document progress of work, and support other Contractor QC requirements in RMS. Maintain all data on a daily basis. Insure that RMS reflects all quality control methods, tests and actions contained within the Contractor Quality Control (CQC) Plan and Government review comments of same within 7 calendar days of Government acceptance of the CQC Plan.

1.7.3.1 Quality Control (QC) Reports

The Contractor's Quality Control (QC) Daily Report in RMS is the official report. The Contractor can use other supplemental formats to record QC data, but information from any supplemental formats are to be consolidated and entered into the RMS QC Daily Report. Any supplemental information may be entered into RMS as an attachment to the report. QC Daily Reports must be finalized and signed in RMS within 24 hours after the date covered by the report. Provide the Government a printed signed copy of the QC Daily Report, unless waived by the Contracting Officer.

1.7.3.2 Deficiency Tracking.

Use the QC Daily Report Module to enter and track deficiencies. Deficiencies identified and entered into RMS by the Contractor or the Government will be sequentially numbered with a QC or QA prefix for tracking purposes. Enter each deficiency into RMS the same day that the deficiency is identified. Monitor, track and resolve all QC and QA entered deficiencies. A deficiency is not considered to be corrected until the Government indicates concurrence in RMS.

1.7.3.3 Three-Phase Control Meetings

Maintain scheduled and actual dates and times of preparatory and initial control meetings in RMS. Worksheets for the three-phase control meetings are generated within RMS.

1.7.3.4 Labor and Equipment Hours

Enter labor and equipment exposure hours on a daily basis. Roll up the labor and equipment exposure data into a monthly exposure report.

1.7.3.5 Accident/Safety Reporting

Both the Contractor and the Government enter safety related comments in RMS as a deficiency. The Contractor must monitor, track and show resolution for safety issues in the QC Daily Report area of the RMS QC Module. In addition, follow all reporting requirements for accidents and incidents as required in EM 385-1-1, Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS and as required by any other applicable Federal, State or local agencies.

1.7.3.6 Definable Features of Work

Enter each feature of work, as defined in the approved CQC Plan, into the RMS QC Module. A feature of work may be associated with a single or multiple pay activities, however a pay activity is only to be linked to a single feature of work.

1.7.3.7 Activity Hazard Analysis

Import activity hazard analysis electronic document files into the RMS QC Module utilizing the document package manager.

1.7.4 Submittal Management

Enter all current submittal register data and information into RMS within 7 calendar days of receiving access to the contract in RMS. The information shown on the submittal register following the specification Section 01 33 00 SUBMITTAL PROCEDURES will already be entered into the RMS database when access is granted. Group electronic submittal documents into transmittal packages to send to the Government, except very large electronic files, samples, spare parts, mock ups, color boards, or where hard copies are specifically required. Track transmittals and update the submittal register in RMS on a daily basis throughout the duration of the contract. Submit hard copies of all submittals unless waived by the Contracting Officer.

1.7.5 Schedule

Enter and update the contract project schedule in RMS by either manually entering all schedule data or by importing the Standard Data Exchange Format (SDEF) file, based on the requirements in Section 01 32 01.00 13 PROJECT SCHEDULE.

1.7.6 Closeout

Closeout documents, processes and forms are managed and tracked in RMS by both the Contractor and the Government. Ensure that all closeout documents are entered, completed and documented within RMS.

1.8 IMPLEMENTATION

Use of RMS as described in the preceding paragraphs is mandatory. Ensure that sufficient resources are available to maintain contract data within the RMS system. RMS is an integral part of the Contractor's required management of quality control.

1.9 NOTIFICATION OF NONCOMPLIANCE

Take corrective action within 7 calendar days after receipt of notice of RMS non-compliance by the Contracting Officer.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

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SECTION 01 45 35

SPECIAL INSPECTIONS

02/15

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3.2 DEFECTIVE WORK

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Statement of Special Inspections

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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.

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2015) International Building Code

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 and qualified in accordance with the Section 01 45 00.00 10 QUALITY CONTROL 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.

1.4 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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Special Inspections Daily Reports
Special Inspections Biweekly Reports

SD-07 Certificates

Fabrication Plant
Steel Joist Institute Membership
Certificate of Compliance
Special Inspector Qualifications; G

SD-11 Closeout Submittals

Comprehensive Final Report of Special Inspections; G

1.5 SPECIAL INSPECTOR QUALIFICATIONS

Submit qualifications for each special inspector.

Certifying Associations	
AABC	Associated Air Balance Council
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
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

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.

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 a copy of the daily reports to the QC Manager.
- d. 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.
- e. 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 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.

- f. 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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SECTION 01 45 35

STATEMENT OF SPECIAL INSPECTIONS

01/20

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Project: SOF Group HQ
 Location: Fort Bragg, NC
 Project #: PN 87437
 Date: 1/22/2020



STATEMENT OF SPECIAL INSPECTIONS

Project Seismic Design Category: C
 Project Risk Category: II
 Project Design Wind Speed (mph): 119
 Number of Stories: 2
 Structure Height Above Grade (ft): 55
 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
Ordinary Concentric Braced Frames	North - South and East-West Directions, See plan for Locations
Horizontal LFRS Elements	Notes
Concrete over metal deck	2nd floor
Metal Roof Deck & Related Fastening System	See Roof Plan
Special Force Transfer Connection	See Details A & B on Sheet S-361

Project: SOF Group HQ
Location: Fort Bragg, NC
Project #: PN 87437
Date: 1/22/2020

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.	DSS Emergency or Standby Power System
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.	DSS Gas lines and associated fittings, anchorage, & flexible Connections
2.	
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	
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

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.

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 <u>PRIOR</u> 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 <u>DURING</u> 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 <u>AFTER</u> 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. CJP groove welds	OBSERVE	Dye penetrant testing (DT) and ultrasonic testing (UT) shall be performed on 20% of CJP groove welds for materials greater than 5/16" (8mm) thick. Testing rate must be increased to 100% if greater than 5% of welds tested have unacceptable defects.
3. 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.
4. 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 - 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**E. 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.

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.

F. STRUCTURAL - COLD-FORMED METAL DECK - PLACEMENT SECTION**THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒**

METAL DECK INSPECTION PRIOR TO 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 DURING 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 AFTER 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. Manufactures 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.

G. STRUCTURAL - COLD-FORMED METAL DECK – WELDING SECTION**THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒**

METAL DECK INSPECTION <u>DURING</u> 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 <u>AFTER</u> 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.

H. STRUCTURAL - COLD-FORMED METAL DECK – FASTENING SECTION**THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒**

METAL DECK INSPECTION <u>BEFORE</u> 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.

I. 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.

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.

J. 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	✓ 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	✓ 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.

K. 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.

L. 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**M. 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 ²	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

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.

² **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.

N. 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**O. 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**P. 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 ²	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

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.

² **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. 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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TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS

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AMENDMENT 0002

PART 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

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 AVIATION ADMINISTRATION (FAA)

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

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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

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 BACKFLOW PREVENTERS CERTIFICATE

Certificate of Full Approval from FCCCHR List, University of Southern California, attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval will not be acceptable.

1.3.1 Backflow Tester Certificate

Prior to testing, submit to the Contracting Officer certification issued by the State or local regulatory agency attesting that the backflow tester has successfully completed a certification course sponsored by the regulatory agency. Tester must not be affiliated with any company participating in any other phase of this Contract.

1.3.2 Backflow Prevention Training Certificate

Submit a certificate recognized by the State or local authority that states the Contractor has completed at least 10 hours of training in backflow preventer installations. The certificate must be current.

1.4 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 five 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 Project Identification Signs

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

2.1.3 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 Haul Roads

Construct access and haul roads necessary for proper prosecution of the work under this contract in accordance with EM 385-1-1 Section 04. Construct with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic are to be avoided. Submit haul road plan for approval. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, must be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads are subject to approval by the Contracting Officer. Lighting must be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations.

2.2.2 Barricades

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

Amendment 0002*****

2.3 FENCING

Provide fencing along the construction site as shown on the plan drawings (type and location) 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.

*******Amendment 0002**

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.

Amendment 0002*****

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 not be set in concrete or any other rigid material. 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.

*******Amendment 0002**

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 flanged cast iron, 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. All temporary utilities shall be paid by the contractors.

3.3.2 Water

Make connections to existing facilities to provide water for construction purposes. Water used will not be furnished by the Government.

3.3.3 Sanitation

Provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer and periodically empty wastes into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Obtain approval from the system owner prior to discharge into any municipal, district, or commercial sanitary sewer system. Any penalties or fines associated with improper discharge will be the responsibility of the Contractor. Coordinate with the Contracting Officer and follow station regulations and procedures when discharging into the station sanitary sewer system. Maintain these conveniences at all times. Include provisions for pest control and elimination of odors. Government toilet facilities will not be available to Contractor's personnel.

3.3.4 Telephone

Make arrangements and pay all costs for telephone facilities desired.

3.3.5 Obstruction Lighting of Cranes

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

3.3.6 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 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

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, so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Do not place or store trailers, materials, or equipment outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of

the construction site but within the installation boundaries. Trailers, equipment, or materials must not be open to public view with the exception of those items which are in support of ongoing work on any given day. Do not stockpile materials outside the fence in preparation for the next day's work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day.

3.5.4 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. Paint in accordance with facility standards and maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal.

3.5.6 Maintenance of Storage Area

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.

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 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.

3.5.9.1 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 GOVERNMENT FIELD OFFICE

Contractor shall provide one, 12' x 56' (minimum size) separate office trailer for the Corps of Engineers' use only. The trailer shall be located directly beside the loading dock at Building X-7170, which is 37 3/4" high, so that you walk out of the trailer onto the dock. See Sketch 1 for proposed location. The loading dock bumper rails shall be removed to ensure there is a minimal gap between the loading dock and the trailer. Provide skirting on (3) sides of the trailer. The condition of the trailer shall be in like new condition and appearance with operable windows on at least one exterior wall. Exterior doors shall be 3' wide and equipped with a locking hasp mounted with through bolts on the wall and door. The trailer shall be provided with space heat, cooling, electric light and power, electric outlets and toilet facilities consisting of one lavatory and one water closet complete with sanitary collection tank emptied and serviced weekly. The power shall run from the pump house building (X-7169) in a Schedule 80 PVC conduit on the ground until it returns to the trailer. Provide a 125A fused disconnect also. Water shall run above ceiling from latrine in Building X-7170 out to the trailer. Communications will be run overhead from the Mechanical Closet in Building X-7170 out to the trailer. Please note connections coming from Building X-7170 require drilling holes through an existing brick and block wall. Telephone connections shall be provided and installed; six separate telephone lines and data lines shall be provided, one set located in each of the cubicle areas offices and one set located in the open office area. Trailer shall be properly secured to meet all code standards regarding anchoring straps

and hurricane protection. Install a 9'x30' canopy between Building X-7170 and the trailer. The trailer and necessary utility and site alterations and associated requirements shall be provided for the duration of the contract, cost to be borne by the contractor. All setup, maintenance, utility connection from the project site is the responsibility of the contractor along with all fees and associated costs

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.

-- End of Section --

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SECTION 01 57 19

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
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 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 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 172.101	Hazardous Material Regulation-Purpose and Use of Hazardous Material Table
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 an Environmental Compliance Branch, Bldg 3-1137, 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 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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preconstruction Survey

Solid Waste Management Permit; G

Regulatory Notifications; G

Environmental Protection Plan; 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

Solid Waste Management Report; G

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

Solid Waste Management Report; G

Hazardous Waste/Debris Management; G

Regulatory Notifications; G

Sales Documentation; G

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 SPECIAL ENVIRONMENTAL REQUIREMENTS

Comply with the special environmental requirements listed here and included with contract specifications, plans and drawings..

1.6 QUALITY ASSURANCE

1.6.1 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.

1.6.2 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 14 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).

1.6.3 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.

1.6.4 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.

1.6.5 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. Ensure every employee completes a program of classroom instruction or on-the-job training that teaches them to perform their duties in a way that ensures compliance with federal, state and local regulatory requirements for RCRA Large Quantity Generator. Provide a Position Description for each employee, by subcontractor, based on the Davis-Bacon Wage Rate designation or other equivalent method, evaluating the employee's association with hazardous and regulated wastes. This Position Description will include training requirements as defined in 40 CFR 265 for a Large Quantity Generator facility. Submit these 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 North Carolina.

1.6.5.1 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.

1.6.6 Non-Compliance Notifications

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with federal, state or local environmental laws or regulations, permits, and other elements of the Contractor's EPP. After receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions will be granted or equitable adjustments allowed for any such suspensions. This is in addition to any other actions the Contracting Officer may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

1.7 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 15 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:

1.7.1 General Overview and Purpose

1.7.1.1 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, wastewater management plan, air pollution control plan, contaminant prevention plan, pesticide treatment plan, a historical, archaeological, cultural resources, biological resources and wetlands plan, traffic control plan Hazardous, Toxic and Radioactive Waste (HTRW) Plan Non-Hazardous Solid Waste Disposal Plan and borrowing material plan.

1.7.1.2 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.

1.7.1.3 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.

1.7.1.4 Communications

Communication and training procedures that will be used to convey environmental management requirements to Contractor employees and subcontractors.

1.7.1.5 Contact Information

Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

1.7.2 General Site Information

1.7.2.1 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.

1.7.2.2 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.

1.7.2.3 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.

1.7.3 Management of Natural Resources

- a. Land resources
- b. Tree protection
- c. Replacement of damaged landscape features
- d. Temporary construction
- e. Stream crossings
- f. Fish and wildlife resources
- g. Wetland areas

1.7.4 Protection of Historical and Archaeological Resources

- a. Objectives
- b. Methods

1.7.5 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).

1.7.6 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.

1.7.7 Prevention of Releases to the Environment

Procedures to prevent releases to the environment

Notifications in the event of a release to the environment

1.7.8 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.

1.7.9 Clean Air Act Compliance

1.7.9.1 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.

1.7.9.2 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).

1.7.9.3 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.

1.7.9.4 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.

1.7.9.5 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.

1.7.9.6 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.

1.8 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 or will be obtained by the Government:

- (1) Erosion and Sediment Control Certificate of Approval
- (2) Stormwater Management Permit

1.9 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.

1.10 PESTICIDE DELIVERY, STORAGE, AND HANDLING

1.10.1 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.

1.10.2 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.

1.11 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.

1.11.1 Solid Waste Management Report

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the definitions provided in this section), amount, location, and name of the business receiving the solid waste.

1.12 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.

3.1.3 Streams

Stream crossings must allow movement of materials or equipment without violating water pollution control standards of the federal, state, and local governments. Construction of stream crossing structures must be in compliance with any required permits including, but not limited to, Clean Water Act Section 404, and Section 401 Water Quality.

The Contracting Officer's approval and appropriate permits are required before any equipment will be permitted to ford live streams. In areas where frequent crossings are required, install temporary culverts or bridges. Obtain Contracting Officer's approval prior to installation. Remove temporary culverts or bridges upon completion of work, and repair the area to its original condition unless otherwise required by the Contracting Officer.

This requirement shall extend to any existing stormwater management BMPs. The Contractor shall protect these BMPs from damage, and make repairs if necessary.

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.
- b. Select applicable BMPs from EPA Fact Sheets located at <http://water.epa.gov/polwaste/npdes/swbmp/Construction-Site-StormWater-Run-Off-Control.cfm> 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.
- d. Comply with the Erosion and Sediment Control Certificate of Approval.

3.2.1.2 Stormwater Notice of Intent for Construction Activities

Prepare and submit the Notice of Intent for NPDES coverage under the general permit for construction activities to the Contracting Officer for review and approval, if not already obtained by the Government.

Submit the approved NOI and appropriate permit fees onto 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 State Permitting Agency, 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.

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.

3.2.2.1 Erosion Control

Prevent erosion by measures as outlined in those specifications and as used as shown on the Contract Drawings. Use of hay bales is prohibited.

Provide seeding in accordance with Section 32 92 19 SEEDING.

3.2.2.2 Sediment Control Practices

Implement sediment control practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement sediment control practices prior to soil disturbance and prior to creating areas with concentrated flow, during the construction process to minimize erosion and sediment laden runoff. Include the following devices: silt fence, temporary diversion dikes, storm drain inlet protection, rock check dams and other BMPs as shown. Location and details of installation and construction are indicated on the drawings.

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.

3.3 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 and the Clean Water Act Section 404. 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.

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	cubic yards, tons, cubic meters as appropriate
C&D Debris Recycled	cubic yards, tons, cubic meters as appropriate
Total C&D Debris Generated	cubic yards, tons, cubic meters as appropriate
Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount)	cubic yards, tons, cubic meters 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 Solid Waste Management Report

Provide copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, a statement indicating the disposal location for the solid waste that is signed by an employee authorized to legally obligate or bind the firm may be submitted. The sales documentation 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. 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.

3.7.3.3.2 Contractor Disposal Turn-In Requirements

Hazardous waste generated must be disposed of in accordance with the following conditions to meet installation requirements:

- a. Drums must be compatible with waste contents and drums must meet DOT requirements for 49 CFR 173 for transportation of materials.
- b. Band drums to wooden pallets.
- c. No more than three 55 gallon drums or two 85 gallon over packs are to be banded to a pallet.
- d. Band using 1-1/4 inch minimum band on upper third of drum.
- e. Provide label in accordance with 49 CFR 172.101.
- f. Leave 3 to 5 inches of empty space above volume of material.

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.

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 and the state or local authority.

Submit verbal and written notifications as required by the federal (40 CFR 300.125 and 40 CFR 355), state, local regulations and instructions. Provide copies of the written notification and documentation that a verbal notification was made within 20 days. Spill response must be in accordance with 40 CFR 300 and applicable state and local regulations. Contain and clean up these spills without cost to the Government.

3.7.4.2 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, obtain a state or federal permit specific for pumping and discharging ground water prior to surface discharging. Surface discharge in accordance with federal, state, and local laws and regulations.

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 land-applied in accordance with federal, state, and local laws and regulations for land application.

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.

3.9 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. 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. 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.

3.13 CONTROL AND MANAGEMENT OF LIGHTING BALLAST AND LAMPS CONTAINING PCBS

Manage and dispose of contaminated waste in accordance with 40 CFR 761.

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 unless authorized by the Contracting Officer. 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 overfill 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 overfilling 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 without written permission from the Contracting Officer, and then only during the designated times. Confine pile-driving operations to the period between 8 a.m. and 4 p.m., Monday through Friday, exclusive of holidays, unless otherwise specified.

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 --

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08/09

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SECTION 01 58 00

PROJECT IDENTIFICATION
08/09

PART 1 GENERAL

1.1 REFERENCES

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

U.S. ARMY CORPS OF ENGINEERS (USACE)

EP 310-1-6a (2006) Sign Standards Manual, VOL 1

EP 310-1-6b (2006) Sign Standards Manual, VOL 2,
Appendices

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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Sign Legend Orders; G

1.3 PROJECT SIGN

Prior to initiating any work on site, provide one project identification sign at the location designated. Construct the sign in accordance with project sign detail, which can be downloaded at: <https://www.wbdg.org/FFC/NAVGRAPH/graphoc.pdf>. Maintain sign throughout the life of the project. Upon completion of the project, remove the sign from the site.

1.3.1 Construction Project Signs (USACE)

Furnish the construction project sign package, maintain the signs during construction, and remove the signs from the job site upon completion of the project. The construction project sign package consists of two signs: one for project identification and the other to show the on-the-job safety performance of the contractor. The package shall conform to the requirements of EP 310-1-6a and EP 310-1-6b, specifically Section 16. Submit the sign legend orders as described in Section 16 of EP 310-1-6a prior to erecting the signs.

PART 2 PRODUCTS

Not Used

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PART 3 EXECUTION

Not Used

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SECTION 01 74 19.00 37

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT
05/15

PART 1 GENERAL

1.1 GOVERNMENT POLICY

Government policy is to apply sound environmental principles in the design, construction, and use of facilities. As part of the implementation of that policy: (1) practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction and demolition waste from landfills and incinerators and to facilitate their recycling or reuse. A minimum of 75 percent by weight of total project solid waste shall be diverted from the landfill.

1.2 MANAGEMENT

Develop and implement a waste management plan. Take a pro-active, responsible role in the management of construction and demolition waste and require all subcontractors, vendors, and suppliers to participate in the effort. Construction and demolition waste includes products of demolition or removal, excess or unusable construction materials, packaging materials for construction products, and other materials generated during the construction process but not incorporated into the work. In the management of waste consideration shall be given to the availability of viable markets, the condition of the material, the ability to provide the material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates. The Contractor is responsible for implementation of any special programs involving rebates or similar incentives related to recycling of waste. Revenues or other savings obtained for salvage, or recycling accrue to the Contractor. Appropriately permit firms and facilities used for recycling, reuse, and disposal for the intended use to the extent required by federal, state, and local regulations. Also, provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-11 Closeout Submittals

Records

1.4 MEETINGS

Conduct Construction Waste Management meetings. After award of the Contract and prior to commencement of work, schedule and conduct a meeting with the Contracting Officer to discuss the proposed Waste Management Plan

and to develop a mutual understanding relative to the details of waste management. The requirements for this meeting may be fulfilled during the coordination and mutual understanding meeting outlined in Section 01 45 00.00 20 QUALITY CONTROL. At a minimum, environmental and waste management goals and issues shall be discussed at the following additional meetings:

- a. Preconstruction meeting.
- b. Regular QC meetings.
- c. Work safety meetings.

1.5 RECORDS

Records shall be maintained to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Quantities shall be measured by weight. List each type of waste separately noting the disposal or diversion date. Identify the landfill, recycling center, waste processor, or other organization used to process or receive the solid waste. With each report, submit updated documentation for solid waste disposal and diversion, and submit manifests, weight tickets, receipts, and invoices specifically identifying the project and waste material. The records shall be made available to the Contracting Officer during construction, and a copy of the records shall be delivered to the Contracting Officer upon completion of the construction. See Section 01 33 29.00 37 SUSTAINABILITY for additional information and requirements.

1.6 REPORTS

Quarterly and final reports shall include project name, information for waste generated this quarter, and cumulative totals for the project. Each report shall include supporting documentation to include manifests, weight tickets, receipts, and invoices specifically identifying the project and waste material.

1.7 COLLECTION

Separate, store, protect, and handle at the site identified recyclable and salvageable waste products in a manner that maximizes recyclability and salvagability of identified materials. Provide the necessary containers, bins and storage areas to facilitate effective waste management and clearly and appropriately identify them. Provide materials for barriers and enclosures around recyclable material storage areas which are nonhazardous and recyclable or reusable. Locate out of the way of construction traffic. Provide adequate space for pick-up and delivery and convenience to subcontractors. Recycling and waste bin areas are to be kept neat and clean, and recyclable materials shall be handled to prevent contamination of materials from incompatible products and materials. Clean contaminated materials prior to placing in collection containers. Use cleaning materials that are nonhazardous and biodegradable. Handle hazardous waste and hazardous materials in accordance with applicable regulations and coordinate with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS. Separate materials by one of the following methods:

1.7.1 Source Separated Method

Waste products and materials that are recyclable shall be separated from

trash and sorted as described below into appropriately marked separate containers and then transported to the respective recycling facility for further processing.

1.7.2 Co-Mingled Method

Waste products and recyclable materials shall be placed into a single container and then transported to a recycling facility where the recyclable materials are sorted and processed.

1.7.3 Other Methods

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

1.8 DISPOSAL

Control accumulation of waste materials and trash. Recycle or dispose of collected materials off-site at intervals approved by the Contracting Officer and in compliance with waste management procedures. Except as otherwise specified in other sections of the specifications, disposal shall be in accordance with the following:

1.8.1 Reuse

First consideration shall be given to salvage for reuse since little or no re-processing is necessary for this method, and less pollution is created when items are reused in their original form. Coordinate reuse with the Contracting Officer. Sale or donation of waste suitable for reuse shall be considered.

1.8.2 Recycle

Waste materials not suitable for reuse, but having value as being recyclable, shall be made available for recycling. All fluorescent lamps, HID lamps, and mercury-containing thermostats removed from the site shall be recycled. Arrange for timely pickups from the site or deliveries to recycling facilities in order to prevent contamination of recyclable materials.

1.8.3 Waste

Materials with no practical use or economic benefit shall be disposed at a landfill or incinerator.

1.8.4 Return

Set aside and protect misdelivered and substandard products and materials and return to supplier for credit.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

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CLOSEOUT SUBMITTALS

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.

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

SD-03 Product Data

As-Built Record of Equipment and Materials
Warranty Management Plan
Warranty Tags
Final Cleaning
Spare Parts Data

SD-08 Manufacturer's Instructions

Preventative Maintenance
Condition Monitoring (Predictive Testing)
Inspection
Posted Instructions

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G, RO

SD-11 Closeout Submittals

Record Drawings
Certification of EPA and USDA Designated Items; G, RO
Form DD1354; G, RO
Checklist for Form DD1354; G, RO

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/BIM files, in the specified software and format, revised to reflect bid amendments, at the preconstruction conference for projects requiring CADD/BIM 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 20 days 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 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 20 days 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 two copies 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 5 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 3 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 33 29.00 37 SUSTAINABILITY, 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 SDD Notebook.

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 be 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 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 and 01 91 00.00 37 COMMISSIONING 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 09 23.01 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS and 01 91 00.00 37 COMMISSIONING 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.

1.11 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.

-- End of Section --

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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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 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

Training Video Recording; G

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 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 4 for commissioned items without a specified data package requirement in the individual technical sections. Provide a Data Package 4 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. List the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA				
Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used

1.5.5 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 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 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
- z. Contractor information
- 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
- e. Environmental conditions
- f. Preventive maintenance plan, schedule, and procedures
- g. Troubleshooting guides and diagnostic techniques
- h. Wiring and control diagrams
- i. Maintenance and repair procedures
- j. Removal and replacement instructions
- k. Spare parts and supply list
- l. Product submittal data
- m. Manufacturer's instructions
- n. O&M submittal data
- o. Parts identification
- p. Testing equipment and special tool information
- q. Warranty information
- r. Extended warranty information

- s. Testing and performance data
- t. Contractor information
- u. Field test reports
- v. Additional requirements for HVAC control systems

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 TRAINING

Prior to acceptance of the facility by the Contracting Officer for Beneficial Occupancy, provide comprehensive training for the systems and equipment specified in the technical specifications. The training must be targeted for the building maintenance personnel, and applicable building occupants. Instructors must be well-versed in the particular systems that they are presenting. Address aspects of the Operation and Maintenance Manual submitted in accordance with Section 01 78 00 CLOSEOUT SUBMITTALS.. Training must include classroom or field lectures based on the system operating requirements. The location of classroom training requires approval by the Contracting Officer.

3.1.1 Training Plan

Submit a written training plan to the Contracting Officer for approval at least 60 calendar days prior to the scheduled training. Training plan must be approved by the 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.

3.1.1.2 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. Spend 95 percent of the instruction time during the presentation on the OPERATION AND MAINTENANCE DATA. Include the following for each system training presentation:

- a. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.
- b. Relevant health and safety issues.
- c. Discussion of how the feature or system is environmentally responsive. Advise adjustments and optimizing methods for energy conservation.
- d. Design intent.
- e. Use of O&M Manual Files.
- f. Review of control drawings and schematics.
- g. Interactions with other systems.
- h. Special maintenance and replacement sources.
- i. Tenant interaction issues.

3.1.1.3 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.

3.1.1.4 Training Video Recording

Record classroom training session(s) on video. Provide to the Contracting Officer two copies of the training session(s) in DVD video recording format. Capture within the recording, in video and audio, the instructors' training presentations including question and answer periods with the attendees. The recording camera(s) must be attended by a person during the recording sessions to assure proper size of exhibits and projections during the recording are visible and readable when viewed as training.

3.1.1.5 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.

3.1.6 Validation of Training Completion

Ensure that each attendee at each training session signs a class roster daily to confirm Government participation in the training. At the completion of 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.

3.1.7 Quality Control Coordination

Coordinate this training with the CxA in accordance with Section 01 45 00.00 10 QUALITY CONTROL.

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SECTION 01 78 24.00 10

FACILITY DATA REQUIREMENTS
05/18

PART 1 GENERAL

This specification requires the collection, organization, and turnover of electronic Facility Data for specific assets designed and constructed as part of this contract. Provide a Facility Document Set (FDS) and Facility Data Workbook (FDW) as defined in this specification. See Sections 01 33 00 SUBMITTAL PROCEDURES, 01 78 00 CLOSEOUT SUBMITTALS, for additional Facility Data delivery requirements.

1.1 REFERENCES

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

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 19005-3	(2012) Document Management -- Electronic Document File Format for Long-Term Preservation -- Part 3: Use of ISO 32000-1 with Support for Embedded Files (PDF/A-3)
ISO 32000-1	(2008) Document Management -- Portable Document Format -- Part 1: PDF 1.7

1.2 DEFINITIONS AND ABBREVIATIONS

1.2.1 Assets

Assets are specific items of property or equipment.

1.2.2 Attributes

Attributes are individual pieces of Facility Data that describe facilities and their associated assets.

1.2.3 Facility Data

Information defined and collected in the Facility Data Workbook (FDW) and Facility Document Set (FDS).

1.2.4 Facility Document Set (FDS)

An electronically compiled and organized document containing the supporting documents and data used to populate the Facility Data Workbook during its respective phase of development.

1.2.5 Facility Data Workbook (FDW)

A pre-formatted spreadsheet template used to compile Asset, Attribute, Facility, and Space Data that the Government wishes to manage via electronic means. The FDW also contains all requirements associated with

proper collection, organization, and turnover of the Facility Data.

1.2.6 Facility Data Project Execution Plan (FDPxP)

A document that describes the clear and organized plan for the collection, organization, and turnover of the Facility Data deliverables required by this specification.

1.3 UNITS OF MEASURE

Provide Facility Data deliverables utilizing the units of measure identified in the contract documents.

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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Facility Data Project Execution Plan(FDPxP)

SD-10 Operation and Maintenance Data

Facility Data Workbook, Construction Progress; G, RE

Facility Document Set, Construction Progress; G, RE

SD-11 Closeout Submittals

Facility Data Workbook, Construction Final; G, RE

Facility Document Set, Construction Final; G, RE

1.5 QUALITY ASSURANCE

1.5.1 Facility Data Project Execution Plan (FDPxP)

Provide the Government with a plan for the collection, organization, and turnover of the Facility Data deliverables to the Government. At a minimum, include the following items in the FDPxP:

1.5.1.1 Front Matter

Provide a Cover Page, Table of Contents, and Executive Summary/Objectives.

1.5.1.2 Project Information

List the Project Owner, Project Name, Project Location and address, Contract Type, Project Description, Project/Contract Number, Project Milestones.

1.5.1.3 Submittal Schedule

Identify delivery schedule for all deliverables in compliance with the submission requirements identified in this specification.

1.5.1.4 Personnel

Identify key personnel involved in the development of the Facility Data deliverables including Contractor and Government personnel.

1.5.1.5 Facility Data Workbook(s)

Identify Facility and Space Data as applicable at time of FDPxP submission. Individually list every asset group from the FDW Requirements that will require Facility Data collection. No attribute data is required at this time. Identify any asset groups from the FDW Requirements that are not required within the scope of this Contract. Document the version of FDW to be used through the duration of the project.

1.5.1.6 Facility Document Set(s)

Define structure and format of the submittal. Provide a comprehensive outline of the final FDS to be delivered. Organize the outline with headings, titles, and descriptions such that the Government may ascertain that working documents comply with the formatting requirements defined by this specification.

1.5.1.7 Protocols

Detailed procedures:

- a. Facility Data documentation/collection process.
- b. Facility Document Set production/development process.
- c. Collaboration procedures including strategy, meetings, communication, and subcontractor/consultant involvement.
- d. Quality Control, including site verification of FDW, as applicable.
- e. File and folder naming structure.
- f. Hardware and software being used for collection and organization of Facility Data. Identify type, format, and anticipated organization of digital storage media to be provided as part of required deliverables. Include means and methods for checking deliverables for malicious content.

1.5.2 Meetings

To assure that Facility Data requirements are being met through the duration of the project, organize the following meetings and discuss the subsequent topics:

1.5.2.1 Pre-Construction Meeting

At a minimum, discuss the following:

- a. The requirement for Facility Data deliverables under this contract.

- b. Primary roles and responsibilities associated with the development and delivery of the Facility Data deliverables, and.
- c. Identify and agree upon a date and attendance list for the meetings described below:

1.5.2.2 FDPxP Coordination Meeting

- a. Facilitate a meeting following submission and Government review of the FDPxP. Include the Facility Data Preparer(s), Quality Control (QC) Manager, Government's Facility Data Proponent, Contracting Officer's Representative, and Directorate of Public Works (DPW) Facilities Management Specialist (FMS). Also include any Government personnel required for obtaining security clearances and waivers for proper Facility Data collection in this meeting.
- b. The purpose of this meeting is to coordinate the efforts necessary by contract parties to ensure an accurate collection, preparation, quality control, and submittal of these deliverables.
- c. The FDPxP serves as the primary agenda for this meeting. At a minimum, discuss the following:
 - (1) Processes and methods of gathering facility data during construction. Discuss and obtain special permissions and/or waivers as necessary (photo waivers, data encryption, etc.);
 - (2) Contractor Quality Control practices and procedures;
 - (3) Corrective actions necessary for Government approval of FDPxP;
 - (4) Necessity for additional or recurring Facility Data Coordination Meetings outside of those required by this specification, as requested by the Contractor. Intent of these meetings would be to maintain regular contact between responsible parties of the Contractor and Government with regard to development of the facility data deliverables. Conduct status meetings with a frequency agreed upon at this meeting.

1.5.2.3 Submittal Coordination Meeting

- a. Facilitate a meeting following submission and Government review of each design or progress submittal of the Facility Data. Include the Facility Data Preparer(s), Quality Control (QC) Manager, Government's Facility Data Proponent, Contracting Officer's Representative, and Directorate of Public Works (DPW) Facilities Management Specialist (FMS). Include Mechanical, Electrical, Plumbing, and Fire Protection subcontractors as applicable.
- b. The purpose of this meeting is to demonstrate ongoing compliance with the requirements identified in this specification.
- c. The applicable deliverables, along with Government remarks associated with review of these submittals serve as the primary guide and agenda for this meeting. At a minimum, discuss the following during this meeting:
 - (1) Review assets, applicable attributes, facility, and space data in

FDW at time of submittal;

- (2) Demonstrate Quality Control and site verification procedures, as applicable, by Contractor QC;
- (3) Review contents and organization of FDS at time of submittal;
- (4) Discuss Government review comments and/or unresolved items preventing completion and Government approval of the Facility Data Workbook and Facility Document Set.

1.5.3 Facility Turnover and Contract Closeout

Include the Facility Document Set, Construction Final as a deliverable in Facility Turnover and Contract Closeout procedures as defined in 01 78 00 CLOSEOUT SUBMITTALS.

1.5.4 Facility Data Workbook Quality Requirements

For each submittal, ensure that the information contained in the FDW(s) reflects the minimum content requirements defined in the PART 3 EXECUTION portion of this section. Ensure that information provided as part of the FDW(s) conforms to the standards described below:

- a. Compile FDW(s) using approved spreadsheet templates. Do not alter the formatting or organizational layout of the templates in any way. For this Contract, templates are available for download from the USACE CAD/BIM Technology Center website, site information provided in the PART 2 PRODUCTS portion of this section.
- b. Instructions for the proper maintenance and completion of these FDWs are contained in the FDW Requirements contained within the FDW template.

1.5.5 Facility Document Set Quality Requirements

Ensure that information provided as part of each FDS conforms to the electronic and data formatting standards identified below:

1.5.5.1 Document Files

Utilize PDF file format in accordance with ISO 32000-1 and ISO 19005-3 for all document-based files. Provide files from original sources, text-searchable, and saved in "Standard" (uncompressed) resolution. Bookmark and label files as defined in the PART 2 PRODUCTS portion of this section.

1.5.5.2 Photograph Files

If photographs are required, utilize JPEG file format for all photograph and image files. Provide full-color photos with photo resolution of not less than 4 megapixels and not more than 12 megapixels.

Provide a copy of any installation-specific letters or waivers allowing permission to take installed equipment photographs on this Contract. Waivers need not be attached to every photo, only one copy of each permission letter need be included in the Government deliverables.

1.5.5.3 Drawing Files

Provide all drawings required by this specification in full-size PDF format in accordance with ISO 32000-1 and ISO 19005-3. Produce PDF files from original sources, text-searchable, and saved in "Standard" (uncompressed) resolution whenever possible. Bookmark and label files as defined in the PART 2 PRODUCTS portion of this section.

Submission of scanned or photocopied drawing files is prohibited. Only vector-preserved PDF files are acceptable.

1.5.6 Facility Document Set Integrity Requirements

Ensure that information provided as part of each FDS conforms to the integrity standards identified below:

1.5.6.1 File Protection

Do not restrict data files, document files or photographic files from being printed, exported, modified or copied. Do not deliver files with any restrictions (expiration date, locks, etc.) for access, viewing, archiving, or editing.

1.5.6.2 Manufacturer-Specific Documents

Provide text-searchable, vector-based document files from the manufacturer's online or electronic documentation. Color documents are preferred. Provide documents specific to the product(s) installed under this Contract. When possible, do not submit document files containing multiple product catalogs from the same manufacturer, or product data from multiple manufacturers in the same file. Provide documents directly from the manufacturer whenever possible. Do not provide scanned copies of hardcopy documents.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver facility data submittals in an organized and legible manner. Provide submittals adhering to the requirements of described below.

1.6.1 Number of Copies

Provide three identical copies of disks for approval; for each submittal and each facility required. Provide on approved electronic media (one copy per disk or set of disks) as defined below. Provide submittal files on electronic storage media in compliance with the quality requirements identified in this specification.

1.6.2 Malicious Content

Scan all files for malicious viruses using a commercially available scanning program that is routinely updated to identify and remove current virus threats.

1.6.3 Storage Media

Provide facility data on disk-based (DVD-R/RW) media. Any deviations from the required storage media must be approved by the Government. Select and apply technology used for electronic data transmission to ensure that the full Facility Data submittal for each facility is provided on one single

disk, whenever possible. When separation of the submittal is required, first separate the FDS and the FDW onto separate media. Second, separate FDS into logical segments or components. Any further divisions must be documented in the FDPxP and approved by the Government.

Provide Facility Data on disk-based (DVD-R/RW) media. Any deviations from the required storage media shall be approved by the Government. Select and apply technology used for electronic data transmission to ensure that the full Facility Data submittal for each facility is provided on one single disk, whenever possible. When separation of the submittal is required, first separate the FDS and the FDW onto separate media. Second, separate FDS into logical segments or components. Any further divisions must be documented in the FDPxP and approved by the Government.

- a. Apply a label directly printed to storage media. Do not provide adhesive, paper-based labels. List the name of the facility, Project, Project location, Contract number, Designer of Record firm/Prime Contractor company's name, title of submission, and security classification (in accordance with the appropriate security classification labeling regulations) on the label. If multiple disks are provided, clearly document the contents of each disk on the label.
- b. Include the name and contact information of the individual who produced the final data disk to ensure that any problems with the data or media can be easily resolved.
- c. When browsed on any computer, the disk shall display the following folders and their associated content:
 - (1) Facility Data Workbook (containing 1 FDW per facility);
 - (2) Facility Document Set (containing 1 FDS per facility);
 - (3) FDPxP (containing 1 PxP per contract);
 - (4) Readme (Containing 1 TXT, PDF, or HTML file with general use information, organizational instructions, and basic preparer contact information. Include all information included on the storage media label).

1.6.4 Encryption

Encrypt deliverable data as directed by Resident Office Engineer.
Document the encryption to be used in the FDPxP.

PART 2 PRODUCTS

2.1 FACILITY DATA WORKBOOK(S)

Provide one compiled FDW for each facility identified above. Complete all portions of each FDW including facility, space, asset, and attribute data in compliance with the FDW Requirements. The current FDW template (.xlsm format) shall be downloaded from the USACE CAD/BIM Technology Center website at <https://cadbimcenter.erdcdren.mil>.

2.1.1 Spaces

Provide data for all applicable spaces in the facility. Minimum space definitions are as follows:

- a. Provide all rooms as defined in the design documents.
- b. If not otherwise defined, provide a minimum of one "roof" space in the

FDW.

- c. If not otherwise defined, provide a minimum of one "site" space in the FDW.
- d. Provide all spaces not otherwise described, but necessary to accurately indicate the location of all FDW assets required by this specification.

2.1.2 Assets

- a. Compile an FDW that contains the maintainable and warrantable equipment (assets) associated with each facility. This includes assets in contract scope and within the project extents. See 01 78 00 CLOSEOUT SUBMITTALS for related requirements. Assets shall include but are not limited to those types described in the "Required Assets" portion of the FDW template and any additional assets defined in the FDPxP. FDW asset entries shall be individually itemized (instance-based). Entries indicative of multiple assets (type-based) are not allowed.

Assets applicable to the scope of this project shall be documented in the FDPxP.

- b. Sub-component assets that are an integral and functional part of another component (e.g. An electric motor that serves as part of an air-handling unit) need not be duplicated or listed separately as its own asset.
- c. Definitions, descriptions, and formatting requirements for these assets can be found in the FDW Requirements contained within the FDW template.
- d. If an asset type is not included in the scope of the Project, no Facility Data (assets or attributes) are to be included in the FDW (even as a placeholder) for that asset type.

2.1.3 Attributes

- a. Populate each individual asset with all required attributes defined in the "Required Attributes" portion of the FDW template.
- b. Definitions, descriptions, and formatting requirements for these attributes can be found in the FDW Requirements contained within the FDW template.
- c. If an attribute is not applicable, populate that field with "N/A." Do not leave it blank.

2.2 FACILITY DOCUMENT SET

2.2.1 Organization

Organize the FDS in a hierarchical manner as follows. Use electronic bookmarks to create an easily navigable document. The first and primary hierarchical level must contain the following bookmarks:

- a. "Design Data" - See subordinate hierarchical requirements in the "DESIGN DATA HIERARCHY" paragraph.
- b. "O&M Data" - See subordinate hierarchical requirements in the "O&M DATA HIERARCHY" paragraph.

- c. "Record Drawings" - See subordinate hierarchical requirements in paragraph RECORD DRAWINGS HIERARCHY.

PART 3 EXECUTION

3.1 CONSTRUCTION PROGRESS SUBMITTALS

Submit the FDW and FDS construction progress submittals together. Meet the following completeness and formatting requirements listed below:

- a. Provide Facility Data Workbook, Construction Progress submittal(s) when all assets are identified, but not later than 60 days prior to Beneficial Occupancy Date (BOD) as identified in the Government-Approved construction schedule. Clearly identify any assets or asset groups missing in the "variations" section of the ENG Form 4025 Transmittal Form provided with the submittal. Populate assets with any front-loaded attribute data that is available at the time of asset input. See the FDW Requirements contained within the FDW template for a list of attributes to be completed for this submittal.
- b. Submit individual FDW templates for each facility identified in the "FACILITIES" paragraph. While FDWs are not required to be complete for this submittal, any data provided shall be accurate and formatted correctly according to the FDW Requirements.
- c. Submit a sample or working Facility Document Set, Construction Progress submittal containing "draft" or "example" documents that are organized in the manner defined by this specification. Draft or example documents need not be technically accurate or complete in their content, but defined and separated in a manner such that all organizational and formatting requirements defined by this specification may be evaluated.

3.2 CONSTRUCTION FINAL SUBMITTALS

Submit the FDW and FDS construction final submittals as they are completed. Coordinate the Facility Data Workbook, Construction Final submittal with data verification procedures as defined in the accepted FDPxP. Provide the Facility Document Set, Construction Final submittal only after Government acceptance of its individual components as defined by 01 78 00 CLOSEOUT SUBMITTALS and 01 78 23 OPERATION AND MAINTENANCE DATA.

3.3 FACILITY DATA WORKBOOK VERIFICATION

Verify the FDW through the quality control personnel and procedures as defined in the FDPxP. One-hundred percent accuracy of FDW information is required for Government acceptance.

-- End of Section --

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ATTACHMENTS:

Basis of Design

Owner's Project Requirements

Preliminary Commissioning Plan

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COMMISSIONING
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PART 1 GENERAL

1.1 REFERENCES

The references below form a part of this specification to the extent referenced. The publications are referred to within the text by 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; ERTA 3/2015, 4/2017, 3/2018, 3/2019) Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED BDC Ref Guide	(2013) USGBC LEED Reference Guide for Building Design and Construction, v4
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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. Cx does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product.

1.3.1 Applicable Criteria

The work shall conform to the following:

a. LEED BDC 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 (CA)

The CA will be provided by the Government. All submittals and correspondence for the CA shall be submitted to the CA through the Contracting Officer's Representative (COR). Descriptions of tasks and products provided by the Government CA are included in this Section for Contractor information and coordination purposes.

1.3.3 LEED

See Section 01 33 29.00 37 SUSTAINABILITY. Project shall meet the requirements for LEED Energy & Atmosphere (EA) Prerequisite 1, Fundamental Commissioning and Verification and EA Credit 1, Enhanced Commissioning.

1.3.4 Process

The following activities outline the Cx tasks and the general order in

which they occur. The Commissioning Agent (CA) shall coordinate all activities.

- a. Review construction documents, basis of design and design intent documents prepared by Designer of Record (DOR). LEED Owner's Project Requirements (OPR) and Basis of Design (BOD) documents are attached.
- 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:

Product

Developed By

Design document review	CA
Draft and Final Cx Plan	CA
Meeting minutes	Contractor (CTR)
Cx schedules	CTR, CA, Contracting Officer's Representative (COR)
Equipment documentation submittals	CTR
Sequence clarifications	CTR
PFT checklists	CTR with CA review
Startup and initial checkout plan	CTR, CA compiles existing documents
Completely filled out startup, initial checkout, and PFT forms and checklists	CTR
TAB Plan	CTR with CA review
Final TAB report	CTR with CA review
Commissioned systems issues log (deficiencies)	CA
Cx Progress Record	CA
Commissioned systems deficiency reports	CA
FPT forms	CA with CTR assistance
Completely filled out FPT forms	CA, CTR with CA review
O&M Manual	CTR
Systems Manual	CA with CTR assistance
Cx record book	CA
Training Plan	CTR with CA and COR review
Specific training agendas	CTR
Final Cx Report	CA
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. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Control Drawings; CA

SD-06 Test Reports

Filled out functional test readiness forms; G, RO; CA

Completed PFT checklists; G, RO; CA

Completed startup checklists; G, RO; CA

Completed PVT forms; CA

Nonconformance and Approval in PFT checklists and Startup; CA

Progress reports and test results

SD-07 Certificates

Calibration documentation; CA

Calibration certification; CA

SD-08 Manufacturer's Instructions

Startup and Checkout Plan; CA

Checkout Forms; CA

Test Procedures; CA

SD-10 Operation and Maintenance Data

Training Plan; G, RO; CA

Training Documentation; CA

Training Verification; CA

SD-11 Closeout Submittals

Deficiency Report and Resolution Record; CA

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 Agent.

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. Building envelope including thermal and moisture integrity and air tightness
- f. Water and energy measurement devices
- g. EMCS/UMCS systems

1.7 COORDINATION

1.7.1 Commissioning Team

The members of the Cx team shall consist of the CA, the Contractor, the COR, subcontractors, QC Specialists, Designers of Record (under construction period services contract with the Government) 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 CA 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 CA shall work with the Contractor and the COR to schedule the Cx activities. The CA shall provide the initial schedule of primary events at the Cx scoping meeting. The Draft Cx Plan shall provide a format for this schedule, and both shall be submitted together. The CA shall provide sufficient notice to the Contractor and the COR for scheduling Cx activities. The Contractor shall integrate all Cx activities into the master schedule. As construction progresses the CA shall update the Cx schedule with more details. Notify the Contracting Officer and CA 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 CA within 90 days of award of the construction Contract. The CA shall plan and conduct the Cx scoping meeting with the entire Cx team in attendance (attendance by conference call is acceptable). 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 CA 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 CA 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. Attendance by conference call is acceptable. 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 CA are not responsible for construction means, methods, job safety, or management function related to Cx on the job site.

1.8.1 CA Responsibilities

The CA 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 and evaluated by the CA for compliance with Cx needs and the Contract documents. The CA shall ensure proper coordination and submission of all documents. During construction, the CA 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 (attendance by conference call is acceptable); review construction meeting minutes for potential revisions or substitutions related to the Cx process; and assist in resolving any discrepancies.

1.8.2 Contractor Responsibilities

The 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). In each purchase order or subcontract written, requirements for submittal data, Cx documentation, O&M data, and training shall be included. During construction, the Contractor shall maintain as-built red-line drawings for all drawings and final CAD as-builts for contractor-generated coordination drawings. These drawings shall be updated after completion of Cx (excluding deferred testing). See attached Commissioning Plan for additional Contractor responsibilities. The Contractor shall use the CA's commissioning software to document pre-functional checklists, issues logs, performance verification tests, etc.

1.9 COMMISSIONING PLAN

The CA 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, attached 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, including applicable excerpts from approved Construction Quality Control (CQC) Plan.
- 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 and design intent (prepared by DOR and obtained from the Government).
 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 and including applicable excerpts from CQC Plan.
 4. System performance verification.
 5. Submittal review procedures, including applicable excerpts from CQC Plan.

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, including applicable excerpts from CQC Plan.

8. Warranty period activities.

f. A list and description of the written work products, as specified in the paragraph Written Work Products.

g. An activity schedule.

h. A description of the rigor, scope, and procedures of testing and acceptance, including applicable excerpts from CQC Plan.

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 CA shall update and submit the Draft Cx Plan for Contracting Officer final review. The CA shall adjust the Draft Cx Plan as required and submit as the Final Cx Plan and schedule prior to commencement of work. The Final Cx Plan shall include specific scheduling of 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 CA shall request in writing from the 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 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 CA. The CA 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 CA 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 Report

The CA shall compile a Final Cx Report focusing on evaluating Cx process issues, and provide two electronic copies to the Contracting Officer

within 30 days after completion of all FPTs. 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 CA shall provide the following for each piece of equipment:

- a. Assessment of how the equipment meets the specifications 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 CA shall be included in the report, certifying the Cx Plan has been successfully executed and the design intent of the facility has been achieved.

1.11.2 Systems Manual

The CA shall develop an indexed systems manual to be submitted in electronic version with the Final Cx Report. 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 subcontractors, 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.

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 Contractor shall provide all test equipment necessary to perform startup and initial checkout and required FPT. 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 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.

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 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 CA. The Cx procedures and FPT do not relieve or lessen this responsibility or shift that responsibility partially to the CA 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 Contractor shall assist the CA in developing the PFT checklists. The manufacturer and Contractor shall develop the detailed startup plans for all equipment. The primary role of the CA 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 CA 2 weeks minimum prior to PFTs being performed. The 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.

3.1.2.2 Startup Plan

The Contractor shall develop the full startup plan and submit the plan to the CA for review and approval. The CA 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 Contractor shall schedule PFT activities with the Contracting Officer and CA. The Contractor shall execute the PFTs of all equipment and systems defined in the commissioning plan. The CA may attend the PFTs. The Contractor shall fill out the PFT checklists and submit the completed PFT checklists to the CA for review and approval. The Contractor shall use the CA's commissioning software to document pre-functional checklists.

3.1.4 Execution of Startup

Two weeks prior to startup, the Contractor shall schedule startup and checkout activities with the Contracting Officer and CA. Prior to start-up of all commissioned equipment the pre-functional checklists must be approved by the CA. The Contractor shall execute the start-up of all equipment and systems defined in the commissioning plan. The 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 CA may attend the startup.

3.1.4.1 Startup Documentation

After startup completion, the Contractor shall provide the CA 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.

3.1.5 Nonconformance and Approval in PFT Checklists and Startup

The 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 CA within 2 days of test completion. The CA shall review the report and submit either a nonconformance report or an approval form to the Contracting Officer. The Contractor shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA 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 CA shall recommend approval of the execution of the PFTs and startup of each system to the Contracting Officer using a standard form. Contractor shall notify CA 2 weeks minimum prior to any re-inspection and get approval from the CA prior to starting re-inspection.

3.2 SENSOR AND ACTUATOR CALIBRATION

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. The Contractor shall use the CA's commissioning software to document all sensor and actuator calibration.

3.2.1 Calibration Methods

Alternate methods may be used, if approved by the Government beforehand.

3.2.1.1 All Sensors

The 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 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 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 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 Contractor shall be responsible for Cx activities related to controls. Before initial startup, the Contractor shall gather and review the current control sequences and interlocks and with the CA 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 CA. The Contractor shall use the CA's commissioning software to document performance verification tests. Controls contractor shall perform functional performance tests with CA directing and witnessing the tests. Controls contractor shall provide their controls proprietary software for the CA and TAB contractor to install on their computers so they are capable of controlling and viewing the control system. The Contractor will be required to provide all tools necessary to perform these tests.

3.4 TAB

TAB shall be completed after controls are tested, checked out, and adjusted. The 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 CA. 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. LIGHTING CONTROLS MANUFACTURER SHALL BE PRESENT FOR THE COMMISSIONING OF THE LIGHTING SYSTEM.

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.

3.5.2.5 Commission Requirements

Lighting controls manufacturer shall be present for the commissioning of the lighting system.

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 Contractor shall prepare testing plans and checklists and coordinate them with CA.

3.7 FUNCTIONAL PERFORMANCE TESTING

The Contractor shall provide FPT of all commissioned equipment and systems. The CA 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 O. The Contractor shall document the FPT of all equipment and systems that are not witnessed by the CA. The Contractor shall notify the CA and the COR a minimum of 2 weeks prior to start of functional tests and shall get approval from the CA prior to starting functional tests. 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 CA 2 weeks minimum prior to FPTs being performed. The Contractor shall execute the tests with skilled technicians provided under the direction of the CA. 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 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 Contractor shall assist the CA to develop the FPT procedures in a sequential written form, and coordinate, oversee, and document the actual testing.

3.7.1 Development of Test Procedures

Before test procedures are completed, the Contractor shall provide to the CA 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 CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. The Contractor shall assist the CA 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 CA shall provide the test procedures to the Contractor for review. The 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 CA, 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 Contractor and CA shall determine which method, or combination of methods, is most appropriate for tests that do not have a method specified. The Contractor shall provide FPT of commissioned equipment and systems. The CA 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 Contractor. The Contractor shall assist the CA 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 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 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 CA shall schedule FPTs through the 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.

3.7.4 Documentation, Review and Approval

The CA shall document the results of all FPTs witnessed by the CA (as indicated in paragraph FUNCTIONAL PERFORMANCE TESTING) using the specific test procedures and forms developed by the CA for that purpose. For all equipment and systems not witnessed by the CA, the Contractor shall document the results of all FPT and submit the completed PVT forms for CA review. The CA 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 CA and the Contractor. The CA 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 CA 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 Contractor shall have responsibility for resolving construction deficiencies, and the CA 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 CA shall maintain a master deficiency and resolution log, and shall provide the Contracting Officer with written progress reports and test results with recommended

actions.

3.8.1 Procedure

All deficiencies or nonconformance issues shall be noted and reported to the Contracting Officer and CA. The Contractor shall report in writing to the CA 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 CA, 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 CA shall discuss the issue with the Contractor. When there is no dispute on the deficiency and the Contractor accepts responsibility to correct it, the CA shall document the deficiency, the adjustments or alterations required to correct it, and the Contractor's response and intentions. The next test or sequence may then be performed. After the day's work, the CA shall submit all the nonconformance reports to the Contracting Officer for signature. Copies shall be provided to the Contractor and Contracting Officer. The Contractor shall correct the Deficiency and notify the CA and COR that the equipment is ready to be retested. The CA shall reschedule the test and the test shall be repeated as specified in the paragraph Retesting.

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 form with the Contractor's response and a copy given to the Contracting Officer and 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 CA shall document the resolution process. Once the interpretation and resolution have been decided, the Contractor shall correct the deficiency, sign the statement of correction on the nonconformance form and provide it to the CA. The CA shall reschedule the test and the test shall be repeated as specified in the paragraph Retesting.

3.8.2 Retesting

The cost to retest a prefunctional test or FPT shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor. The CA or Contracting Officer's representative shall witness retesting as necessary until satisfactory performance is achieved. Notify the CA a minimum of 2 weeks prior to any retesting and get approval from the CA prior to starting any retesting.

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 Contractor shall provide the Contracting Officer with the following:

- a. Within 1 week of notification from the Contracting Officer, the 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 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 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 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 CA 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

If contracted to do so, the CA 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 Contractor shall execute and document tests and correct deficiencies with facilities staff and the CA or Contracting Officer's representative witnessing. Testing shall be completed during the warranty period to fully test all sequences of operation. The Contractor shall make necessary revisions to O&M manuals and records due to the testing.

3.9.3 Short-Term Diagnostic Testing

After initial occupancy, the 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 Contractor shall document tests and findings, and correct deficiencies according to the original testing requirements.

3.10 TRAINING

For each commissioned system, the Contractor shall conduct a training course for approximately 3 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 Contractor shall make audiovisual recordings of all training sessions and add them to the O&M manuals. A training day is defined as 8 hours of classroom instruction, including two 15-minute breaks and excluding lunchtime, Monday through Friday, 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. The training shall not occur until after the functional performance tests have been successfully completed and the training manual has been reviewed and approved by the government and Commissioning Agent.

3.10.1 Training Plan and Schedule

The Contractor shall prepare the training plan which shall be reviewed by the CA 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 Contractor shall work with the CA 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

Contractor shall prepare training documentation consisting of:

- a. Course Sign-in Sheet: A list of course attendees which shall be signed and dated by all attendees including the instructor. Provide two 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 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 additional copies delivered to the COR for archive.

3.10.4 Training Verification

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 CA for inclusion in the Cx Report. The CA shall verify that all training in the approved training plan has been conducted.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 91 00.00 37

BASIS OF DESIGN

01/20

-- End of Section Table of Contents --

Basis of Design Document for LEED Fundamental Commissioning

SOF Group Headquarters Building, Fort Bragg, North Carolina

Approved:

Name

Design Agent's Representative

Date

Name

Commissioning Authority

Date

Overview and Instructions

The purpose of this document is to provide clear and concise documentation of the Designer's response to the Owner's goals, expectations and requirements for commissioned systems, and shall be utilized in conjunction with the Owner's Project Requirements Document for LEED Fundamental Commissioning throughout the project delivery and commissioning process to provide an informed baseline and focus for design development and for validating constructed systems' energy and environmental performance.

The Basis of Design Document for LEED Fundamental Commissioning is a required document for LEED Version 4 EA Prerequisite, Fundamental Commissioning and Verification. It shall be completed by the Designer and shall be reviewed and approved by the Design Agent (as Owner's representative) and the Commissioning Authority.

Use of this template is not required, nor are there any restrictions on editing of it. It is provided simply as a tool to assist project teams in meeting the documentation requirements for LEED Fundamental Commissioning.

This template has not been coordinated with the requirements of ASHRAE Guideline 1, The HVAC Commissioning Process. If compliance with ASHRAE Guideline 1 is required, this document must be edited as needed to comply.

The Basis of Design Document for LEED Fundamental Commissioning shall be submitted with each design submittal, updated as design progresses, and submitted complete as part of the final design submittal. It must be completed prior to the approval of Contractor submittals of any commissioned equipment or systems to meet LEED requirements. Subsequent updates to the document will be made as needed during the as-built phase. Development of and all updates to this document shall be made by the

USACE LEED Basis of Design Template

(Based on PECI Model Commissioning Plan and Guide Specifications document PECI D_INTENT.V08)

Designer and approved by the Design Agent (as Owners Representative) and the Commissioning Authority.

The intent of the Basis of Design Document for LEED Fundamental Commissioning, per the LEED v2.2 Reference Guide, is to describe the design of systems to be commissioned and outline any design assumptions that are not otherwise included in the design documents. This template contains the basic recommended components indicated in the LEED v4 Reference Guide. It shall be adapted as needed to suit the project, remaining reflective of the LEED intent.

The document shall address the primary areas related to energy use and comfort for which the design intent and basis of design should be defined. The design intent provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner, coming out of the programming and conceptual design phases. The 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 format merges the salient parts of the design intent and basis of design. The design intent evolves from more general descriptors during the conceptual design, to more specific descriptors during actual design, to in-depth and specific descriptors during the specifying stage, which are finalized during the as-built phase. As part of the design narrative, one-line CAD drawings shall be developed for the systems listed in the *Design-Phase Commissioning Plan*.

Under each area or building system is an outline of pertinent questions and data needed. Sequences of operation for all outlined dynamic systems and components should be clearly documented. Attaching equipment manufacturers' sequences may be acceptable, but will generally require additional narrative.

Updates to the Basis of Design Document for LEED Fundamental Commissioning throughout the course of project delivery shall be made by the Designer based on decisions and agreements coordinated with and agreed to by the Design Agent as Owner's representative and the Commissioning Authority.

The Basis of Design Document for LEED Fundamental Commissioning shall be included in the project's LEED documentation file under EA Prerequisite, Fundamental Commissioning and Verification.

Basis of Design Document for LEED Fundamental Commissioning

Contents

1. General Building Design, Function and Landscaping
 - Overview
 - Sustainable construction and environmental compatibility
 - Indoor environmental quality—thermal, air distribution, acoustics, air quality, visual quality
 - Landscaping
2. HVAC Systems and Design Parameters
 - Overview
 - Design conditions and load assumptions
3. Chiller System (Chillers, Cooling Towers, Pumps, Piping)
4. Boiler and Heating Water System
5. Roof Top Packaged System(s)
6. VAV Terminal Units – Air Conditioning Only (TU-AC)
7. VAV Terminal Units – Reheat (TU-RH)
8. Heat Recovery Unit (HRU)
9. Computer Room Air Conditioning Unit (CRACU)
10. Daylighting Controls
11. Lighting Sweep Control
12. Building Automation System (BAS)
13. Split Air Conditioning; Heat Pump System
14. Emergency Power System

1 General Building Design, Function, and Landscaping

1.1 General Building Design and Function

What are the general design objectives regarding energy efficiency?

Meeting UFC 1-200-02, Building energy achieve 30% better than ASHRAE 90.1-2013 if LCCE, Meet Army SDD, and LEED v4 Silver certification

Comfort and indoor environmental quality?

Meet ASHRAE 55-2013 and ASHAE 62.1-2013 as well as UFC 4-214-02

Sustainability and environmental compatibility?

Meet UFC 1-200-02 and Army SDD

Other:

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

All UFCs and codes as well as ASHRAE Standards

1.2 Sustainable Construction and Environmental Compatibility

Design Intent

What are the objectives regarding sustainability and environmental compatibility?

Integrative Design is used to involve all stake holders, develop clear project and energy goals, and commission the building systems. Objectives are select sites based on sustainable practices, mitigate heat island effects, reduce light pollution, and provide stormwater management.

Basis of Design-General Description and Function

How will the building/grounds systems meet the design intent?

The site was not previously developed.

The building orientation is based on the roads. Pavement is used and light colored roof to mitigate heat island effects. The 98th percentiles storm water is captured using low impact developments.

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

UFC 1-200-02 and Army SDD

1.3 Indoor Environmental Quality

Design Intent

What are the general objectives for indoor environmental quality?

To meet ASHRAE 62.1-2013 and ASHRAE 55

Thermal Comfort—General Description and Function

Record the occupant activity and design temperatures for the various spaces in Table 1.

Air Distribution

What issues were considered in choosing diffusers?

Diffusers were selected to provide cooling without blowing directly on the occupants.

Is the return air (RA) ducted or open-plenum? Why?

All return air is ducted because it is required by UFC.

Are the RA grills in every room? Why?

Ducted return.

What special considerations are being given to spaces with high solar load regarding cooling, large glazed areas, cold-air convective drafts, etc.? What solutions were used?

Due to type and function of buildings no special considerations were required.

Acoustics

What is the design NC (noise criteria) sound level? Provide this information in Table 1. Are there any special acoustical considerations for any areas (areas close to the AHU, private areas, open office areas, etc.)? How will this criteria be met? (flexible duct, duct lining, fan type, lead wraps, diffuser type, TU damper type, etc.)

Noise class (NC) 35-40 for closed offices and 41-43 for open offices, recommended by ASHRAE)

The project just needs to meet the UFC for sound. Some areas will need additional sound requirements to meet STC-50.

Air Quality

For the general building and individual spaces, what is the desired outside air fraction or cfm per person and the number of persons per square foot? (Provide this information in Table 1). Is the outside air (OSA) controlled by CO₂ monitors? Explain. Are there airflow measurement devices provided?

Outside air is determined by ASHRAE 62.1-2013. Densely occupied spaces will require CO₂ sensors. Demand controlled ventilation shall be used in class and conference rooms. Ventilation air shall be controlled at the AHU.

Can occupants adjust ventilation? How and what limits apply to what areas?

Occupants cannot adjust ventilation.

Are there any special indoor pollutant source concentrations? How are they handled? List areas served by exhaust fans, the fan size, air changes per hour and operational control.

Janitors closets and restrooms are exhausted through the ventilation system.

Is smoking of tobacco products allowed in or near the building? Y/N

N

How will the fresh air rate be maintained at low supply air volumes of the VAV system? Are perimeter zones treated differently than interior zones (reheat box damper settings, etc.)?

The DOAS system will constantly calculate ASHRAE 62.1 required flow for the VAV system. Due to the climate, perimeter zones are not treated differently.

Where are the outside air intakes located? Are they near any potential sources of pollutants?

Per ATFP, the outside air intakes are 10 feet above grade and on the back of the building away from pollutants.

Are full-drain condensate pans used in the air handler units? ☒Yes / ☐No

What other special IAQ issues were considered?

Visual Quality

What are the design footcandle levels for the various spaces? (Provide this information in Table 1). Why? Is additional task lighting assumed?

Footcandle levels are per UFC 4-214-02 and UFC 3-530-01 and IES Lighting Handbook. Levels to meet ASHRAE 90.1-2013. Task lighting is included with furniture per Reserve requirements.

Do any spaces have special glare requirements? ☐Yes / ☒No

How will they be met? (special light fixtures and lenses, fixture layout, special CRT screens, etc.)

How will glare be controlled in daylit areas?

Shades are included in project and window design is to decrease glare.

What are the parameters and sequences of operation for the daylighting controls and dimming lights? How will occupants interact with the system (overrides, education, etc.)?

The daylighting controls are not provided.

Can occupants adjust the lighting system?

Yes per on/off switches

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

UFCs and codes.

1.4 Landscaping

Design Intent

Describe the objectives and the elements of the specific landscape design that contribute to energy efficiency, water conservation, and comfort.

Irrigation will not be used. Drought tolerant plants
and native grasses will be used.

Sequences

What are the main control sequences for the watering systems that ensure water conservation?

N/A

Maintenance

Are there any special instructions as to the care of the landscape elements that will enhance or degrade their energy and comfort benefits? (refer to O&M manual sections, if applicable)

N/A

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

Army SDD, UFC 1-200-02

Number of sheets attached to this section: _____

1.5 Interior Conditions Basis of Design

Table 1

Reception, records, conference room, closed offices, open offices, exercise room, lunch room, inventory, stock, etc.

TABLE 1: Room / Area	<u>Occ'd</u> Cooling (°F)	<u>Unocc'd</u> Cooling (°F)	<u>Occ'd</u> Heating (°F)	<u>Unocc'd</u> Heating (°F)	Relative Humidity	Vent. Per Person (cfm)	Vent per Sq. Ft. (cfm)
Offices	78	85	68	55	30-50%	5	0.06
Conference Rooms	78	85	68	55	30-50%	5	0.06
Break Rooms	78	85	68	55	30-50%	5	0.12
Reception	78	85	68	55	30-50%	5	0.06
Copy/Work Rooms	78	85	68	55	30-50%	5	0.5
Storage	78	85	68	55	30-50%	0	0.12
Corridor	78	85	68	55	30-50%	0	0.06
Elec/Tele Rooms	78	80	55	55	30-50%	0	0.06
Restrooms	-	-	68	55	-	50 cfm per fixture	-

2 HVAC Systems and Design Parameters

2.1 General

General description of the main HVAC systems and areas served.

<u>System</u>	<u>Areas Served</u>
VAV System	Office, Break, and other conditioned areas.
AC-X/CU-X	Electrical and Comm Areas

Why were the above particular systems chosen?

Systems were selected by Life Cycle Cost Analysis and to meet the project and UFC requirements.

Describe the level of priority given to energy conservations for the system.

Energy conservation is one of the main concerns with high priority.

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

UFCs, codes, ASHRAE standards

2.2 Specific System Descriptions

System	Heating / Cooling / Both	Areas Served
All	Cool/Heat	Whole building

What is the rationale for the way the HVAC and lighting were zoned?

The HVAC was zoned per industry standards, UFC 4-214-02, and similar load profiles. Lighting is zoned similar per industry standards and UFC.

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

UFCs and codes

2.3 Load Calculations

What outdoor design conditions were assumed for load calculations?

Summer: DB 94 WB 75.2 Winter: DB 26.2

What indoor design conditions were assumed for load calculations?

Summer: DB 78 RH 50 Winter: DB 68 RH 50

Internal load assumptions: Lighting: 0.4 W/sf. Misc: 1.24 W/sf. Other: _____

SF/Person: _____ Btu/hr/person: sensible _____, latent _____

Ventilation: _____ cfm/person. Basis (code, etc.): ASHRAE

Infiltration: ☒ 0.04 cf/sf wall area, or ☐ _____ air changes per hour.

Glazing:

Orientation	% of Wall Area	Overall U	SC
N			
S			
E			
W			

What overall safety factor was used and how much diversity was assumed for the heating, cooling plant and fan size?

No safety factors and minimal diversity

For redundant equipment, what redundancy criteria were used?

No redundant equipment

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

UFCs and codes

Number of sheets attached to this section: _____

(Complete the following sections for each commissioned system as applicable or indicate "N/A". Add sections with similar information for additional other anticipated commissioned systems as applicable)

3 Chiller System (Chillers, Cooling Towers, Pumps, Piping)

3.1 Design Intent (Provide this information for each chiller)

What is this chiller system used for? ☐ Supplies chilled water to air handler units to cool building space. ☐ Computer room AC units. ☐ Process chilled water

☐ Heat recovery for: _____

Other: _____

What areas of the building do this chiller serve? All conditioned areas with exception of IT and TR spaces.

List the areas that this chiller does not serve? All IT and TR spaces.

What types of air conditioning equipment serve the areas not served by this chiller? Dedicated air to air split systems.

What vibration and noise considerations are given to the location of this chiller? None. Chiller located outside on grade.

What energy efficiency objectives are there for the chiller system? ☒ Highly efficient, ☐ Moderately efficient, ☐ Standard efficiency

What level of automatic control features are desired for this chiller system relative to automatic staging, optimization, central building automation system monitoring and control capabilities, etc.? ☒ Highly automated, ☐ Moderately automated, ☐ Minimally automated

What type of refrigerant will be used and why? 410A or 134A for sustainability and LEED.

3.2 Basis of Design-Components Description and Methods for Meeting Design Intent

Chillers

Briefly describe the chiller system.

Air cooled chillers located on grade. Variable primary pumping with 100% pumping. Chiller bypass valve for minimum chiller flow.

- ☐ Centrifugal ☒ Screw
- ☐ Hermetically sealed
- ☐ Heat recovery
- ☐ Refrigerant type: _____
- ☒ Air cooled ☐ Water cooled
- ☐ Evaporative cooled
- ☐ Capacity control type: _____
- ☐ Prerotation vanes
- ☐ Other: _____
- ☐ Reciprocating chiller
- ☐ Heat recovery
- ☐ Refrigerant type: _____
- ☐ Air cooled ☐ Water cooled
- ☐ Evaporative cooled
- ☐ Stages of unloading: _____
- ☐ Other: _____

How many chillers of each size are there? (size and number of each size): _____
One chiller sized for building chilled water block load.

Is there a standby / redundant chiller during design conditions? No

Are there isolation valves for when only one chiller is running? _____

What method was used for determining the design cooling load? Trane Trace

Attach load calculations and assumptions, if not given in a previous section. (Diversity, safety factor, outdoor DB, WB, indoor DB, lighting W/sf, plug loads W/sf, sf/person, ventilation cfm/person, infiltration rate, glazing % of wall, overall U; SC).

Describe any provisions in the chiller system for accomodating future building or load expansion.

No Previsions for future load.

What evidence can be provided to show the chillers are not oversized? Load calculations

Why were they chosen to be different or equal size? _____

Was variable compressor speed seriously considered? If not, why not? Variable speed drive included with basis of design chiller.

Was heat recovery for the chiller analyzed? NO Why or why not? Cost and complexity

What were the results of the analysis? _____

What vibration and noise considerations were given to the model and features of the selected chillers? Chiller selected with a "quiet" design package for minimum noise.

What is the rated efficiency of each chiller at full load and the APLV, in kW/ton? _____
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What rationale was used to select these efficiencies with the sizes? Were more efficient models analyzed? _____

Attach engineering or energy simulation and economic calculations for the selections.

Are the chillers intended to be staged back and forth, depending on load, to minimize energy use?

Single chiller with 2 compressors and variable speed drives.

Will staging occur manually or automatically? Yes, via factory chiller controls.

What special control strategies will be employed with the chiller system? _____

During normal operation, chiller will operate under factory controls.
During an emergency power situation, chiller amps will be limited
so as to limit the generator load. AHU-1, AHU-4, and AHU-2 as well
as the chilled water pump shall operate on the EG as well.

What controls will be in place to allow the lowest economical entering condenser water temperature to be realized? What other options were considered besides this strategy? N/A

Fully describe the interface that the building automation system has with the chiller system: _____
BAS will interface with chiller LON controller.

What control will the building automation system (BAS) have over the chiller system?

☒ BAS enables/disables the chiller, ☐ assigns the lead chiller, ☒ assigns the lead primary chilled water pump, ☐ assigns the lead secondary chilled water pump, ☐ assigns the lead condenser pump, ☐ assigns the lead cooling tower

The BAS monitors the following: ☒ LCHWT, ☒ RCHWT, ☐ ECDWT, ☐ LCDWT, ☐ CDW flow, ☒ CHW primary flow, ☐ Secondary CHW flow, ☐ Cooling tower bypass valve,

☒ Chiller alarms that report to BAS (list): All chiller alarms

Other _____

The BAS can change the following: ☒ LCHWT setpoint, ☐ Reset parameters, ☐ ECDWT setpoint, ☐ Cooling tower fan staging parameters, ☐ Chilled water pumping pressure setpoints, ☒ Pressure reset parameters, ☐ Demand limits, ☐ Other _____

Cooling Tower

Describe the cooling tower (cross flow, counterflow, etc.) N/A

What are the sizes of the cooling towers? _____

What is the approach temperature rating of the cooling tower? _____

Why was a lower approach not chosen? _____

Attach energy and economic analyses.

Were oversized cooling towers analyzed to improve chiller efficiency? _____ Why or why not?

Attach analysis.

How many motors are there per tower fan? _____ Describe. _____

Are the motors premium efficiency? _____

How is the fan speed controlled? _____

How do the sizes of the chillers affect the sizes of the cooling towers selected? Are they paired? _____

Can two cooling towers serve one chiller? _____

How are the cooling towers staged? _____

Will condenser water flows be monitored? _____ If not, explain why. _____

Will the cooling tower be used in winter? _____ Why? _____

Air or Evaporative Cooled Condenser

☒ Air cooled ☐ Evaporative cooled

Why was an air-cooled condenser chosen over a cooling tower? LCCA

Why was an air-cooled condenser chosen over an evaporative condenser?
Not the appropriate environment for evaporative cooler.

Describe main features of the condensers and the chillers they serve.
Condenser fans are oversized for quiet operation. Fans also have variable speed drives for capacity control.

Were more efficient models analyzed? (attach analysis) No.

Describe the staging features Fans are controlled by chiller factory controls and have variable speed drives for capacity control.

Chilled and Condenser Water Pumps and Piping

What pressure drop range was the piping system designed to:

☐ Very low pressure drop, ☒ Moderately low pressure drop, ☐ Standard pressure drop. Was an analysis performed for using a lower pressure drop to reduce pump size and energy use? Attach analysis. How were pipe losses determined? rule of thumb, x detailed take-off and calculation, other.

Are piping circuits designed to be proportionally self-balancing, to minimize the restriction (head loss) of balancing valves and circuit setters?

Describe the pumps chosen. Primary: Variable speed primary pumping.

Secondary: N/A

Condenser pumps N/A

Are they equipped with premium energy-efficient motors? Yes

Why or why not?

How large of safety factor was considered in the pump sizing? 10%

What was the over-sizing rationale for the pumps? ☐ Potential system expansion, ☒ Safety factor, ☐ Both of above.

ASHRAE 90.1 doesn't allow flow throttling with a balancing valve more than 3 hp. Will this system comply? If no, why not? Yes

Would a more detailed head loss calculation likely result in a smaller safety factor and pump?

Describe any standby or redundant pumps and their operation. 2 total pumps; each sized for 100% flow; lead-lag controlled

Will the control sequences allow for automatic changeover to the lag or standby pump upon pump failure and similarly for cooling tower fan failure or will manual valving be required? Upon failure, does the lag pump or tower start or does the chiller go down and lag chiller start. Explain fully for each:

2 total pumps; each sized for 100% flow; lead-lag controlled

Primary chilled water pumps: 2 total pumps; each sized for 100% flow; lead-lag controlled

Secondary chilled water pumps: N/A

Condenser water pumps: N/A

Cooling tower fans: Variable speed, controlled by chiller factory controls.

How is the secondary chilled water capacity controlled? ☐ Variable speed drives (VFD) on pumps, ☐ Bypass valve. If by bypass valve, explain the rationale for not using variable speed drives and attach the economic analysis. _____

For VFD's, how will the pump speed be controlled? ☐ Constant water pressure setpoint, ☒ Reset water pressure setpoint. If the pressure is not reset, why not? _____

For a VFD on pressure reset, how low of speed will the pump be allowed to go? Is this as low as possible? Explain. Typically 30%, or as recommended by Mfgr.

Will chilled water flows be monitored? ☒ Primary flow, ☐ Secondary flow. If not, explain. _____

Chiller System Sequence of Operations and Operating Parameters

Attach a full and comprehensive sequence of operations, including but not limited to the following conditions and systems, including all interactions:

Chiller, Cooling Tower and Pumps

- List parameter conditions that initiate start-up.
- Provide a detailed narrative of the full sequence and status and action of EACH component during EACH stage of start-up: low load, medium load, high load, staging to next chiller, up to full load on all chillers, and then back down again to OFF condition. List all setpoints, delays, parameters, conditions, etc., that are required to pass through each stage. The components for which status will be given at each stage are: chiller stage and load, primary, secondary and condenser pump status, speed and flow, cooling tower stage, cooling tower bypass valve, cooling tower fans and speed, pipe pressures and setpoint resets.

Describe the sequences for the following:

- Chiller optimization staging.
- Temperature lockouts.
- Status and sequence at power outage and fire alarm.
- Effects of manual shutoff or failure of chiller, primary pump and secondary pump, condenser pump, cooling tower fan, vibration alarm.
- List all alarms.
- Include full sequences and setpoints for capacity and pressure control of the secondary chilled water system.
- Include full sequences and setpoints for condenser water temperature control and cooling tower fan control parameters.
- Cooling tower sump heater sequences, parameters and setpoints.
- List the full sequence of operation for all energy conserving strategies, including their setpoints and parameters.
- Weekend operation.
- Normal occupied and unoccupied modes.

Equipment manufacturers' sequences and control drawings may be included, but will generally require additional narrative. Flow charts may be used if sufficiently detailed. Narrative and flow chart examples are found in Section 4 of the instructions.

For the chiller, cooling tower and pumps, the sequences are expected to be about five single-spaced, typewritten pages.

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

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Number of sheets attached to this section: _____

See plans and specifications for control sequences.

4 Boilers and Heating Water System

4.1 Design Intent

Hot Water. What is this heating water system used for? ☐ Supplies hot water to air handler units to ___ heat building space, ___ preheat incoming cold air. ☒ Supplies hot water to ___ perimeter VAV reheat terminal units, ☒ core VAV reheat terminal units.

Steam. What is the steam used for? ☐ Supplied to air handler units to ___ heat building space, ___ preheat incoming cold air. ☐ Supplies hot water to ___ perimeter, ___ core VAV reheat terminal units. ☐ Is converted to hot water in a converter before being used by the building. ☐ Is used for humidification of the building.

Other: No steam

What areas of the building do the boilers serve? All conditioned areas with exception of IT and TR spaces.

List the areas that the boilers do not serve. All IT and TR spaces.

What types of heating equipment serve the areas not served by the boilers? Dedicated air to air split systems.

What vibration and noise considerations are given to the location of the boilers? _____

What energy efficiency objectives are there for the boiler system? ☒ Highly efficient, ☐ Moderately efficient, ☐ Standard efficiency

What level of automatic control features are desired for this boiler system relative to automatic staging, optimization, central building automation system monitoring and control capabilities, etc.? ☒ Highly automated, ☐ Moderately automated, ☐ Minimally automated

What type of fuel will be used and why? ☒ Natural gas, ☐ Fuel oil, ☐ Other _____

4.2 Basis of Design-Components Description and Methods for Meeting Design Intent

Boilers

The boiler is a ☒ Condensing, ☐ Forced draft, ☐ Atmospheric burner, ☐ Packaged, ☐ Other: _____

Briefly describe the boiler system.

2 direct vented, condensing natural gas boilers. 2, 100% variable speed pumps in a lead/lag configuration.

How many boilers of each size and type are there? (list number and size): _____
Two 750 MBH total boilers sized for 66% of peak heat load.

Is there a standby / redundant boiler during design conditions? NO

What method was used for determining the design heating load? _____
Trane Trace load calculation software.

Attach load calculations and assumptions, if not given in a previous section. (Diversity, safety factor, outdoor DB, WB, indoor DB, lighting W/sf, plug loads W/sf, sf/person, ventilation cfm/person, infiltration rate, glazing % of wall, overall U; SC).

Describe any provisions in the boiler system for accomodating future building or load expansion.
No provisions incorporated.

What evidence can be provided to show that the boilers are not oversized? _____
Calculated load results.

Why were they chosen to be different or equal size? _____
Standard design.

What vibration and noise considerations are given to the model and features of the chosen boilers? No provisions incorporated.

How many total stages of capacity does each boiler have? (burner beds and stages of fire) ____
What is the rated efficiency of each boiler? 15:1 turndown; 90% efficiency min.

What rationale was used to select these efficiencies with the sizes? Were more efficient models analyzed? _____

Attach engineering or energy simulation and economic calculations for the selections.

Are the boilers intended to be staged back and forth, depending on load, to minimize energy use?
Staging controlled by master boiler module.

Will this be done manually or automatically? Automatically.

What special control strategies will be employed with the boiler system? _____

Fully describe the interface that the building automation system has with the boiler system:
Master controller will interface with BAS via Lon protocol.

What control will the building automation system (BAS) have over the boiler system?

☒ BAS enables/disables the boiler, ☐ assigns the lead boiler, ☐ assigns the lead primary boiler pump, ☐ assigns the lead secondary boiler water pump.

The BAS monitors the following: ☒ boiler alarm status, ☒ pump status, ☐ internal water temperature, ☐ steam pressure, ☒ HW primary flow, ☒ secondary HW flow, ☐ three-way mixing valve, ☒ boiler alarms that report to BAS (list): _____

Other _____

The BAS can change the following: ☒ LHWT setpoint, ☐ Reset parameters, ☐ Boiler water pumping pressure setpoints, ☒ Pressure reset parameters, ☐ Demand limits, ☐ Other _____

Will the boilers have low water cutout controls? Yes.

4.3 Heating Water Pumps and Piping

What pressure drop range was the piping system designed to?

☐ Very low pressure drop, ☒ Moderately low pressure drop, ☐ Standard pressure drop. Was an analysis performed for using a lower pressure drop to reduce pump size and energy use? _____ Attach analysis. How were pipe losses determined? ___ rule of thumb, x detailed take-off and calculation, ___ other.

Are pipe circuits designed to be close to being self-balanced proportionally, to minimize the restriction (head loss) of balancing valves and circuit setters?

Describe the pumps chosen. Primary: Provided as part of boiler package.

Secondary: 2 Variable speed pumps sized for 100% flow in a lead/lag configuration.

Are they equipped with premium energy-efficient motors? Yes.

Why or why not? _____

How large of safety factor was used in the pump sizing? 10%. What was the over-sizing rationale for the pumps? ☐ Potential system expansion, ☒ Safety factor, ☐ Both of above.

ASHRAE 90.1 doesn't allow flow throttling with a balancing valve more than 3 hp. Will this system comply? If no, why not? Yes.

Would a more detailed head loss calculation likely result in a smaller safety factor and pump? N/A.

Describe any standby or redundant pumps and their operation. 2 Variable speed pumps sized for 100% flow in a lead/lag configuration.

Will the control sequences allow for automatic changeover to the lag or standby pump upon pump failure or will manual valving be required? Explain fully.

Automatic changeover.

Primary heating water pumps: _____

Secondary heating water pumps: _____

How is the secondary heating water capacity controlled? ☒ Variable speed drives (VFD) on pumps, ☐ Bypass valve(s). If bypass valves, explain the rationale for not using variable speed drives and attach the economic analysis. _____

For VFD's, how will the pump speed be controlled? ☐ Constant water pressure setpoint, ☒ Reset water pressure setpoint. If the pressure is not reset, why not? _____

For a VFD on pressure reset, how low of speed will the pump be allowed to go? Is this as low as possible? Explain. 30% or based on Mfr recommendation.

Will heating water flows be monitored? ☐ Primary flow, ☒ Secondary flow. If not, explain. _____

How is supply water temperature controlled? ☐ 3-way mixing valve, ☒ Other Boiler fire modulation, 15:1 turndown ratio.

4.4 Boiler System Sequence of Operations and Operating Parameters

Attach a full and comprehensive sequence of operations, including but not limited to the following conditions and systems, including all interactions:

- List parameter conditions that initiate start-up.
- Provide a detailed narrative of the full sequence and status and action of EACH component during EACH stage of start-up: low load, medium load, high load, staging to next boiler, up to full load on all boilers, and then back down again to OFF condition. List all setpoints, delays, parameters, lockouts, conditions, etc., that are required to pass through each stage. The components for which status will be given at each stage are: boiler stage and load, primary, secondary pump status, speed and flow, pipe pressures and setpoint resets.

Describe the sequences for the following:

- Boiler optimization staging.
- Temperature lockouts.
- Status and sequence at power outage and fire alarm.
- Effects of manual shutoff or failure of boiler, primary pump and secondary pump.
- List all alarms.
- Include full sequences and setpoints for capacity and pressure control of the secondary heating water system.
- List the full sequence of operation for all energy conserving strategies, including their setpoints and parameters.
- Weekend operation.
- Normal occupied and unoccupied modes.
- Warm-up mode

Equipment manufacturers' sequences and control drawings may be included, but will generally require additional narrative. Flow charts may be used if sufficiently detailed. Narrative and flow chart examples are found in Section 4 of the instructions.

For the boiler and pumps, the sequences are expected to be about ____ single spaced, typewritten pages.

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

Number of sheets attached to this section: _____

5 Roof Top Packaged System(s) (RTU)

5.1 Design Intent

What is this system or component used for? N/A

Systems Description

Briefly describe the system:

- | | |
|--|--|
| <input type="checkbox"/> Heat pump | <input type="checkbox"/> Steam |
| <input type="checkbox"/> Gas pack | <input type="checkbox"/> Constant volume |
| <input type="checkbox"/> AC only | <input type="checkbox"/> Dual duct |
| <input type="checkbox"/> Resistance coil | <input type="checkbox"/> Multizone |
| <input type="checkbox"/> Hot water | <input type="checkbox"/> Other _____ |
| <input type="checkbox"/> VAV | <input type="checkbox"/> Other _____ |

List equipment and areas served: _____

5.2 Basis of Design-Components Description and Methods for Meeting the Design Intent

Give size, quantity, and other specific information and the areas served, and how it will meet the objectives.

Plant

Number of units of this type: _____ EER (cooling): _____ Tons cooling each unit: _____

Accumulated capacity for all units of this type: Total tons cooling: _____

MBtu heating: _____ Heat Pump COP: _____ Gas efficiency: _____

Areas served: _____

Supply Fans and Capacity Control

Total CFM for packaged systems of this type: _____

☐ Inlet vanes ☐ VFD ☐ Vane axial ☐ Outlet damper ☐ Other: _____

Motor efficiency: _____ Std. effic., _____ Premium effic.

Return Fans / Exhaust Fans / Relief Dampers

Describe return fans, exhaust fans, or relief dampers, if any, and their function.

Describe how building static pressure is controlled (setpoints, etc.).

VFD control:

Which fans does each VFD control? ☐ Supply ☐ Return/Exhaust

Location of duct static-pressure sensor (distance from fan and proximity from branch takeoffs up and down stream):

Duct static pressure: ☐ Fixed setpoint / ☐ Reset or variable

Expected duct static pressure setpoint (or average if reset):

Total pressure across fan at design flow: [discharge pressure - suction pressure (negative)]

Minimum fan capacity (lower frequency limit setting in VFD, % of max.)

Are VFD settings ☐ monitored or ☐ controlled by the BAS system? (check one)

Method used for sizing ducts ☐ equal friction ☐ static regain

Note: Equal friction gives smaller ducts and higher pressure requirements. If equal friction was used, was a calculation made to make sure the increased pressure and subsequent increase in energy use by the fan is more than offset by the savings in duct materials? If no, why not?

Compressor(s)

Number of compressors per RTU: . Low ambient compressor package?

Number of condenser fans per RTU: . Locked out during morning warmup?

Compressor capacity control; general description:

Cooling coil

Provide general description and any special features (high efficiency, face velocity, low pressure drop, etc.). Was a low pressure drop coil analyzed? What were the results?

Dampers

Describe the dampers and their function.

Smoke and Fire Dampers

Describe the smoke and fire damper system (location and operation). _____

Setpoint Temperatures

Supply air (SA): _____ SA reset (see strategy sequence): _____ Mixed air: _____

Filters

Provide general description and any special features (low pressure drop, etc.). Were low pressure drop filters analyzed? What were the results? _____

Heating System

Describe type, fuel, perimeter reheat, areas served, etc.

Economizer and OSA Dampers

☐ Enthalpy ☐ Dry Bulb ☐ Integrated ☐ Economizer is first stage of cooling

Number of damper positions: ☐ _____ or ☐ infinite.

Dampers closed during warm-up? ☐ Yes / ☐ No

If dry-bulb type: OSA changeover temperature: _____

If enthalpy: OSA enthalpy changeover: _____

Other special features of the RTU:

How will the fresh air rate be maintained at low supply air volumes of the VAV system? Are perimeter zones treated differently than interior zones (reheat box damper settings, etc.)?

How is the RTU controlled?

- ☐ Stand-alone controllers with thermostats in zones
- ☐ Above, but enabled/disabled by central building automation system (BAS)
- ☐ Integrated into BAS as below:

Integration of Control and Monitoring Points With the BAS

Point or Feature	BAS Monitors	BAS Can Change SetPts	Point or Feature	BAS Monitors	BAS Can Change SetPts
Mixed air temp.	_____	_____	Compressor stage	_____	NA
RA temp.	_____	NA	Bldg. static pressure	_____	_____
SA temp	_____	_____	Temp. lockouts	_____	_____
SA reset parameters	_____	_____	CO ₂ for OSA control	_____	_____
RA enthalpy	_____	NA	Htg. coil position	_____	NA
DA static pressure	_____	_____	Optimum start	NA	_____
Duct static pressure	_____	_____	Night purge	NA	_____
Supply fan statuc	_____	NA	Demand limit	NA	_____
Ret./Exh. fan status	_____	NA	Alarms (list):	_____	_____
Supply fan speed	_____	NA	-Dirty filter	_____	_____
Ret./Exh. fan speed	_____	NA	-Compressor fail	_____	_____
Supply fan cfm	_____	NA	-Fan loss of air	_____	_____
Ret./Exh. fan cfm	_____	NA	-High DA pressure	_____	_____
Inlet vane position	_____	NA	-Fire/smoke	_____	_____
Filter Diff. pressure	_____	_____	-Emerg. shutdown	_____	NA
Occup. schedule override	_____	_____	OSA compensation for VAV	_____	_____
Night low limits	_____	_____	OSA economizer	_____	_____
_____	_____	_____	_____	_____	_____

Describe other equipment tied to the ON/OFF status of the RTU (exhaust fans, etc.)

5.3 RTU Sequence of Operations and Operating Parameters

Provide a full and comprehensive sequence of operations, including but not limited to the following conditions and systems, including all interactions:

Systems	Conditions or Modes
<ul style="list-style-type: none"> • supply fans • exhaust fans • return air and exhaust dampers • supply air capacity control • economizer and OSA dampers • building static pressure control • coil valve operation • CO₂ sensor OSA control • smoke dampers 	<ul style="list-style-type: none"> • start-up • shut-down • normal occupied & unoccupied periods • warm-up • temperature lockouts • compressor and condenser staging • override sequences • winter/summer changeover • weekend operation • normal operation heating • normal operation cooling • through deadband ranges • alarms: fire, smoke, shutdown, equip. failure, temp. and pressure limits, etc. • all energy conserving strategies (optimum start/stop, resets, etc.) • fire alarm

Include the position or status at which each component resides at start-up, what occurs at fire alarm, provide all setpoints and control parameters, including all time delays. In the sequences, describe what controls what. That is, what components must be ON or at certain conditions in order for others to operate. Equipment manufacturers' sequences and control drawings may be included, but will generally require additional narrative. Flow charts may be used if sufficiently detailed. Narrative and flow chart examples are found in Section 4 of the instructions.

For this RTU system, these sequences are expected to be about _____ single spaced, typewritten pages.

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

Number of sheets attached to this section: _____

6 VAV Terminal Units—Air Conditioning Only (TU_AC)

6.1 System Description

Briefly describe the TU: Pressure independent, shutoff VAV terminal box
with hot water coil and 2-way valve.

Number of TU_ACs: _____ Type of area served: _____

TU type: ☒ pressure independent / ☐ pressure dependent

Minimum air damper position: _____% open. See plans and schedules

Are these fan powered? No. ☐ Parallel, ☐ Series. Why? _____

TU measures air flow via total and static pressure sensors. Y/N Y.

☒ Cross, ☐ Linear flow station? Other flow method: _____

Describe TU controller type: Electronic, Lonworks

Damper actuator type: ☒ Electric, ☐ Pneumatic.

What noise considerations were used when specifying the TU's? _____

Integration of Control and Monitoring Points With the BAS

Point or Feature	BAS Monitors	BAS Can Change SetPts	Point or Feature	BAS Monitors	BAS Can Change SetPts
TU air flow	<u>X</u>	<u>X</u>	TU air flow max.	<u>X</u>	_____
TU air flow min.	<u>X</u>	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

6.2 TU_AC Sequence of Operations and Operating Parameters

Provide a full and comprehensive sequence of operations (including all sequences, deadband, alarm actions, etc.) on a separate sheet(s) and attach to this section of the form.

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

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Number of sheets attached to this section: _____

7 VAV Terminal Units—Reheat (TU_RH)

7.1 System Description

Briefly describe the TU: _____

Number of TU_RHs: _____ Type of area served: _____

TU type: ☐ pressure independent / ☐ pressure dependent, ☐ VAV, ☐ constant volume

Are these fan powered? _____. ☐ Parallel, ☐ Series.

Number of fan speeds? _____

Why? _____

What provisions will be made to minimize reheat? _____

What provisions will be made to minimize system simultaneous heating and cooling? _____

TU measures air flow via total and static pressure sensors. Y/N ____.

☐ Cross, ☐ Linear flow station? Other flow method: _____

Minimum air damper position: _____% open.

When the damper is at minimum in heating and space setpoint is not being maintained, will dampers open? _____ Why? _____

Describe TU controller type: _____

Damper actuator type: ☐ Electric, ☐ Pneumatic.

Heating coil type: ☐ hot water, ☐ electric resistance and stages ____.

Describe heating coil valve: ☐ Two position, ☐ Modulating. _____

Heating valve actuator type: ☐ Electric, ☐ Pneumatic.

Do some units have 3-way valves? Why? _____

Automatic flow control valve? ____ Describe: _____

What noise considerations were used when specifying the TU's? _____

Integration of Control and Monitoring Points With the BAS

Point or Feature	BAS Monitors	BAS Can Change SetPts	Point or Feature	BAS Monitors	BAS Can Change SetPts
TU air flow	_____	_____	TU air flow max.	_____	_____
TU air flow min.	_____	_____	Valve position	_____	_____
_____	_____	_____	_____	_____	_____

7.2 TU_RH Sequence of Operations and Operating Parameters

Provide a full and comprehensive sequence of operations (including heat lockout parameters, heating valve sequences, deadbands, alarm actions, etc.) on a separate sheet(s) and attach to this section of the form.

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

Number of sheets attached to this section: _____

8 Heat Recovery Unit (HRU)

8.1 Design Intent

Describe the purpose of the HRU: N/A

8.2 System Description

Briefly describe the system: _____

On which air handlers does this system operate? _____

Integration of Control and Monitoring Points With the BAS

Point or Feature	BAS Monitors	BAS Can Change SetPts	Point or Feature	BAS Monitors	BAS Can Change SetPts
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

8.3 HRU Sequence of Operations and Operating Parameters

Provide a full and comprehensive sequence of operations (including seasonal variations) on a separate sheet(s) and attach to this section of the form.

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

Number of sheets attached to this section: _____

9 Computer Room Air Conditioning Unit (CRACU)

9.1 Design Intent

What is this system or component used for?

N/A

General Description

Briefly describe the system or component.

9.2 Basis of Design-Component Description and Methods for Meeting the Design Intent

Areas served: _____

Number of CRACUs: _____ Sizes (tons) _____ EER: _____

Location of CRACU: _____

☐ Ducted system or ☐ discharge only? _____

How is heat rejected? ☐ Cooling tower / ☐ DX air-cooled condenser / ☐ Other

Location of condenser: _____

Humidifier description: _____

Reheat description: _____

Is there a 3-way valve in the unit? _____ Will this defeat the purpose of any variable speed drives on the chilled water system? _____

How is the CRACU controlled?

- ☐ Stand-alone controllers with thermostats in zones
- ☐ Same, but enabled/disabled by central building automation system
- ☐ "fully" controlled by BAS

Does supply air enter this space from the main HVAC system? ☐ Yes / ☐ No

If Yes, when? _____

How is fresh air brought into and controlled in the space? _____

Integration of Control and Monitoring Points With the BAS

Point or Feature	BAS Monitors	BAS Can Change SetPts	Point or Feature	BAS Monitors	BAS Can Change SetPts
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

9.3 CRACU Sequence of Operations and Operating Parameters

Provide a full and comprehensive sequence of operations (including setpoints, unoccupied, occupied, fire alarm periods, etc.) on a separate sheet(s) and attach to this section of the form.

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

Number of sheets attached to this section: _____

10 Daylighting Controls

10.1 Design Intent

Briefly describe the system: N/A

What is the primary reason for using daylighting? ☐ energy savings / ☐ view/aesthetics
☐ visual light quality

What budget limitations were there? _____

10.2 Basis of Design

System type: ☐ continuous dimming / ☐ stepped dimming in _____ steps

Describe related architectural features such as light shelves, sloped ceilings, skylights, special interior finishes, intended furniture systems, etc. _____

How low are the lights allowed to dim? _____%.

The system is controlled by: ☐ main BAS / ☐ stand alone controllers

What is the light level setpoint(s) at the work plane:

<u>Area</u>	<u>Design Foot Candles</u>
_____	_____
_____	_____
_____	_____
_____	_____

How deep into the building do the lights dim? _____ ft.

Are the dimming rates the same across this distance? ☐ Yes / ☐ No

Explain: _____

What areas of the building have dimming control?

How many zones and controllers (light sensors) are there? _____

How do occupants override the dimming? _____

Who has access for adjusting light levels? _____

Where are these adjustments made? _____

Where are the sensors located? _____

10.3 Sequence of Operations and Operating Parameters

Provide a full and comprehensive sequence of operations (including setpoints and occupied and unoccupied conditions, etc.) on a separate sheet(s) and attach to this section of the form.

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

Number of sheets attached to this section: _____

11 Lighting Sweep Control

11.1 System Description

Briefly describe the system: N/A

11.2 Operating Parameters

The system is controlled by: ☐ Main BAS / ☐ Stand-alone controller

How many zones will there be? _____ Describe the zones. _____

What is the floor area of the largest zone? _____

How many sweeps will there be? _____

At what times?

Weekdays: _____

Saturday: _____

Sunday: _____

Describe the type of switching system that occupants will use to turn the lights back on in their zone. _____

What is the maximum override duration? _____ hours

Who will be able to globally override the sweeps or change the schedule?

How will the sweeps work with housekeeping schedules? _____

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

Number of sheets attached to this section: _____

12 Building Automation System (BAS)

12.1 Design Intent

Briefly describe the system: Full BAS to control and monitor all HVAC equipment - Open Lonworks

Why was this system chosen over others considered? Its required by USA

Describe any budget limitations: _____

How important was energy conservation in the decision of BAS type? _____

12.2 Basis of Design—Component Description and Methods for Meeting the Design Intent

Central system is: ☒ DDC, ☐ pneumatic

Valve actuators: ☒ electric, ☐ pneumatic

AHU damper actuators: ☒ electric, ☐ pneumatic

VAV terminal box damper actuators: ☒ electric, ☐ pneumatic

Fire / smoke damper actuators: ☒ electric, ☐ pneumatic

User interface: ☒ graphical display of components

Limitations of the modules or features specified, compared to the highest model line system:
See control plans

Check the systems that the BAS will control (vs local equipment, packaged controllers). Refer to the individual system section for a complete description of the points and their control by the BAS

	Virtually Full Control	Partial Control	Enable/Disable Only	Monitor Only
Rooftop packaged unit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Air handler unit	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Terminal units	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Economizer functions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Boiler plant	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heating water pumping system	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chiller plant	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chilled water pumping system	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cooling tower	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Condenser water pumping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Terminal unit settings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heat recovery unit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Daylighting setpoints	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lighting sweep control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Exterior lighting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Computer room HVAC unit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fan coil unit and condenser	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Unit heaters	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Smoke and fire control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Emergency power system	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
UPS power system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Service water heating pump	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Location of user interface: Main Mechanical room

Type of user interface:

- ☐ Permanent on-site computer terminal
☒ Plug-in portable computer
☐ Remote terminal of _____
☐ Keypad only

Describe parties who will be able to change schedules only: Facility Manager

Describe parties who will have full access to system: Facility Manager

Check the energy conserving control strategies that will be operational in this building through the BAS.

- | | |
|--|---|
| <input checked="" type="checkbox"/> Holiday scheduling | <input checked="" type="checkbox"/> Occupancy-based outside air control |
| <input checked="" type="checkbox"/> Zonal scheduling | <input type="checkbox"/> DX compressor optimization |
| <input type="checkbox"/> Sequential startup of equipment | <input type="checkbox"/> Mixed air temperature control |
| <input type="checkbox"/> Lighting sweep | <input checked="" type="checkbox"/> Boiler staging and optimization |
| <input checked="" type="checkbox"/> Night setup/setback | <input type="checkbox"/> Heat element (coil) staging |
| <input checked="" type="checkbox"/> Optimum start | <input checked="" type="checkbox"/> Hot water reset |
| <input type="checkbox"/> Optimum stop | <input type="checkbox"/> Heat recovery option control |
| <input checked="" type="checkbox"/> Hot & cold deck reset (supply air) | <input type="checkbox"/> Water-side economizer control |
| <input checked="" type="checkbox"/> Chilled water reset | <input checked="" type="checkbox"/> Variable speed pump control |
| <input type="checkbox"/> Chiller staging and optimization | <input checked="" type="checkbox"/> Occupancy based HVAC control |
| <input type="checkbox"/> Cooling tower component staging | <input type="checkbox"/> Terminal regulated air volume (TRAV) |
| <input type="checkbox"/> Air-side economizer control | <input type="checkbox"/> Thermal storage control |
| <input type="checkbox"/> Night ventilation purge / pre-cooling | <input type="checkbox"/> Demand limiting or load shedding |
| <input checked="" type="checkbox"/> CO2 outside air rate control | <input type="checkbox"/> Duty cycling of equipment |
| <input checked="" type="checkbox"/> VAV control-pressure independent | <input checked="" type="checkbox"/> DHW recirculation pump control |
| <input type="checkbox"/> VAV control-pressure dependent | <input type="checkbox"/> DHW temperature control |
| <input type="checkbox"/> Duct static pressure reset | <input type="checkbox"/> Full trending capabilities |
| <input type="checkbox"/> _____ | <input type="checkbox"/> _____ |
| <input type="checkbox"/> _____ | <input type="checkbox"/> _____ |
| <input type="checkbox"/> _____ | <input type="checkbox"/> _____ |

List all special monitoring points installed for diagnostic, performance verification and trouble shooting purposes. Which are not needed to execute the control sequences and strategies?

See control plans

12.3 BAS Sequence of Operations and Operating Parameters

Provide a full and comprehensive sequence of operations, including setpoints, deadbands, etc. List full control sequences for all control strategies. Refer to sequences already provided in other component sections, if applicable. List on a separate sheet(s) and attach to this section of the form.

Include the position or status at which each component resides at start-up, provide all setpoints and control parameters, including all time delays. In the sequences, describe what controls

what. That is, what components must be ON or at certain conditions in order for others to operate. Equipment manufacturers' sequences and control drawings may be included, but will generally require additional narrative. Flow charts may be used if sufficiently detailed. Narrative and flow chart examples are found in Section 4 of the instructions.

Note: Complete BAS description, points list with all details, program listing, etc. are not part of the design intent, but will be required as part of the O&M documentation.

12.4 Points List

For this design intent, list all points in a table that includes at *least* the information shown in the following example table.

Controlled System	Point Abbr.	Point Description	Display Units	Control or Setpoint Y/N	Monitoring Point Y/N	Intermediate Point Y/N	Calculated Point Y/N
See controls plans and specifications.							

Key:

Point Description: DB temp, airflow, etc.

Control or Setpoint: Point that controls equipment and can have its setpoint changed (OSA, SAT, etc.)

Intermediate Point: Point whose value is used to make a calculation which then controls equipment (space temperatures that are averaged to a virtual point to control reset).

Monitoring Point: Point that does not control or contribute to the control of equipment, but is used for operation, maintenance, or performance verification.

Calculated Point: "Virtual" point generated from calculations of other point values.

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

UFCs, codes

Number of sheets attached to this section: _____

13 Split x Air Conditioning; ___ Heat Pump System**13.1 Design Intent**

What is this system or component used for? Dedicated cooling for electrical and comm rooms

Systems Description

Briefly describe the system:

- | | |
|--|---|
| <input type="checkbox"/> DX AC only | <input type="checkbox"/> VAV |
| <input checked="" type="checkbox"/> Heat Pump and AC | <input checked="" type="checkbox"/> Constant volume |
| <input type="checkbox"/> Resistance coil | <input type="checkbox"/> Dual duct |
| <input type="checkbox"/> Hot water coil | <input type="checkbox"/> Multizone |
| <input type="checkbox"/> Gas furnace | <input type="checkbox"/> Other _____ |
| | <input type="checkbox"/> Other _____ |

List equipment and areas served: See schedules

13.2 Basis of Design-Component Description and Methods for Meeting the Design Intent

Give size, quantity, and other specific information and the areas served, and how it will meet the objectives.

Plant

Number of units of this type: 10 EER (cooling): 19.2 Tons cooling each: 2 to 5

Accumulated capacity for all units of this type: Total tons cooling: 35

MBtu heating: _____ Heat Pump COP: _____ Gas efficiency: _____

Areas served: _____

Compressor(s) and Condenser(s)

Number of compressors per condenser unit: _____. Low ambient compressor package? ____

Number of condenser fans condenser unit: _____

Compressor capacity control; general description: _____

Evaporator / Cooling Coil

Provide general description and any special features (high efficiency, face velocity, low pressure drop, etc.). Was a low pressure drop coil analyzed? What were the results?

Supply Fans and Capacity Control

Total CFM for inside fan coil or air handler of this type: _____

☐ Constant volume ☐ Inlet vanes ☐ VFD ☐ Vane axial ☐ Outlet damper ☐ Other: ____

☐ Evaporator fan cycles ON and OFF with compressor. Motor efficiency: ____ Std. effic.,
____ Premium effic.

Dampers

Describe any dampers and their function. _____

Smoke and Fire Dampers

Describe the smoke and fire damper system (location and operation). _____

Setpoint Temperatures

Supply air (SA): _____ SA reset (see strategy sequence): _____

Filters

Provide general description and any special features (low pressure drop, etc.). Were low pressure drop filters analyzed? What were the results? _____

Standard throwaway filters

Heating System

Describe type, fuel, perimeter reheat, areas served, etc.

Economizer and OSA Dampers

☒ No OSA via this unit ☐ Enthalpy ☐ Dry Bulb ☐ Integrated ☐ Economizer is first stage of cooling

Number of damper positions: ☐ _____ or ☐ infinite.

Dampers closed during warm-up? ☐ Yes / ☐ No

If dry-bulb type: OSA changeover temperature: _____

Other special features of the split system:

How will the fresh air rate be maintained at low supply air volumes of the VAV system? Are perimeter zones treated differently than interior zones (reheat box damper settings, etc.)?

How is the split system controlled? BAS Monitored independent controls

☒ Stand-alone controllers with thermostats in zones. Number of zones: 5

☒ Above, but enabled/disabled by central building automation system (BAS)

☐ Integrated into BAS as below:

Integration of Control and Monitoring Points With the BAS

Point or Feature	BAS Monitors	BAS Can Change SetPts	Point or Feature	BAS Monitors	BAS Can Change SetPts
RA temp.	_____	NA	Compressor stage	_____	NA
SA temp	_____	_____	Temp. lockouts	_____	_____
SA reset parameters	_____	_____	CO ₂ for OSA control	_____	_____
RA enthalpy	_____	NA	Htg. valve position	_____	NA
DA static pressure	_____	_____	Optimum start	NA	_____
Duct static pressure	_____	_____	Night purge	NA	_____
Supply fan status	_____	NA		NA	_____
Ret./Exh. fan status	_____	NA	Alarms (list):	_____	_____
Occup. schedule override	_____	_____	Night low limits	_____	_____
OSA economizer	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Describe other equipment tied to the ON/OFF status of the split system unit (exhaust fans, etc.)

13.3 Split System Sequence of Operations and Operating Parameters

Provide a full and comprehensive sequence of operations, including but not limited to the following conditions and systems, including all interactions:

Systems	Conditions or Modes
<ul style="list-style-type: none"> • supply fans • supply air capacity control • economizer and OSA dampers • building static pressure control • coil valve operation • CO₂ sensor OSA control • smoke dampers 	<ul style="list-style-type: none"> • start-up • shut-down • normal occupied & unoccupied periods • warm-up • temperature lockouts • compressor and condenser staging • override sequences • winter/summer changeover • weekend operation • normal operation heating • normal operation cooling • through deadband ranges • alarms: fire, smoke, shutdown, equip. failure, temp. and pressure limits, etc. • all energy conserving strategies (optimum start/stop, resets, etc.) • fire alarm

Include the position or status at which each component resides at start-up, what occurs at fire alarm, provide all setpoints and control parameters, including all time delays. In the sequences, describe what controls what. That is, what components must be ON or at certain conditions in order for others to operate. Equipment manufacturers' sequences and control drawings may be included, but will generally require additional narrative. Flow charts may be used if sufficiently detailed. Narrative and flow chart examples are found in Sections 4 of the instructions.

For this system, these sequences are expected to be about _____ single spaced, typewritten pages.

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

01 FEB 07

UFCs, codes

Number of sheets attached to this section: _____

14 Emergency Power System

14.1 Design Intent

Briefly describe the system: N/A

What is the purpose of the emergency power and any UPS for each load other than the fire, life, safety loads?

14.2 Basis of Design-Component Description and Methods for Meeting the Design Intent

Generator

Is the generator sized to be able to handle additional loads? _____ How many? _____

What is the maximum time it should take the generator to be providing power from the time street power is lost (seconds)? _____

Is there an automatic generator exercizer? _____

For how long should the generator be able to provide power without refueling? _____

Describe any special frequency and voltage regulation output requirements for the generator. _

Power Quality

Describe any special power quality concerns or considerations (sensitive equipment, etc.). ____

UPS

How many UPS systems are there? List all, including integral batteries in equipment. _____

What kind of UPS bypass will be used on the stand-alone UPS? _____

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

UFCs and codes

Number of sheets attached to this section: _____

15 Service Water Heating

15.1 Design Intent

Service Water. What does the system serve? Domestic Hot Water

What energy efficient objectives are there for the service water system? Meet ASHRAE
Solar hot water is not LCC effective and is not included.

What is the fuel type and why? x Natural gas, Electricity, # Fuel oil, Steam,
 deg F water.

15.2 System Description

Service Water. Briefly describe the system. NG fired, instantaneous.

15.3 Basis of Design

What is the type of water heater and why? Storage tank type, x Instantaneous type

What is the burner type? Natural draft, Forced draft

Is there a return water circulation pump and why and how is it controlled?
controlled by BAS based on occupancy

If it is a non-recirculating system is there a heat trap? y

What is the water storage temperature? N/A deg F

What is the water supply temperature? 110 deg F

Is there a mixing valve and what type? Yes

What is rated efficiency of the water heater? 92%

What is the method used for determining the domestic water pipe size, storage tank size and heating load? Standard calculations per UFC

Attach calculations and assumptions.

Applicable References

What are the applicable codes, guidelines, standards, regulations, criteria and other references that will be followed relating to this section?

UFC and codes

Number of sheets attached to this section: _____

16 OTHER SYSTEMS NEEDING SAMPLE FORMATS

Fire Alarm and Protection
Systems

Air Handler Units	Capacity control
	Supply fan
	Return/exhaust fan and dampers
x	Heating and cooling coil valves
	Economizer and OSA and return air dampers
	Mixed air control

Exhaust Fans

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OWNERS PROJECT REQUIREMENTS

01/20

-- End of Section Table of Contents --

Owner's Project Requirements Document for LEED Fundamental Commissioning

Project: SOF Group Headquarters Building

Approved:

Name

Owner's Representative

Date

Name

Design Agent's Representative

Date

Overview and Instructions

The purpose of this document is to provide clear and concise documentation of the Owner's goals, expectations and requirements for commissioned systems, and shall be utilized throughout the project delivery and commissioning process to provide an informed baseline and focus for design development and for validating systems' energy and environmental performance.

The Owner's Project Requirements Document is a required document for LEED Version 2.2 EA Prerequisite 1, Fundamental Commissioning of the Building Energy Systems. It shall be completed by the Corps District/Design Agent based on coordination with the Installation/User/Proponent and shall be approved by the Installation/User/Proponent representative.

Use of this template is not required, nor are there any restrictions on editing of it. It is provided simply as a tool to assist project teams in meeting the documentation requirements for LEED Fundamental Commissioning.

The intent of the Owner's Project Requirements Document, per the LEED v2.2 Reference Guide, 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. This template contains the basic recommended components indicated in the LEED v2.2 Reference Guide. It should be adapted as needed to suit the project, remaining reflective of the LEED intent.

The Owner's Project Requirements Document should ideally be completed before the start of design and furnished to the design team. It must be completed prior to the approval of Contractor submittals of any commissioned equipment or systems to meet LEED requirements.

Updates to the Owner's Project Requirements Document throughout the course of project delivery shall be made by the Corps District/Design Agent based on decisions and agreements coordinated with and agreed to by the Installation/User/Proponent.

The Owner's Project Requirements Document shall be included in the project's LEED documentation file under EA PR1, Fundamental Commissioning of the Building Energy Systems.

Owner's Project Requirements Document for LEED Fundamental Commissioning

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 - Occupant Training and Orientation
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TABLE 1

1. Owner and User Requirements

What is the primary purpose, program and use of this project? (example: office building with data center)

The SOF Group Headquarters Building located at Ft. Bragg, North Carolina will contain secure administrative space, conference rooms, secure area, group operations center, logistics, network operation center, headquarters company, arms vault and storage to support the missions and activities throughout the full range of military operations in all environments, and provide the National Command Authority and theater commanders a means to resolve crises, achieve US objectives and pursue US strategic goals. The building will be 96,016 gross square feet.

Describe pertinent project history. (example: standard design development)

Currently, the 3rd Special Forces Group has grown in personnel and equipment. The current facilities do not support this growth and this project will complete the deficit solution requirement.

Broad Goals

What are the broad goals relative to program needs?

The intent is to provide the 3rd Special Forces Group with a facility that will allow all units to be under one roof and promote unit integrity. The building shall utilize quality materials that are sustainable “green” and complement the environment while providing an atmosphere suitable for the mission.

What are the broad goals relative to future expansion?

There is not a goal for building expansion.

What are the broad goals relative to flexibility?

The layout has been developed to make the most efficient use of the floor space and provide flexible environments allowing re-use of areas if needed in the future.

What are the broad goals relative to quality of materials?

(Army) Buildings with a 25-year useful design life before a possible re-use/re-purpose or renovation requirement, to include normal sustainment, restoration, modernization activities. Provide an appropriate level of quality to ensure the continued use of the facility over that time period with the application of reasonable preventive maintenance and repairs that would be industry-acceptable to a major civilian sector project owner.

What are the broad goals relative to construction costs?

(Army) Obtain full scope award within funds available.

What (Army) Reasonable preventative maintenance and repairs that would be industry-acceptable to a major civilian sector project owner.

What are the broad goals relative to life cycle of the equipment?

The most life cycle cost effective systems will be used to meet the functions of the building.

Other broad goals: *(Insert as applicable)*

Meet UFCs and ICD 705 requirements.

2. Environmental and Sustainability Goals

What are the project goals relative to sustainability and environmental issues? (example: LEED Silver rating)

(Army) Meet federal High Performance Sustainable Buildings (HPSB) requirements and achieve as many LEED credits as possible using LEED-NC. Meet UFC 1-200-02.

What are the project goals relative to energy efficiency? (example: Meet EPACT)

(Army) Minimum 30% energy use reduction, excluding process loads, using ASHRAE 90.1 baseline.

What are the project goals and requirements for building siting that will impact energy use?

(Army) Orient building for optimum energy efficiency within the constraints of the functional requirements and site boundary limits.

What are the project goals and requirements for building facade that will impact energy use?

The building shall utilize quality materials that are sustainable “green” and complement the environment while providing an atmosphere suitable for the mission.

What are the project goals and requirements for building fenestration that will impact energy use?

All openings must meet federal antiterrorism standards and ICD 705 requirements.

What are the project goals and requirements for building envelope that will impact energy use?

The building shall utilize quality materials that are sustainable “green” and complement the environment while providing an atmosphere suitable for the mission and meeting ICD 705 requirements.

What are the project goals and requirements for building roof that will impact energy use?

The roof will be a standing seam metal roof over vinyl faced insulation with a minimum R value of 26.

Other: *(Insert as applicable)*

3. Indoor Environmental Quality Requirements

What is the intended use for all spaces? For all spaces that have an intended use that is not readily apparent from the space name, provide this information in Table 1.

The building will primarily contain administrative spaces, conference rooms, a secure area, group operations center, logistics, network operations, Headquarters Company, arms vault, secure storage and required support spaces.

What is the anticipated occupancy schedule (numbers of occupants and time frames) for all occupied spaces? Indicate the default occupancy schedule below and for all spaces that have an occupancy schedule that differs from the default, provide this information in Table 1.

Default occupancy is Monday-Friday 0600-1800 occupied, 1800-0600 unoccupied. Building is assumed unoccupied on weekends and holidays with the exception of the duty desk area.

What accommodations for after-hours use are required? (example: access control, lighting controls, HVAC controls) Indicate general accommodations required below and for all spaces that have special requirements, provide this information in Table 1.

Occupant space overrides and lighting occupancy sensors allow the after-hours use of the building.

What are the lighting, temperature, humidity, air quality, ventilation and filtration requirements for all spaces? Indicate the default requirements below and for all spaces that have a requirement that differs from the default, provide this information in Table 1.

Lighting: _____

Temperature: Space design temperature of 75F cooling 68F heating

Humidity: Humidity shall be controlled to be less than 60% at all times.

Air Quality: Air Quality as per ASHRAE 62.1-2013

Ventilation: Ventilation as per ASHRAE 62.1-2013

Filtration: Filtration as per ASHRAE 62.1-2013

What is the desired level of occupant ability to adjust systems controls? Indicate the default desired levels below and for all spaces that have a desired level that differs from the default, provide this information in Table 1.

Lighting: To be determined in detailed design

Temperature: 78F summer; 68F winter

Humidity: 50-60% RH

What, if any, specific types of lighting are desired? (example: fluorescent in 2x2 grid, accent lighting, particular lamps)

To be determined in detailed design

4. Equipment and System Expectations

(Complete for each category as applicable or indicate "none identified" or "N/A". Add desired features information for other anticipated commissioned systems as applicable)

Indicate desired features for the following commissioned system: Space Heating

Desired Type: Condensing Gas Boilers

Quality: High efficiency, direct vented

Indicate desired features for the following commissioned system: Ventilation

Desired Type: Total energy wheel heat recovery.

Indicate desired features for the following commissioned system: Air Conditioning

Desired Type: Central Station Variable air volume with air cooled chillers and condensing gas boilers.

Indicate desired features for the following commissioned system: HVAC Controls

Desired Type: Lonworks integrated into JSOC Logix front end UMCS

Preferred Manufacturer: To be determined in detailed design but generally open Lonworks

Indicate desired features for the following commissioned system: Domestic Hot Water

Desired Type: Instantaneous gas fired condensing domestic hot water heaters.

Indicate desired features for the following commissioned system: Lighting Controls

Desired Type: To be determined in detailed design

Desired Technologies: To be determined in detailed design

Indicate desired features for the following commissioned system: Emergency Power

Desired Type: Diesel emergency generator.

Preferred Manufacturer: To be determined in detailed design

Reliability: To be determined in detailed design

Automation: To be determined in detailed design

Flexibility: To be determined in detailed design

Maintenance Requirements: To be determined in detailed design

Desired Technologies: To be determined in detailed design

5. Building Occupant and O&M Personnel Requirements

How will the facility be operated? Who will operate the facility?

The facility shall be operated by designated Government personnel.

Will the facility be connected to an EMCS? If so, what are the interface requirements? (example: monitoring points, control points, scheduling)

The DDC system shall be integrated into the JSOC open Lonworks front end which is a "Building Logix" system. Specifics of the integration shall be determined during detailed design.

What is the desired level of training and orientation for building occupants to understand and use the building systems?

The building operator shall be fully trained to operate all building systems as part of the project.

What is the desired level of training and orientation for O&M staff to understand and maintain the building systems?

The building operator shall be fully trained to operate all building systems as part of the project.

TABLE 1: Room / Area	Occ'd Cooling (°F)	Unocc'd Cooling (°F)	Occ'd Heating (°F)	Unocc'd Heating (°F)	Relative Humidity	Vent. Per Person (cfm)	Vent per Sq. Ft. (cfm)
Offices	78	85	68	55	30-50%	5	0.06
Conference Rooms	78	85	68	55	30-50%	5	0.06
Break Rooms	78	85	68	55	30-50%	5	0.12
Reception	78	85	68	55	30-50%	5	0.06
Copy/Work Rooms	78	85	68	55	30-50%	5	0.5
Storage	78	85	68	55	30-50%	0	0.12
Corridor	78	85	68	55	30-50%	0	0.06
Elec/Tele Rooms	78	80	55	55	30-50%	0	0.06
Restrooms	-	-	68	55	-	50 cfm per fixture	-

Table 1

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DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 91 00.00 37

PRELIMINARY COMMISSIONING PLAN

02/20

-- End of Section Table of Contents --

**SOF Group Headquarters
Ft Bragg, North Carolina
Preliminary
Commissioning Plan**

108 Bentons Lodge Rd, Ste B

Summerville, SC 29485

www.cemsengineering.com



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I. General Project Information

The SOF Group Headquarters Building is located at the Yarborough Complex on Ft Bragg, NC. The building is a two-story building with approximately 96,016 square feet (SF) of useable space. The building will consist mainly of administrative space, conference rooms, a secure area, joint operations center (JOC), logistics, network operation center (NOC), headquarters company, unit storage, lockers and restrooms. The buildings will be conditioned using a chilled and heating hot water for cooling and hot water systems.

II. Commissioning Program Overview

The commissioning process for this project will consist of multiple steps. Developing the Owner's Project Requirements (OPR) and Basis of Document (BOD). Both of these documents must be developed throughout the pre-design and design phases of the project. OPR will be written first. Then the engineer and architect will develop the BOD from the requirements of the OPR, this may be developed through meetings with the owner, architect, engineer and contractor. The commissioning agent (CxA) will review those documents to create a list of systems, which require commissioning.

Once the commissioning systems and required level of performance have been determined, a commissioning plan will be developed. The commissioning plan will be updated throughout the design and start of construction. This document represents the commissioning plan and will include information from the OPR and BOD.

The CxA will do a design review of the construction documents of all systems to be commissioned. All comments by the CxA must be evaluated and incorporated into the design drawings and specifications.

Pre-functional and functional performance checklists will be developed by the CxA during the design and finalized prior to the installation of the commissioned systems. The contractors will review the checklists and give their feedback to incorporate prior to the tests.

The sequence and timing of commissioning activities during construction must be incorporated into the overall project schedule.

Training of the maintenance and operating staff shall be completed as discussed below in the training section within this commissioning plan.

A final commissioning report, generated by the CxA, will show the results of all checklists and performance tests. Any system deficiencies will be noted in the report along with a time line to

have them complete. The report will also include the submittal review, site observations, proof of owner training and copy of all the project O&M manuals.

The commissioning process does not end until all commissioning systems issues are resolved to the satisfaction of the owner and full documentation of the systems is provided. **Acceptance of these systems by the owner initiates the warranties of all equipment. This is when the warrantee period begins.**

Approximately 8-10 months after occupancy, the CxA shall review the building operations with the operating staff and occupants. If any issues are found a plan will be developed to resolve the outstanding issues.

III. Goals and Objectives

The project will be designed and developed for a sustainable rating of LEED Silver. The primary purpose of building commissioning is to have all of the energy related systems within the building perform according to the OPR, BOD and construction documents. The goals of building commissioning are to reduce building systems and equipment maintenance, ensure the thermal comfort requirements of the building occupants are met by the systems and reduce the delay in the building start-up. The objectives of building commissioning are to ensure the equipment and systems are installed per the specification provided by the manufacturer and per the construction documents, ensure the contractors properly test the installed equipment prior to building occupancy, ensure the staff of the building understand how to operate the building systems, verify that maintenance procedures are in place prior to occupancy and ease the flow of information between contractors.

IV. Commissioned Systems

The basis of this plan is to commission the plumbing, mechanical, electrical, storm water systems and their associated equipment. The following systems and their associated equipment will be commissioned during this project.

Plumbing System

- Water Heater and Associated Piping
- Pumps
- DDC Water & Gas Meters

Mechanical System

- Chilled Water System
- Boiler Hot Water System
- Air Handling Units, VAV boxes and Associated Ductwork
- Air Handling Units and Associated Ductwork
- Energy Recovery Units and Associated Ductwork
- Computer Units
- Unit Heaters
- Ductless Split Systems
- Supply, Exhaust and Relief Fans and Associated Ductwork
- DDC Electric meter
- HVAC Controls

Electrical System

- Exterior and Interior lighting Control System

Building System

- Building envelope including thermal and moisture integrity and air tightness

V. Commissioning Team

The following are the members of the commissioning team for the project, included is their contact information.

Project Manager

Joshua Mitchell
US Army Corps of Engineers
Joshua.A.Mitchell@usace@army.mil
(910) 251-4640

Resident Engineer

Name
US Army Corps of Engineers
name@usace@army.mil
office (XXX) XXX-XXXX

The owner's project manager will manage the contracts of the design team, the general contractor, the subcontractors and the CxA. She will assist the CxA in defining, reviewing and revising the project design and commissioning scope.

The resident engineer will review the commissioning progress and deficiency reports and attend commissioning management meetings, witness tests if desired, coordinate the resolution of any deficiencies and approve any changes made to the design intent. He will contact and invite the CxA to the pre-bid meeting to make sure all contractors bidding on the project will understand their roles in the commissioning process. He will forward equipment submittals and as-built drawings to the CxA for review. He will review, comment on and accept the final commissioning plan and report. He will then issue the start of the warranty period for all commissioned equipment.

Commissioning Authority (CxA)

Scott Parkhurst, PE, CxA, CBCP, LEED AP BD+C
CEMS Engineering, Inc.
320-C Midland Parkway
Summerville, SC 29485
sparkhurst@cems-ae.com
office (843) 875-3637
cell (530) 386-5047

The primary role of the CxA is to develop and coordinate the execution of a testing plan, observe and document performance that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. He is to organize and lead the commissioning team in a sequential and efficient manner using consistent methods and forms, centralize documentation, clear and continual communication, and consultations with all necessary parties, frequently updated timelines and schedules and offer technical expertise. He will report directly to the project engineer unless approve otherwise. The CxA will perform all the following tasks:

- Perform commissioning design reviews and providing comments in Dr. Checks.
- Prepare the Preliminary Commissioning Plan for the government and design team to review and include in the specifications.
- Prepare the Preliminary Pre-functional (PFT) and Functional (FPT) Checklists for the government and design team to review and include in the specifications.
- Update the Commissioning plan, PFT and FPT for the owner and contractors to review.

- Organize and lead the commissioning team.
- Coordinate and conduct commissioning team meetings as required and issue commissioning meeting notes. The kickoff meeting is the only meeting the CxA will attend in person unless it coincides with another site visit.
- Provide Cx activities into the construction schedule.
- Provide a Cx Issues Log for all issues found during site visits related to the Cx systems.
- Review equipment submittals related to Cx systems.
- Review Start-Up Forms prepared by Contractors.
- Review Control point-to-point checks
- Review the TAB report
- Witness 20% of PFT checklists (contractor is responsible for 100%)
- Witness and direct contractor execution of all FPT.
- Review O&M Manuals
- Verify Owner Training
- Lead 10-Month Warranty Review.
- Provide Final Commissioning Report.
- Provide Systems Manual
- Complete LEED credit templates and provide all documentation required by the USGBC.

Architect

Michelle Barnett
Mason & Hanger Group Inc.
Michelle.barnett@masonandhanger.com
859-280-3515

Mechanical Engineer

Grant Page
Mason & Hanger Group Inc.
Stan.raispis@masonandhanger.com
859-550-2274

Electrical Engineer

Chris Welch
Mason & Hanger Group Inc.
Chris.welch@masonandhanger.com
757-213-6047

General Contractor

Project Manager

Point of Contact
Company
Address
Email Address
Phone Number

Quality Control Manager

Point of Contact
Company
Address
Email Address
Phone Number

The general contractor will be present on-site for majority of the construction. The general contractor is responsible for the overall supervision of all commissioned systems and verifying the subcontractors perform all work according to construction drawings and specifications. He is responsible for providing the CxA with system specifications and installation procedures. He will also provide scheduling for the commissioning process to the team. He will be required to be onsite during FPT.

Mechanical Contractor

Point of Contact
Company
Address
Email Address
Phone Number

The mechanical contractor will be present on-site for all mechanical system installation. He is responsible for installing all of the mechanical systems per manufactures specification and per the construction drawings and specifications. He will also demonstrate that all the mechanical systems run according to specifications. He will be required to be onsite during FPT.

Electrical Contractor

Point of Contact
Company
Address
Email Address
Phone Number

The electrical contractor will be present on-site for all electrical system installation. He is responsible for installing all of the electrical systems per manufactures specification and per the construction drawings and specifications. He will also demonstrate that all the electrical systems work according to specifications. He will be required to be onsite during FPT.

Fire Protection Contractor

Point of Contact
Company
Address
Email Address
Phone Number

The fire protection contractor will be present on-site for all fire protection system installation. He is responsible for installing all of the fire protection systems per manufactures specification and per the construction drawings and specifications. He will also demonstrate that all the fire protection systems work according to specifications. He will be required to be onsite during FPT.

Controls Contractor

Point of Contact
Company
Address
Email Address
Phone Number

The controls contractor will be present on-site for all system installation, TAB services and functional performance tests. He is responsible for installing the systems requiring controls per manufactures specification and per the construction drawings and specifications. He will provide control point-to-point for review. He will provide as-built drawings reflecting all changes made during the construction phase and FPT. He will also demonstrate that all of

those systems run according to specifications. He will run all FPT with the CxA witnessing and directing them. He will provide all necessary labor, tools and instruments needed to execute the tests.

TAB Agency

Point of Contact
Company
Address
Email Address
Phone Number

The TAB agency shall submit to the design team and CxA for approval a report detailing TAB procedures and instruments planned for use on the project. The TAB report shall include descriptions of the operational conditions required before systems will be ready for balancing. The TAB agency is responsible for checking that all pre-requisites for the start of TAB services have been completed prior to initiating their field work. The TAB agency performs TAB services in accordance with the project specifications and the procedures submitted and approved at the beginning of the construction phase. During early construction phase the TAB agency shall provide comments from their review of the contract documents pertaining to testing air, water flows, temperatures and pressures. The TAB agency shall submit a tentative schedule for their scope of work. The schedule shall include site visits to evaluate the impacts of as-built conditions on the planned procedures and schedule, and to determine when the installation will be ready for on-site TAB work. He will be required to be onsite during FPT.

Air Barrier Testing Company

Point of Contact
Company
Address
Email Address
Phone Number

The air barrier testing company will perform the air barrier test. They shall perform periodic site visits to prior to the air barrier test. If the test is unsuccessful they shall help the contractor determine where the leaks in the building are located. Once the test is successful they shall provide a report to the team for review.

The Engineers, Architect, Contractors, Subcontractors and Construction Manager shall:

- Provide adequate support to the Commissioning Team including design narrative information to convey the basis of design and initial design concepts.
- Perform the typical submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc.
- Prepare contract documents indicating descriptions of system operation and parameters.

- Within the design, provide adequate space for installation, testing & balancing and maintenance of equipment and systems.
- Coordinate the resolution of system deficiencies identified during commissioning, according to the contract documents throughout project commissioning and warranty period commissioning.
- Attend the Commissioning Management Program Meetings and participate in any problem resolution discussions.
- Provide electronic and hard copies of review documents throughout pre-design, schematic design, design development and the construction documents phase of design. As part of this documentation, also include coordination drawings of the building system.
- Be responsible for system evaluation, adequacy of the system to meet design intent, capacity of the system, quality control checks, and any of the other elements of the system design and recommend final acceptance of the systems to the owner.
- From the Contractors' red-line drawings, edit and update any diagrams developed as part of the design narrative and those provided by the vendors as shop drawings for the systems being commissioned.
- Provide 11x17, half sized, and full-sized copies of final As-Built drawings for inclusion into the owner's final Commissioning Manuals and Project Documentation.
- Coordinate the commissioning schedule into the overall contraction schedule, consider that time may be required for correction and retesting of components or systems.
- Provide the necessary cooperation in coordinating the availability of all contractors and subcontractors required for the Commissioning Management Program Meetings, commissioning tests and any problem resolution discussions.
- Participate in implementing the equipment check-in, start-up verification, pre-functional and functional performance testing throughout the commissioning process.
- Provide acceptance of CxA test procedures for the various equipment and systems.
- Provide O&M information shortly after approval of submittals, because these will be used throughout the project to train the owner and commission the equipment.
- Provide documentation to CxA as requested.
- Review and comment on Cx plan, PFT and FPT checklists.
- Incorporate Cx schedule into construction schedule.
- Provide equipment submittals and startup documents for review.
- Provide RFI's and drawing revisions to CxA that relate to Cx systems.
- Provide equipment, tools, special wrenches, laptop computers, etc. necessary to demonstrate to CxA during functional performance testing that equipment and systems perform according to the drawings and manufacturers recommendations. Specifically provide a power quality meter that will allow CxA to verify accuracy of EPMS meters. Power Quality Meters shall be capable of waveform capturing and transient detection to illustrate equipment recovery and switching times. Power Quality meters shall also be capable of generating CBEMA Power Acceptability curves automatically.
- Prepare and submit Training Plans to government, CxA for review and comment 2 weeks prior to the proposed training date.
- Schedule and conduct Owner Training as contracted. Review approved O&M documentation as part of Owner Training.
- Participate in Warranty review.

The facility will be under warranty for at least one year following acceptance by the government. The facility manager will report problems to a government representative that was involved in the project during construction for correction during that year. Upon completion of the warranty year maintenance will be accomplished by the in house work force. Who the government representative, during the warranty period, and the in house work force is has not been determined at this time.

VI. Communication Protocol

The CxA will communicate between the project owner and the contractor for all issues related to the building commissioning. Additionally, he will communicate all commissioning requirements to the commissioning team. All subcontractors will communicate any commissioning related issues to the general contractor. The general contractor will then relay those issues to the CxA and the related Engineer or Architect depending on the issue.

Issue	Protocol
Requests for Information (RFI) or formal documentation requests:	The CxA will submit an appropriate RFI to the Project Manager. Project Manager will respond or forward to appropriate parties for clarification.
Minor clarifications and verbal information exchanges:	The CxA will contact the respective discipline.
Notification of contractors of deficiencies in commissioning requirements:	The CxA will document the deficiencies through the Project Manager.
Scheduling function tests or training:	The CxA will schedule any on-site training with the General Contractor and Subcontractors.
Scheduling of commissioning meetings:	The CxA will schedule all meetings with the Commissioning Team.
Major Request for Change (RFC):	The CxA will make any major RFCs with the Project Team and any affected parties. It will be up to the discretion of the Project Manager from affected discipline and affected parties whether the changes are implemented.
Minor Request for Change (RFC):	The CxA will communicate the need for any minor RFCs with the Project Team and any affected parties. It will be up to the discretion of the Project Manager whether the changes are implemented.

Subcontractor disputes with commissioning requirements:	All commissioning requirements will be followed to completion. Any disputes involving the subcontractors will be resolved by the General Contractor and Project Manager.
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VII. Meetings

Meetings will be conducted on a regular basis in order to ensure that the commissioning requirements are being followed and that no conflicts have arisen. The first meeting will occur prior to the installation of any commissioned systems. This meeting will include all members of the commissioning team. The scope of the meeting will include the systems to be commissioned, the requirements of the commissioning and a schedule for completion and start-up. During the meeting all parties will be informed of their responsibility to the commissioning process and any deliverables to be submitted. Meetings shall in conjunction with the regular progress meetings.

On a monthly basis, the subcontractors and general contractor will meet with the CxA in order to provide a project update. During the meeting with the general contractor, the general contractor will provide an overview of any commissioned system installation that has occurred during the previous month.

Following a system testing, a meeting will be conducted with all the commissioning team members associated with the system being tested. During that meeting the results will be discussed. If any deficiencies exist, a timeline will be developed to resolve issue.

VIII. Commissioning Construction Schedule

- 1) Prefunctional Performance Tests
 - i. CxA approval of completed prefunctional performance checklists is required prior to moving forward to next phase. This is only for checks required prior to start-up. The rest will be completed and approved after start-up.
- 2) Equipment start-ups
 - i. CxA approval of completed start-up reports is required prior to moving forward to next phase.
- 3) Controls Point-to-Point Checks
 - i. CxA approval of contractor completed controls point-to-point checks and controls sequence programming checks are required prior to moving forward to next phase.
- 4) Test and Balancing of Systems
 - i. CxA and mechanical engineer approval of completed final TAB report is required prior to moving forward to next phase.

- 5) Functional Performance Tests
 - i. CxA approval of completed functional performance checklists is required prior to moving forward to next phase.
- 6) Operations Staff Training
- 7) Warranty period starts
 - i. The commissioning process does not end until all commissioning systems issues are resolved to the satisfaction of the owner and full documentation of the systems is provided. **Acceptance of these systems by the owner initiates the warranties of all equipment. This is when the warrantee period begins.**

IX. Cx Kickoff Meeting

The Cx kickoff meeting will be scheduled by the CxA prior to any equipment being commissioned arrives on the jobsite. Contractors required to be in attendance include however not limited to general, mechanical, plumbing, electrical, telecom, controls and TAB contractors. The project engineer should also attend. If the air barrier consultant has been hired on then they should attend to if possible. The purpose of this meeting is:

- Review the Cx Plan.
- Review the roles and responsibilities of each Cx team member.
- Determine the lines of reporting and communication.
- Review preliminary PFT and FPT checklists
- Discuss the preliminary schedule and time frames.
- Address any questions of the Cx team member.

X. Equipment Submittals

The CxA will review the submittal register to determine what submittals they need to review. The contractor will submit the equipment submittals to the project engineer for approval. The project engineer will provide a copy of the equipment submittals that are being commissioned to the CxA. The CxA will review the equipment submittals for compliance with the OPR, BOD, controls, access and maintenance requirements. Once completed the CxA will forward their review to the project engineer. The project engineer is responsible for approving or rejecting the submittals so the project engineer must see the CxA's review prior to finishing their review. The CxA will limit their review of each submittal to a maximum of two reviews. Any additional reviews will be at the expense of the contractor. The CxA will use these submittals to update the PFT and FPT checklists.

XI. Equipment Startup Reports

Startup forms are intended to document the process used to prepare a piece of equipment for operation. It is a process whereby equipment is transitioned from being shipped and installed to full operation according to the manufacturer's specifications. Proper startup is important. If not started up correctly it could result in equipment failures, inefficiencies and failure to meet design capacities.

The startup of equipment should be done in accordance with the manufacturer's startup procedures and performed only by individuals with sufficient experience and training on the specific equipment. This process applies to both large and small equipment and is targeted at the equipment that is to be commissioned.

Most startup technicians/contractors have equipment-specific startup procedures. A requirement of Cx is to document this quality control process through the use of startup reports.

The installing contractor is not always the contractor responsible for documenting the startup process. The GC is responsible for determining who is responsible for documenting startup for each piece of equipment.

The contractor responsible for the startup is also responsible for obtaining the manufacturer's startup forms or developing them on their own. The responsible contractor is asked to submit the startup form to the CxA through the GC and Owner for each unique piece of equipment prior to commencing the startup process. The CxA will review the form to assess its general adequacy and provide comments back to the responsible contractor through the Owner and GC. The contractor, not the CxA, is ultimately responsible for the proper startup of the equipment and is viewed as an expert as it relates to this equipment. If the CxA or any other individual makes a recommendation that the contractor feels may cause damage to the equipment, the contractor should inform that party of their concern and only proceed with the startup procedure they determine acceptable.

The contractor is expected to follow every step on the startup form, sign and date it upon successful completion and provide to the CxA a maximum of two weeks after completion of startup. Each of the following types of equipment within the Cx scope is expected to have a unique startup report completed for each piece of equipment:

- Equipment supplied with 3-phase power
- Fuel burning equipment
- Direct expansion (DX) cooling equipment

XII. Control Point-to-Point

Once equipment start-up has been completed the controls contractor can start to carry out point-to-point control checks and document the results on checkout sheets. These checks shall confirm that all control-points wiring has been correctly installed and terminated, sensors have been calibrated and field devices operate correctly. This involves physical observation of device responses by the controls contractor to ensure they match control system displays. The controls contractor shall forward the documentation and checkout sheets to the CxA to verify the results.

XIII. Testing and Balancing

The TAB agency shall submit a report detailing TAB procedures and instruments planned for use on the project to the design team and CxA for approval. The TAB report shall include descriptions of the operational conditions required before systems will be ready for balancing.

After the equipment has been started-up successfully and the control point-to-point checklists are complete it is the TAB agencies responsibility to verify the systems are ready to be tested and balanced. This will include the TAB agency performing a site visit prior to the start of testing and balancing. Once the systems are ready the TAB agency shall start the testing and balancing of the systems. Their services shall be in accordance with the project specifications. When the TAB report is complete it shall be submitted to the design team for approval. The TAB report should include an executive summary stating all items not meeting TAB standards. It should also include calibration for airflow measuring stations, water flow meters and differential pressure (DP) sensors. When DP sensors are used for controlling fan or pump speed the TAB report should provide what the DP setpoint was determined to be set at and how that was determined. The CxA shall review the TAB report for approval.

XIV. Pre-Functional Checklists

Pre-Functional Checklists (PFT's) are intended to document the quality control process used on the project as it relates to equipment within the commissioning scope. This process applies to both large and small equipment.

The PFT process is designed to make sure that the following is addressed for each piece of equipment:

- Equipment matches the submitted/approved make and model number.
- Equipment is not damaged - either when received on site or anytime thereafter.
- Equipment is protected while on site prior to installation.
- Equipment is installed per the manufacturers' instructions.
- Equipment has all of the accessories required by the construction documents.

- Equipment is started up in accordance with manufacturer's guidelines.
- TAB is completed.
- Control of equipment is as specified.
- Control system interface is as specified.

The checklist is of primary importance when determining when the Functional Performance Test witnessing can begin and when the CxA should arrange to be on-site. Misrepresentation of completed work within the document may result in the responsible contractor receiving back-charges for the CxA's time and travel expenses.

PFT's are separated into typical trade divisions – mechanical, electrical, etc. However, it is the GC's responsibility to determine who is responsible for the completion of each checklist item.

The contractors, not the CxA, are ultimately responsible for the PFT documentation and proper checkout of the equipment and are viewed as experts relating to the installed equipment. If the CxA or any other individual makes a recommendation that the contractor feels may cause damage to the equipment, the contractor should inform that party of their concern and only continue with the procedure they determine acceptable.

The CxA shall verify that a documented process is being used by reviewing a sampling of PFT in the field. All PFT's must be filled out prior to Functional Performance Testing. They shall be provided to the CxA for review at least two weeks prior to functional testing begins. Each piece of equipment within the Cx scope is expected to have a PFT associated with it.

XV. Functional Performance Tests

The functional performance tests will not start until the following have been completed and provided to the CxA for approval:

1. Complete Filled out Functional Performance Test Readiness Forms
2. Complete Filled out Pre-Functional Checklists
3. Issues Log Completed with Response and Date Completed
4. Control Point-to-Point Checks
5. TAB Report
6. O&M Manual

All the above documents must have been provided to the CxA and approved a minimum of 14 days prior to starting the functional tests. The CxA will schedule the FPT's with the government once all documents have been reviewed and approved.

Systems are typically made up of many independent components which must work together. For example, an air handling unit can have control valves, control dampers and sensors that all must function as intended for the whole system to work properly. Functional performance testing

(FPT) is a process that starts at the individual component level and proceeds to the system level.

Verification of the individual components of a system is needed prior to FPT the whole system. Individual components of a system need to be checked such as the wiring, setpoints and location of that component are acceptable.

Once the proper operation has been verified for all of the individual components, then the system can be checked to see if they work together per the sequences of operation and manufacturer's instructions. Even though the individual components or pieces of equipment may operate properly, the whole system may not be performing as intended. The FPT will also verify that the equipment can achieve design capacities, such as cooling, heating and airflow. This is typically completed with the TAB contractor with some assistance from the controls contractor.

The CxA will create a FPT for each piece of equipment to be commissioned. The FPT's are then turned over to the construction team for review. All FPT's are written with simple pass/fail criteria.

The contractor will perform the functional performance tests. Electrical, mechanical, TAB and controls contractors shall be available at the site when needed during the functional performance tests. For all equipment connected to the DDC system the controls contractor will be performing the FPT's. The contractors are expected to supply the necessary labor, tools and instruments needed to execute the tests.

The CxA will witness and direct 100% of the HVAC functional performance tests, no sampling. For all other systems the CxA will witness 20% of the FPT's. Regardless of whether CxA utilizes a sampling strategy, the contractors are responsible for ensuring all equipment and systems operate as intended.

The CxA will fill out the functional performance checklists. If a piece of equipment or system fails any individual step of the FPT, the CxA may assist the contractors with investigating and resolving the deficiency in the spirit of keeping the testing moving forward. Deficiencies that cannot be solved within a reasonable time frame are noted within the FPT and the deficiency is moved to the Cx Issues Log for resolution by the responsible contractor(s).

If there are issues with any of the functional performance tests, retests will need to occur at the expense of the contractor. The contractor will need to fix the issues and notify the CxA a minimum of 14 days prior to retesting. If a sample was taken and issues were found the CxA may require a larger sample. This larger sample would be at the expense of the contractor.

XVI. Building Envelope Systems

The CxA will perform periodic site visits to confirm the building envelope is being installed per plans and specifications. Important installation items for the CxA to see include window and door installation along with wall to roof air/moister barrier transitions. It is the contractor's responsibility to let the CxA know at least a week in advance when these are being installed.

The air leakage test of the building envelope needs to be completed per specifications. The test shall demonstrate that the air leakage rate does not exceed 0.25 cfm/ft², at a pressure differential of 0.3" w.g., in accordance with the specifications. The test shall not be done until it is verified the continuous air barrier is in place and installed without failures in accordance with installation instructions. The CxA will witness the air barrier test. The general contractor will be responsible for contacting the CxA 14 day's minimum prior to the test.

XVII. Electrical

The CxA will witness and direct approximately a 25% sample of the lighting and lighting control testing. If there are issues with any of the functional performance tests, retests will need to occur at the expense of the contractor. The contractor will need to fix the issues and notify the CxA a minimum of 14 days prior to retesting. If a sample was taken and issues were found the CxA may require a larger sample. This larger sample would be at the expense of the contractor. The equipment manufacture must be present during these tests.

XVIII. O&M Manual and As-Built Drawings

The contractors will develop the control as-built and O&M manuals that gives future operating staff the information needed to understand and optimally operate the commissioned systems. The Owner's facility personnel will refer to these manuals to understand how their equipment is supposed to operate and for the maintenance requirements to keep the equipment operating as designed.

The O&M manual should not just use their submittal data. The O&M information should be specific to the equipment actually installed on the site. Manuals that contain multiple variations of equipment models should indicate exactly which one was installed and indicate its equipment ID tag used on this project. Pages that contain language other than English should be removed from the submittal.

For each piece of equipment, the O&M documentation shall include:

- Maintenance schedule
- Manufacturer performance data sheets
- Model numbers
- Accessories provided
- Warranty information/certificates
- Vendor contact information

The O&M manual shall be started at a minimum of about 50% of construction and provided to the government, CxA for review.

The controls contractor is responsible for documenting all aspects of the controls systems. The as-built should include data on all components included with the controls installation, general description of system, technical and applications data, installation, calibration and maintenance information, schematic diagrams of the entire controls system, completed points list (with records of point-to-point wiring and field device tests), completed sequence of controls (including final values for all parameters and set-points), clearly labeled control panels and devices per specifications and a complete set of system discs for the DDC system. This shall be an open control system and all points should be read/write. This shall all be included in the O&M manual. The O&M manual shall be submitted to the CxA and owner for approval.

XIX. Systems Manual

The systems manual will be put together by the CxA. The final systems manual shall be located at the job site for the operating staffs use. The manuals should include preventative maintenance procedures for all equipment and DDC controls, start-up and shut-down procedures, modes of control and operation sequences, maintenance schedules and procedures, complete listing of contractors and manufacturer contact information, detailed instructions on the control system, equipment monitoring for the DDC systems, and provisions for safety shutdowns, emergency conditions and interfaces with BAS and life-safety systems.

XX. Training

There is one main training session on the electrical systems and one on the mechanical systems for the service personnel. The session will be conducted two months after the start-up and check-out of all commissioned systems. Sessions will be a minimum of one day duration for the basics in each system and be conducted as specified below. These sessions will be conducted at the site.

All training sessions will be visually recorded onto a DVD for longevity. A training agenda in the format enclosed will be provided for each session. This will be submitted three weeks prior to the scheduled training session. All listed owner's representatives will sign this prior to proceeding with the training.

A list of training topics that are appropriate for consideration are listed in the attached Training Agenda Topics list.

The CxA will be notified of the scheduled training time and provided with a copy of the training material fifteen days prior to the training session. The CxA will review the material and share

comments with the Owner and the design professionals. If any aspects do not meet the requirements of the specifications, this will be communicated through the design professionals.

A receipt acknowledging completion of each item of instruction will be secured.

The training will be evaluated based upon the criteria in the attached evaluation form.

Electrical Systems

The Training shall include:

- General familiarization and operating procedures for the entire electrical installation.
- Routine maintenance procedures for equipment.
- Specific operating and maintenance procedures for:
 - All Lighting Equipment/Systems and items listed in Section IV. Commissioned Systems.

Factory-trained technicians will provide operating and maintenance instructions on the following:

System/Equipment	Minimum Session Duration, hrs.
Lighting Control Systems	3

Mechanical Systems

The Training shall include:

- General familiarization with and operating procedures for the entire plumbing, fuel, and HVAC systems installation.
- Routine maintenance procedures for equipment.
- Specific operating and maintenance procedures for:
 - All Mechanical and Plumbing Equipment/Systems listed in Section IV. Commissioned Systems.

Factory-trained technicians will provide operating and maintenance instructions on the following:

System/Equipment	Minimum Session Duration, hrs.
Air Handling	2
All Other HVAC units	1
Automatic temperature controls	1
DDC Control System	4
Hot Water System	2

XXI. Warranty Review

At the nine months after substantial completion, the CxA will visit the site and meet with the Owner's facility and maintenance staff. The CxA will lead the meeting and walk through. The intent of this meeting is to find out how the building is operating, if there have been any issues, any warranty calls and to answer any questions the facility or maintenance staff may have. Once the meeting is complete the CxA will walk through building to review how the systems are actually operating and review items discussed during the meeting. If there are no workstations or integration hasn't been completed yet then the controls contractor will need to be present to review the operation of the control system. The warranty review process may result in additional warranty issues for the contractor to address and additional training.

Once the warranty walk through is completed the CxA will document all findings (warranty or maintenance issues) in a field report. It is the project engineer's responsibility to make sure the items in the report are corrected if warranted.

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05/10

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PN87437, SOF Group Headquarters
Fort Bragg, North Carolina

Solicitation No. W912PM21R0001

3.6 REUSE OF SALVAGED ITEMS

-- End of Section Table of Contents --

SECTION 02 41 00

DEMOLITION
05/10

PART 1 GENERAL

1.1 REFERENCES

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

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI Guideline K (2009) Guideline for Containers for Recovered Non-Flammable Fluorocarbon Refrigerants

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.6 (2006) Safety & Health Program Requirements for Demolition Operations - American National Standard for Construction and Demolition Operations

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)

40 CFR 61 National Emission Standards for Hazardous Air Pollutants

40 CFR 82 Protection of Stratospheric Ozone

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 Plan

Prepare a Demolition Plan and submit proposed salvage, demolition, and removal procedures for approval before work is started. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Identify components and materials to be salvaged for reuse or recycling with reference to paragraph Existing Facilities to be Removed. Append tracking forms for all removed materials indicating type, quantities, condition, destination, and end use. Coordinate with Waste Management Plan in accordance with Section 01 74 19.00 37 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL. Provide procedures for safe conduct of the work in accordance with EM 385-1-1. Plan shall be approved by Contracting Officer prior to work beginning.

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. Remove rubbish and debris from the project site; do not allow accumulations inside or outside the building. The work includes demolition,, salvage of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 ITEMS TO REMAIN IN PLACE

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload pavements to remain.

1.3.1 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.

1.3.2 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.

1.3.3 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.

1.4 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.5 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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Demolition Plan; G, RO
Existing Conditions

SD-07 Certificates

Notification; G, RO

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. 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.

1.7 PROTECTION

1.7.1 Traffic Control Signs

a. Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the Contracting Officer prior to beginning such work.

1.7.2 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.8 EXISTING CONDITIONS

Before beginning any demolition, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results.

PART 2 PRODUCTS

2.1 FILL MATERIAL

- a. Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill basements, voids, depressions or excavations resulting from demolition or deconstruction of structures.
- b. Fill material shall conform to the definition of satisfactory soil material as defined in Section 31 00 00 EARTHWORK shall be free from roots and other organic matter, trash, debris, frozen materials, and stones larger than 2 inches in any dimension.
- c. Proposed fill material must be sampled and tested by an approved soil testing laboratory, in accordance with Section 31 00 00 EARTHWORK.

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 completely including slabs on grade and foundations. 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.

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 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

Remove existing utilities uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered but are not indicated on the drawings, notify the Contracting Officer prior to further work in that area. Remove meters and related equipment and deliver to a location in accordance with instructions of the Contracting Officer.

3.1.3 Air Conditioning Equipment

Remove air conditioning, refrigeration, and other equipment containing refrigerants without releasing chlorofluorocarbon refrigerants to the atmosphere in accordance with the Clean Air Act Amendment of 1990. Recover all refrigerants prior to removing air conditioning, refrigeration, and other equipment containing refrigerants and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)."

3.1.4 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)."

3.1.5 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.

3.2 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 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 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 Disposal of Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in Section, 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting AHRI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. Recovered ODS shall be removed from Government property and disposed of in accordance with 40 CFR 82. Products, equipment and appliances containing ODS in a sealed, self-contained system (e.g. residential refrigerators and window air conditioners) shall be disposed of in accordance with 40 CFR 82. Submit Receipts or bills of lading, as specified. Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped to the Defense Depot, Richmond, Virginia.

3.3.2.1 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.

3.4 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.

3.5.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property .

3.5.3 Removal from Government Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

3.6 REUSE OF SALVAGED ITEMS

Recondition salvaged materials and equipment designated for reuse before installation. Replace items damaged during removal and salvage operations or restore them as necessary to usable condition.

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DIVISION 03 - CONCRETE

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STRUCTURAL CAST-IN-PLACE CONCRETE FORMING
05/14

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 301	(2016) Specifications for Structural Concrete
ACI 347R	(2014; Errata 1 2017) Guide to Formwork for Concrete

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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Formwork; G, AE
Form Removal Schedule; G, AE

SD-03 Product Data

Form Materials

SD-04 Samples

Sample Panels; G

SD-05 Design Data

Calculations

SD-06 Test Reports

Inspection

1.3 QUALITY ASSURANCE

Provide Sample Panels of sufficient size to contain joints and not less than 6 feet long and 4 feet wide. The panels shall be of typical wall thickness and constructed containing the full allocation of reinforcing steel that will be used in the structure, with the forming system that duplicates in every detail the one that will be used in construction of the structure. Use the same concrete mixture proportion and materials, the same placement techniques and equipment, and the same finishing techniques and timing that are planned for the structure. Construction of a finish SF-3.0 will not be permitted until sample panels have been approved. Protect sample panels from construction operations in a manner to protect approved finish, and are not to be removed until all surface finish SF-3.0 concrete has been accepted. After shop drawings have been reviewed, submit sample panels for a surface finish SF-3.0 with applied architectural treatment; build panels on the project site where directed.

1.4 DELIVERY, STORAGE, AND HANDLING

Store fiber voids above ground level in a dry location. Keep fiber voids dry until installed and overlaid with concrete.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

The design, engineering, and construction of the formwork is the responsibility of the Contractor. Design formwork in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses, and capable of withstanding the pressures resulting from placement and vibration of concrete. Comply with the tolerances specified in Section 03 30 00.00 10 CAST-IN-PLACE CONCRETE, paragraph CONSTRUCTION TOLERANCES. However, for surfaces with an ACI Class A surface designation, limit the allowable deflection for facing material between studs, for studs between walers and walers between bracing to 0.0025 times the span. Design the formwork as a complete system with consideration given to the effects of cementitious materials and mixture additives such as fly ash, cement type, plasticizers, accelerators, retarders, air entrainment, and others. Monitor the adequacy of formwork design and construction prior to and during concrete placement as part of the Contractor's approved Quality Control Plan. Submit design analysis and calculations for form design and methodology used in the design.

2.2 FORM MATERIALS

Submit manufacturer's data, including literature describing form materials, accessories, and form releasing agents.

2.2.1 Formwork

Comply with ACI 301 Section 2. Provide for surfaces not exposed to public view a surface finish SF-1.0. Provide for surfaces exposed to public view a surface finish SF-3.0. Patch holes and defects in accordance with ACI 301. Submit form removal schedule indicating element and minimum length of time for form removal.

2.2.2 Retain-In-Place Metal Forms

Use retain-in-place metal forms for concrete slabs and roofs as specified

in Section 05 30 00 STEEL DECKS.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Formwork

Comply with ACI 301 Section 2 with surface tolerances in accordance with ACI 117.

3.2 INSPECTION

Inspect forms and embedded items in sufficient time prior to each concrete placement to certify to the Contracting Officer that they are ready to receive concrete. Report the results of each inspection in writing. Submit field inspection reports for concrete forms and embedded items.

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 - 2.4.2.2 Non-Metallic Waterstops
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PART 3 EXECUTION

- 3.1 INSTALLATION
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 - 3.1.1.2 Sawed Joints
 - 3.1.1.3 Bond Breaker
 - 3.1.2 Expansion Joints
 - 3.1.3 Joint Sealant
- 3.2 WATERSTOPS, INSTALLATION AND SPLICES
 - 3.2.1 Non-Metallic
 - 3.2.1.1 Rubber Waterstop
 - 3.2.1.2 Polyvinyl Chloride Waterstop
 - 3.2.1.3 Quality Assurance
 - 3.2.2 Non-Metallic Hydrophilic Waterstop Installation
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-- End of Section Table of Contents --

SECTION 03 15 00.00 10

CONCRETE ACCESSORIES
05/14

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO T 111 (2011; R 2015) Standard Method of Test for
Mineral Matter or Ash in Asphalt Materials

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995; R 2004) Basic Hardboard

ASME INTERNATIONAL (ASME)

ASME BPVC SEC IX (2010) BPVC Section IX-Welding and Brazing
Qualifications

ASTM INTERNATIONAL (ASTM)

ASTM D1751 (2004; E 2013; R 2013) Standard
Specification for Preformed Expansion
Joint Filler for Concrete Paving and
Structural Construction (Nonextruding and
Resilient Bituminous Types)

ASTM D1752 (2004a; R 2013) Standard Specification for
Preformed Sponge Rubber Cork and Recycled
PVC Expansion

ASTM D4 (1986; R 2010) Bitumen Content

ASTM D412 (2016) Standard Test Methods for
Vulcanized Rubber and Thermoplastic
Elastomers - Tension

ASTM D471 (2016a) Standard Test Method for Rubber
Property - Effect of Liquids

ASTM D5249 (2010; R 2016) Standard Specification for
Backer Material for Use with Cold-and
Hot-Applied Joint Sealants in
Portland-Cement Concrete and Asphalt Joints

ASTM D6/D6M (1995; E 2011; R 2011) Loss on Heating of
Oil and Asphaltic Compounds

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 513 (1974) Corps of Engineers Specifications
for Rubber Waterstops

COE CRD-C 572 (1974) Corps of Engineers Specifications
for Polyvinylchloride Waterstops

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Waterstops; G, AE

SD-03 Product Data

Preformed Expansion Joint Filler
Waterstops

SD-04 Samples

Waterstops

SD-07 Certificates

Preformed Expansion Joint Filler
Waterstops

1.3 DELIVERY, STORAGE, AND HANDLING

Protect material delivered and placed in storage off the ground from moisture, dirt, and other contaminants. Deliver sealants in the manufacturer's original unopened containers. Remove sealants from the site whose shelf life has expired.

PART 2 PRODUCTS

2.1 CONTRACTION JOINT STRIPS

Use 1/8 inch thick tempered hardboard contraction joint strips conforming to AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips must have removable top section.

2.2 PREFORMED EXPANSION JOINT FILLER

Use preformed expansion joint filler material conforming to ASTM D1751 or ASTM D1752, Type I, or resin impregnated fiberboard conforming to the physical requirements of ASTM D1752. Submit certified manufacturer's test reports for premolded expansion joint filler strips, compression seals and

lubricant, and metallic waterstops to verify compliance with applicable specification. Unless otherwise indicated, filler material must be 3/8 inch thick and of a width applicable for the joint formed. Backer material, when required, must conform to ASTM D5249.

2.3 WATERSTOPS

Submit a sample of each material consisting of a piece not less than 12 inches long cut from each 200 feet of finished waterstop furnished, but not less than a total of 4 linear feet of each type and size furnished. For spliced segments of waterstops to be installed in the work, furnish one spliced sample of each size and type for every 50 splices made in the factory and every 10 splices made at the job site for inspection and testing. Make the spliced samples using straight run pieces with the splice located at the mid-length of the sample and finished as required for the installed waterstop; the total length of each spliced sample not less than 12 inches. Submit waterstop materials and splice samples for inspection and testing identified to indicate manufacturer, type of material, size and quantity of material and shipment represented. Submit a shop drawing of the waterstops showing the placement and configuration.

2.3.1 Non-Metallic Materials`

Manufacture non-metallic waterstops from a prime virgin resin; reclaimed material is not acceptable. The compound must contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops conforming to COE CRD-C 513. Polyvinylchloride waterstops conforming to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops conforming to ASTM D471. Submit a piece not less than 12 inch long cut from each 200 ft of finished waterstop furnished, but not less than a total of 4 ft of each type, size, and lot furnished. One splice sample of each size and type for every 50 splices made in the factory and every 10 splices made at the job site. Make the splice samples using straight run pieces with the splice located at the mid-length of the sample and finished as required for the installed waterstop; the total length of each splice not less than 12 inches long.

2.3.2 Non-Metallic Hydrophilic

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water conforming to ASTM D412 as follows: Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum. Hardness must be 50 minimum on the type A durometer and the volumetric expansion ratio in distilled water at 70 degrees F shall be 3 to 1 minimum.

2.3.3 Preformed Plastic Adhesive

Produce preformed plastic adhesive waterstops from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler, containing no solvents, asbestos, irritating fumes or obnoxious odors. The compound cannot depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength.

2.3.3.1 Chemical Composition

Meet the chemical composition of the sealing compound requirements shown below:

PERCENT BY WEIGHT			
COMPONENT	MINIMUM	MAXIMUM	TEST
Bitumen (Hydrocarbon plastic)	50	70	ASTM D4
Inert Mineral Filler	30	50	AASHTO T 111
Volatile Matter		2	ASTM D6/D6M

2.3.3.2 Adhesion Under Hydrostatic Pressure

The sealing compound must not leak at the joints for a period of 24 hours under a vertical 6 foot head pressure. In a separate test, the sealing compound must not leak under a horizontal pressure of 10 psi which is reached by slowly applying increments of 2 psi every minute.

2.3.3.3 Sag of Flow Resistance

Sagging must not be detected when tested as follows: Fill a wooden form 1 inch wide and 6 inches long flush with sealing compound and place in an oven at 135 degrees F in a vertical position for 5 days.

2.3.3.4 Chemical Resistance

The sealing compound when immersed separately in a 5 percent solution of caustic potash, a 5 percent solution of hydrochloric acid, 5 percent solution of sulfuric acid and a saturated hydrogen sulfide solution for 30 days at ambient room temperature must show no visible deterioration.

2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

2.4.1 Materials Tests

2.4.1.1 Non-Metallic Waterstops

Samples of materials and splices will be visually inspected and tested by and at the expense of the Government for compliance with COE CRD-C 513 or COE CRD-C 572 as applicable. If a sample fails to meet the specification requirements, provide new samples.

2.4.2 Splicing Waterstops

2.4.2.1 Procedure and Performance Qualifications

Demonstrate procedure and performance qualifications for splicing waterstops in the presence of the Contracting Officer. Submit procedures for splicing waterstops for approval.

2.4.2.2 Non-Metallic Waterstops

Demonstrate procedure and performance qualifications for splicing non-metallic waterstops by the manufacturer at the factory and the Contractor at the job site by each making three spliced samples of each size and type of finished waterstop.

2.4.2.3 Metal Waterstops

Demonstrate procedure and performance qualifications for splicing metal waterstops at the job site by the Contractor. The brazing procedure, brazers and brazing operators for splicing copper waterstops shall be qualified in accordance with Part QB (Brazing), Article XI (Brazing, General Requirements), paragraph QB-170 (Peel Tests) and other applicable requirements of Articles XI, XII, and XIII of ASME BPVC SEC IX. The welding procedure and welders for splicing stainless steel waterstops shall be qualified in accordance with the manufacturer's recommendations.

PART 3 EXECUTION

3.1 INSTALLATION

Provide joint locations and details, including materials and methods of installation of joint fillers and waterstops, as specified and indicated. In no case may any fixed metal be continuous through an expansion or contraction joint.

3.1.1 Contraction Joints

Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Make joints 1/8 inch to 3/16 inch wide and extend into the slab one-fourth the slab thickness, minimum, but not less than 1 inch.

3.1.1.1 Joint Strips

Provide strips of the required dimensions and as long as practicable. After the first floating, groove the concrete with a tool at the joint locations. Insert the strips in the groove and depress them until the top edge of the vertical surface is flush with the surface of the slab. Float and finish the slab as specified. Work the concrete adjacent to the joint the minimum necessary to fill voids and consolidate the concrete. Where indicated, saw out the top portion of the strip after the curing period to form a recess for sealer. Discard the removable section of PVC or HIPS strips and leave the insert in place. Maintain true alignment of the strips during insertion.

3.1.1.2 Sawed Joints

Saw joints early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Start cutting as soon as the concrete has hardened sufficiently to prevent raveling of the edges of the saw cut. Complete cutting before shrinkage stresses become sufficient to produce cracking. Use concrete sawing machines that are adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Cut joints to true alignment and in sequence of concrete placement. Remove sludge and cutting debris. Form reservoir for joint sealant.

3.1.1.3 Bond Breaker

Coat joints requiring a bond breaker with curing compound or with bituminous paint. Protect waterstops during application of bond breaking material to prevent them from being coated.

3.1.2 Expansion Joints

Use preformed expansion joint filler in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. Extend the filler to the full slab depth, unless otherwise indicated. Neatly finish the edges of the joint with an edging tool of 1/8 inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, install the filler strips at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. Remove the wood strip after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. Thoroughly clean the groove of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust. If blowing out the groove use oil-free compressed air.

3.1.3 Joint Sealant

Fill sawed contraction joints and expansion joints in slabs with joint sealant, unless otherwise shown. Joint surfaces must be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Apply joint sealant as recommended by the manufacturer of the sealant.

3.2 WATERSTOPS, INSTALLATION AND SPLICES

Install waterstops at the locations shown to form a continuous water-tight diaphragm. Make adequate provision to support and completely protect the waterstops during the progress of the work. Repair or replace any waterstop punctured or damaged. Protect exposed waterstops during application of form release agents to avoid being coated. Provide suitable guards to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Accomplish splices with certified trained personnel using approved equipment and procedures.

3.2.1 Non-Metallic

Fittings must be shop made using a machine specifically designed to mechanically weld the waterstop. Use a miter guide, proper fixturing (profile dependant), and portable power saw to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. Splice straight lengths by squaring the ends to be joined. Maintain continuity of the characteristic features of the cross section of the waterstop (for example, ribs, tabular center axis, protrusions) across the splice.

3.2.1.1 Rubber Waterstop

Vulcanize splices or make using cold bond adhesive as recommended by the manufacturer. Splices for TPE-R must be as specified for PVC.

3.2.1.2 Polyvinyl Chloride Waterstop

Make splices by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. Use the correct temperature to

sufficiently melt without charring the plastic. Reform waterstops at splices with a remolding iron with ribs or corrugations to match the pattern of the waterstop. The spliced area, when cooled, must show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

3.2.1.3 Quality Assurance

Edge welding will not be permitted. Compress or close centerbulbs when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 1/2 inch in 10 feet. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9) Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

3.2.2 Non-Metallic Hydrophilic Waterstop Installation

Miter cut ends to be joined with sharp knife or shears. Adhere the ends with cyanacrylate (super glue) adhesive. When joining hydrophilic type waterstop to PVC waterstop, the hydrophilic waterstop shall be positioned as shown on the drawings. Apply a liberal amount of a single component hydrophilic sealant to the junction to complete the transition.

3.2.3 Preformed Plastic Adhesive Installation

Install preformed plastic adhesive waterstops employing a prime, peel, place and pour procedure. Clean and dry joint surfaces before priming and just prior to placing the sealing strips. Splice the end of each strip to the next strip with a 1 inch overlap; press the overlap firmly to release trapped air. During damp or cold conditions, flash the joint surface with a safe, direct flame to warm and dry the surface adequately; dip the sealing strips in warm water to soften the material to achieve maximum bond to the concrete surface.

3.3 CONSTRUCTION JOINTS

Treat construction joints coinciding with expansion and contraction joints as expansion or contraction joints as applicable.

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CONCRETE REINFORCING
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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 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) |
| ACI SP-66 | (2004) ACI Detailing Manual |

AMERICAN WELDING SOCIETY (AWS)

- | | |
|----------------|--|
| AWS D1.4/D1.4M | (2011) Structural Welding Code - Reinforcing Steel |
|----------------|--|

ASTM INTERNATIONAL (ASTM)

- | | |
|-------------------|---|
| ASTM A1035/A1035M | (2016a) Standard Specification for Deformed and Plain, Low-carbon, Chromium, Steel Bars for Concrete Reinforcement |
| ASTM A1064/A1064M | (2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete |
| ASTM A184/A184M | (2017) Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement |
| ASTM A370 | (2017a) Standard Test Methods and Definitions for Mechanical Testing of Steel Products |
| ASTM A615/A615M | (2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement |
| ASTM A706/A706M | (2016) Standard Specification for Low-Alloy Steel Deformed and Plain Bars |

for Concrete Reinforcement

ASTM A884/A884M

(2014) Standard Specification for
Epoxy-Coated Steel Wire and Welded Wire
Reinforcement

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP

(2009; 28th Ed; Errata) Manual of Standard
Practice

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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Reinforcement; G, AE

SD-03 Product Data

Reinforcing Steel; G, AE

SD-06 Test Reports

Tests, Inspections, and Verifications; G, AE

SD-07 Certificates

Reinforcing Steel
Qualified Welders

1.3 QUALITY ASSURANCE

1.3.1 Welding Qualifications

Welders are required to be qualified in accordance with AWS D1.4/D1.4M. Perform qualification test at the worksite and notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4/D1.4M. Submit a list of qualified welders names.

1.4 DELIVERY, STORAGE, AND HANDLING

Store reinforcement and accessories off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 FABRICATED BAR MATS

Fabricated bar mats conforming to ASTM A184/A184M.

2.2 REINFORCING STEEL

Reinforcing steel of deformed bars conforming to ASTM A615/A615M, ASTM A706/A706M, or ASTM A1035/A1035M grades and sizes as indicated. Cold drawn wire used for spiral reinforcement must conform to ASTM A1064/A1064M.

Submit certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

2.3 WELDED WIRE REINFORCING

Welded wire reinforcing conforming to ASTM A1064/A1064M. When directed by the Contracting Officer for special applications, use welded wire reinforcing conforming to ASTM A884/A884M. For wire with a specified yield strength (fy) exceeding 60,000 psi, fy must be the stress corresponding to a strain of 0.35 percent.

2.4 SUPPORTS

Design bar supports for formed surfaces in accordance with CRSI 10MSP and fabricate of steel or precast concrete blocks. Provide precast concrete blocks with wire ties and not less than 4 inches square when supporting reinforcement on ground. Precast concrete block must have compressive strength equal to that of the surrounding concrete. Coat steel supports for coated or galvanized bars with electrically compatible material for a distance of at least 2 inches beyond the point of contact with the bar. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, use galvanized, plastic protected or stainless steel supports within 1/2 inch of concrete surface. Concrete supports used in concrete exposed to view must have the same color and texture as the finish surface. For slabs on grade and topping slabs on steel deck, supports use precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

2.5 TESTS, INSPECTIONS, AND VERIFICATIONS

Perform material tests, specified and required by applicable standards, by an approved laboratory and certified to demonstrate that the materials are in conformance with the specifications. Perform and certify tests, inspections, and verifications and certify. Submit certified tests reports of reinforcement steel showing that the steel complies with the applicable specifications for each steel shipment and identified with specific lots prior to placement. Submit three copies of the heat analyses for each lot of steel furnished certifying that the steel conforms to the heat analyses.

2.5.1 Reinforcement Steel Tests

Perform mechanical testing of steel in accordance with ASTM A370 except as otherwise specified or required by the material specifications. Perform tension tests on full cross-section specimens using a gage length that spans the extremities of specimens with welds or sleeves included. From chemical analyses of steel heats report the percentages of carbon, phosphorous, manganese, sulphur and silicon present in the steel.

2.5.2 Non-Destructive Testing of Welds

Perform non-destructive testing of welds in accordance with AWS D1.4/D1.4M Section 7, except that radiographic testing is not permitted.

PART 3 EXECUTION

3.1 REINFORCEMENT

Fabricate and place reinforcement steel and accessories as specified, as indicated, and as shown on approved shop drawings. Fabrication and placement details of steel and accessories not specified or shown must be in accordance with ACI SP-66 and ACI 318. Cold bend reinforcement unless otherwise authorized. Bending may be accomplished in the field or at the mill. Do not bend bars after embedment in concrete. Place safety caps on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Face wire tie ends away from the forms. Submit detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Show support details including types, sizes and spacing.

3.1.1 Placement

Reinforcement must be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Place reinforcement in accordance with ACI 318 at locations indicated plus or minus one bar diameter. Do not continue reinforcement through expansion joints and place as indicated through construction or contraction joints. Cover with concrete coverage as indicated or as required by ACI 318. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, requires approval before concrete is placed.

3.1.2 Placing Tolerances

Conform bar spacing and concrete cover to ACI 117.

3.1.3 Splicing

Conform splices of reinforcement to ACI 318 and make only as required or indicated. Bars may be spliced at alternate or additional locations at no additional cost to the Government subject to approval. Splicing must be by lapping or by mechanical or welded butt connection; except that lap splices must not be used for bars larger than No. 11 unless otherwise indicated.

3.1.3.1 Lap Splices

Place lapped bars in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Do not space lapped bars farther apart than $1/5$ the required length of lap or 6 inches.

3.2 WELDED-WIRE REINFORCEMENT PLACEMENT

Place welded-wire reinforcement in slabs as indicated. Reinforcement placed in slabs on grade must be continuous between expansion, construction, and contraction joints. Reinforcement placement at joints

must be as indicated.

May lap splices in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Stagger laps to avoid continuous laps in either direction. Wire or clip together reinforcement at laps at intervals not to exceed 4 feet. Position reinforcement by the use of supports.

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CAST-IN-PLACE CONCRETE
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PART 1 GENERAL

1.1 LUMP SUM CONTRACT

Under this type of contract, concrete items will be paid for by lump sum and will not be measured. The work covered by these items consists of furnishing all concrete materials, reinforcement, miscellaneous embedded materials, and equipment, and performing all labor for the forming, manufacture, transporting, placing, finishing, curing, and protection of concrete in these structures.

1.2 REFERENCES

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

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 121R	(2008) Guide for Concrete Construction Quality Systems in Conformance with ISO 9001
ACI 211.1	(1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 211.2	(1998; R 2004) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 213R	(2014; E2017) Guide for Structural Lightweight-Aggregate Concrete
ACI 214R	(2011) Evaluation of Strength Test Results of Concrete
ACI 301	(2016) Specifications for Structural Concrete
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 305.1	(2014) Specification for Hot Weather

Concreting

ACI 306.1	(1990; R 2002) Standard Specification for Cold Weather Concreting
ACI 309R	(2005) Guide for Consolidation of Concrete
ACI 318	(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)
ACI SP-15	(2011) Field Reference Manual: Standard Specifications for Structural Concrete ACI 301-05 with Selected ACI References

ASTM INTERNATIONAL (ASTM)

ASTM C1017/C1017M	(2013; E 2015) Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1064/C1064M	(2017) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1077	(2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1157/C1157M	(2017) Standard Performance Specification for Hydraulic Cement
ASTM C1260	(2014) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C136/C136M	(2014) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C143/C143M	(2015) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2018) Standard Specification for Portland Cement
ASTM C1567	(2013) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C1602/C1602M	(2012) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete

ASTM C173/C173M	(2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C192/C192M	(2016a) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C31/C31M	(2018a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C311/C311M	(2017) Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C330/C330M	(2017a) Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C39/C39M	(2018) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42/C42M	(2018) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C494/C494M	(2017) Standard Specification for Chemical Admixtures for Concrete
ASTM C552	(2017; E 2018) Standard Specification for Cellular Glass Thermal Insulation
ASTM C567/C567M	(2014) Determining Density of Structural Lightweight Concrete
ASTM C578	(2018) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C591	(2017) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C595/C595M	(2018) Standard Specification for Blended Hydraulic Cements

ASTM C618	(2017a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C78/C78M	(2018) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C94/C94M	(2017a) Standard Specification for Ready-Mixed Concrete
ASTM C989/C989M	(2018) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM D5759	(2012) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
ASTM D75/D75M	(2014) Standard Practice for Sampling Aggregates
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
ASTM E1993/E1993M	(1998; R 2013; E 2013) Standard Specification for Bituminous Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP	(2009; 28th Ed; Errata) Manual of Standard Practice
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NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(2018) Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices
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NATIONAL READY MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(2000; R 2006) Concrete Plant Standards
NRMCA QC 3	(2015) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities

NRMCA TMMB 100

(2001; R 2007) Truck Mixer, Agitator and
Front Discharge Concrete Carrier Standards

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 104

(1980) Method of Calculation of the
Fineness Modulus of Aggregate

1.3 DEFINITIONS

1.3.1 Cementitious Material

As used herein, includes all portland cement, pozzolan, fly ash, ground granulated blast-furnace slag.

1.3.2 Chemical Admixtures

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.

1.3.3 Complementary Cementing Materials (CCM)

Coal fly ash, granulated blast-furnace slag, natural or calcined pozzolans, and ultra-fine coal ash when used in such proportions to replace the portland cement that result in considerable improvement to sustainability, durability.

1.3.4 Design Strength (f'_c)

The specified compressive strength of concrete at time(s) specified in this section to meet structural design criteria.

1.3.5 Mass Concrete

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.

1.3.6 Mixture Proportioning

The process of designing concrete mixture proportions to enable it to meet the strength, service life and constructability requirements of the project.

1.3.7 Mixture Proportions

The masses or volumes of individual ingredients used to make a unit measure (cubic yard) of concrete.

1.3.8 Pozzolan

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.

1.3.9 Workability or Consistency

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).

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Quality Control Plan; G
Laboratory Accreditation
Sampling Plan; G

SD-03 Product Data

Recycled Content Products; (LEED)
Cementitious Materials
Vapor Barrier
Floor Finish
Chemical Admixtures

SD-05 Design Data

Mixture Proportions; G, AE
Lightweight Aggregate Concrete

SD-06 Test Reports

Mixture Proportions; G, AE
Testing and Inspection for CQC; G
Fly Ash
Ground Granulated Blast-Furnace (GGBF) Slag
Aggregates
Air Content
Slump
Compressive Strength
Water

SD-07 Certificates

Contractor Quality Control personnel
Ready-Mix Plant

1.5 QUALITY ASSURANCE

Submit qualifications for Contractor Quality Control personnel assigned to concrete construction as American Concrete Institute (ACI) Certified Workmen in one of the following grades or show written evidence of having completed similar qualification programs:

Concrete Field Testing Technician	Grade I
Concrete Laboratory Testing Technician	Grade I or II
Concrete Construction Inspector	Level II
Concrete Transportation Construction Inspector or Reinforced Concrete Special Inspector	Jointly certified by American Concrete Institute (ACI), Building Official and Code Administrators International (BOCA), International Code Council (ICC), and Southern Building Code Congress International (SBCCI)
Foreman or Lead Journeyman of the flatwork finishing crew	Similar qualification for ACI Concrete Flatwork Technician/Finisher or equal, with written documentation

1.5.1 Laboratory Accreditation

Provide laboratory and testing facilities. The laboratories performing the tests must be accredited in accordance with ASTM C1077, including ASTM C78/C78M and ASTM C1260. The accreditation must be current and must include the required test methods, as specified. Furthermore, the testing must comply with the following requirements:

1.5.1.1 Aggregate Testing and Mix Proportioning

Perform aggregate testing and mixture proportioning studies in an accredited laboratory, under the direction of a registered professional engineer in a U.S. state or territory who is competent in concrete materials. This person is required to sign all reports and designs.

1.5.1.2 Acceptance Testing

Furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Furnish and maintain boxes or other facilities suitable for storing and curing the specimens at the site while in the mold within the temperature range stipulated by ASTM C31/C31M.

1.5.1.3 Contractor Quality Control

All sampling and testing must be performed by an approved, onsite, independent, accredited laboratory.

1.5.2 Quality Control Plan

Submit a concrete quality control program in accordance with the guidelines of ACI 121R and as specified herein. Identify the approved laboratories. Provide direct oversight for the concrete qualification program inclusive of associated sampling and testing. Provide all quality control reports to the Quality Manager, Concrete Supplier and the Contracting Officer. Maintain a copy of ACI SP-15 and CRSI 10MSP at the project site.

1.5.3 Special Properties and Products

Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Include any of these materials to be used on the project in the mix design studies.

1.5.4 Government Assurance Inspection and Testing

Day-to day inspection and testing is the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the CQC staff. Government inspection or testing will not relieve any CQC responsibilities.

1.5.4.1 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. Provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D75/D75M. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

1.5.4.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C172/C172M and tested in accordance with these specifications, as considered necessary.

1.5.4.3 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such tests are considered necessary.

1.5.4.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

1.6 DELIVERY, STORAGE, AND HANDLING

Follow ACI 301 and ACI 304R requirements and recommendations. Store cement and other cementitious materials in weathertight buildings, bins, or silos that exclude moisture and contaminants and keep each material completely separated. Arrange and use aggregate stockpiles in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Do not store aggregate directly on ground unless a sacrificial layer is left undisturbed. Store reinforcing bars and accessories above the ground on platforms, skids or other supports. Store other materials in a manner to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing cannot be used unless retested and proven to meet the specified

requirements. Materials must be capable of being accurately identified after bundles or containers are opened.

PART 2 PRODUCTS

In accordance with Section 01 33 29.00 37 SUSTAINABILITY submit documentation indicating: distance between manufacturing facility and the project site, distance of raw material origin from the project site, percentage of post-industrial and post-consumer recycled content per unit of product and relative dollar value of recycled content products to total dollar value of products included in project. Provide Submittals as specified in the subject Section.

2.1 SYSTEM DESCRIPTION

Provide concrete composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

2.1.1 Proportioning Studies-Normal Weight Concrete

Trial design batches, mixture proportions studies, and testing requirements for various types of concrete specified are the responsibility of the Contractor. Base mixture proportions on compressive strength as determined by test specimens fabricated in accordance with ASTM C192/C192M and tested in accordance with ASTM C39/C39M. Obtain mix design approval from the Contracting Officer prior to concrete placement.

- a. Samples of all materials used in mixture proportioning studies must be representative of those proposed for use in the project and be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications.
- b. Make trial mixtures having proportions, consistencies, and air content suitable for the work based on methodology described in ACI 211.1, 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 on the project.
- c. The maximum water-cementitious material ratios allowed in subparagraph WATER-CEMENTITIOUS MATERIAL RATIO below will be the equivalent water-cementitious material ratio as determined by conversion from the weight ratio of water to cement plus pozzolan by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, include the weight of the silica fume and GGBF slag in the equations in ACI 211.1 for the term P, which is used to denote the weight of pozzolan. If pozzolan is used in the concrete mixture, the minimum pozzolan content is 15 percent by weight of the total cementitious material, and the maximum is 35 percent.
- d. Design laboratory trial mixtures for maximum permitted slump and air content. Make separate sets of trial mixture studies for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either may be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies must also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. 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.

- e. Report the temperature of concrete in each trial batch. For each water-cementitious material ratio, make at least three test cylinders for each test age, cure in accordance with ASTM C192/C192M and test at 7 and 28 days in accordance with ASTM C39/C39M. From these test results, plot a curve showing the relationship between water-cementitious material ratio and strength for each set of trial mix studies. In addition, plot a curve showing the relationship between 7 day and 28 day strengths. Design each mixture to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.
- f. Submit the results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength of concrete, at least 60 days prior to commencing concrete placing operations. Base aggregate weights on the saturated surface dry condition. Accompany the statement with test results from an approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions may be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

2.1.2 Proportioning Studies-Lightweight Aggregate Structural Conc

Trial design batches, mixture proportioning studies, and testing requirements must conform to the requirements specified in paragraph PROPORTIONING STUDIES-NORMAL WEIGHT CONCRETE above, except as follows. Trial mixtures having proportions, consistencies and air content suitable for the work must be made based on methodology described in ACI 211.2, using at least three different cement contents. Proportion trial mixes to produce air dry unit weight, concrete strengths, maximum permitted slump, and air content. Test specimens and testing must be as specified for normal weight concrete except that 28-day compressive strength must be determined from test cylinders that have been air dried at 50 percent relative humidity for the last 21 days. Determine air dry unit weight in accordance with ASTM C567/C567M, designed to be at least 2.0 pcf less than the maximum specified air dry unit weight. Plot curves using these results showing the relationship between cement factor and strength and air dry unit weight. Normal weight fine aggregate may be substituted for part or all of the lightweight fine aggregate, provided the concrete meets the strength and unit weight. A correlation must also be developed showing the ratio between air dry unit weight and fresh concrete unit weight for each mix.

2.1.3 Average Compressive Strength

The mixture proportions selected during mixture design studies must produce a required average compressive strength (f'_{cr}) exceeding the specified compressive strength (f'_c) by the amount indicated below, but may not exceed the specified strength at the same age by more than 20 percent. This required average compressive strength, f'_{cr} , will not be a required acceptance criteria during concrete production. However,

whenever the daily average compressive strength at 28 days drops below f'_{cr} during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day f'_{cr} , adjust the mixture, as approved, to bring the daily average back up to f'_{cr} . During production, the required f'_{cr} must be adjusted, as appropriate, based on the standard deviation being attained on the job.

2.1.4 Computations from Test Records

Where a concrete production facility has test records, establish a standard deviation in accordance with the applicable provisions of ACI 214R. Test records from which a standard deviation is calculated must represent materials, quality control procedures, and conditions similar to those expected; must represent concrete produced to meet a specified strength or strengths (f'_c) within 1000 psi of that specified for proposed work; and must consist of at least 30 consecutive tests. A strength test must be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength f'_{cr} used as the basis for selection of concrete proportions must be in accordance with ACI 318 Chapter 5.

2.1.5 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices must be in accordance with ACI 117. Take level and grade tolerance measurements of slabs as soon as possible after finishing; when forms or shoring are used, the measurements must be made prior to removal.

2.1.6 Floor Finish

For floor finishes, see Section 03 35 00.00 10 CONCRETE FINISHING.

2.1.7 Strength Requirements

Specified compressive strength (f'_c) must be as follows:

COMPRESSIVE STRENGTH	STRUCTURE OR PORTION OF STRUCTURE
4000 psi at 28 days	All concrete

Concrete made with high-early strength cement must have a 7-day strength equal to the specified 28-day strength for concrete made with Type I or II portland cement. Compressive strength must be determined in accordance with ASTM C39/C39M.

2.1.7.1 Evaluation of Concrete Compressive Strength

Fabricate six compressive strength specimens, 6 inch by 12 inch cylinders, laboratory cure them in accordance with ASTM C31/C31M and test them in accordance with ASTM C39/C39M. Test two cylinders at 7 days, two cylinders at 28 days, and hold two cylinder in reserve. The strength of the concrete is considered satisfactory so long as the average of all sets of three consecutive test results do not exceed the specified compressive strength f'_c by 20 percent and no individual test result falls below the specified strength f'_c by more than 500 psi), unless approved by the

Contracting Officer. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required when the strength of the concrete in the structure is considered potentially deficient.

2.1.7.2 Investigation of Low-Strength Compressive Test Results

When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 500 psi or if tests of field-cured cylinders indicate deficiencies in protection and curing, take steps to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, obtain cores and test in accordance with ASTM C42/C42M. Take at least three representative cores from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) may not be used as a basis for acceptance or rejection. Perform the coring and repair the holes; cores will be tested by the Government.

2.1.7.3 Load Tests

If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318. Correct concrete work evaluated by structural analysis or by results of a load test as being understrength in a manner satisfactory to the Contracting Officer. Perform all investigations, testing, load tests, and correction of deficiencies approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

2.1.8 Water-Cementitious Material Ratio

Maximum water-cementitious material ratio (w/c) for normal weight concrete is as follows:

WATER-CEMENTITIOUS MATERIAL RATIO, BY WEIGHT	STRUCTURE OR PORTION OF STRUCTURE
0.45	All concrete

2.1.9 Air Entrainment

Air entrain normal weight concrete based on the following table.

MINIMUM AIR CONTENT Percent	STRUCTURE OR PORTION OF STRUCTURE
5.0	All concrete except that receiving hard trowel finish

Attain specified air content at point of placement into the forms within plus or minus 1.5 percent. Determine air content for normal weight concrete in accordance with ASTM C231/C231M.

2.1.1.10 Slump

Slump of the concrete, as delivered to the point of placement into the forms, must be within the following limits. Determine slump in accordance with ASTM C143/C143M.

Structural Element	Slump inches	
	Minimum	Maximum
Walls, columns and beams	2	4
Foundation walls, substructure walls, footings, slabs	1	3
Any structural concrete approved for placement by pumping:		
At pump	2	8
At discharge of line	1	4

When use of a plasticizing admixture conforming to ASTM C1017/C1017M or when a Type F or G high range water reducing admixture conforming to ASTM C494/C494M is permitted to increase the slump of concrete, concrete must have a slump of 2 to 4 inches before the admixture is added and a maximum slump of 8 inches at the point of delivery after the admixture is added. For troweled floors, slump of structural lightweight concrete with normal weight sand placed by pump must not exceed 5 inches at the point of placement. For other slabs, slump of lightweight concrete must not exceed 4 inches at point of placement.

2.1.1.11 Concrete Temperature

The temperature of the concrete as delivered must not exceed 90 degrees F. When the ambient temperature during placing is 40 degrees F or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered must be between 55 and 75 degrees F.

2.1.1.12 Size of Coarse Aggregate

Use the largest feasible nominal maximum size aggregate (NMSA), specified in PART 2 paragraph AGGREGATES, in each placement. However, do not exceed nominal maximum size of aggregate for any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest

dimension between sides of forms, or one-third of the thickness of slabs or toppings.

2.1.13 Lightweight Aggregate Structural Concrete

Conform lightweight aggregate structural concrete to the requirements specified for normal weight concrete except as specified herein. Compressive strength must be at least 4000 at 28 days, as determined by test specimens that have been air dried at 50 percent relative humidity for the last 21 days. Lightweight aggregate structural concrete floor fill must have a 28-day compressive strength of at least 2500 psi and an air-dry unit weight not exceeding 115 pcf at equilibrium.

2.2 CEMENTITIOUS MATERIALS

Cementitious Materials must be portland cement, or portland cement in combination with pozzolan or ground granulated blast furnace slag conforming to appropriate specifications listed below. Restrict usage of cementitious materials in concrete that will have surfaces exposed in the completed structure so there is no change in color, source, or type of cementitious material.

2.2.1 Portland Cement

ASTM C150/C150M, Type I or II with a maximum 10 percent amount of tricalcium aluminate, and a maximum cement-alkali content of 0.80 percent Na₂O_e (sodium oxide) equivalent.

2.2.2 Blended Cements

Conform blended cement to ASTM C595/C595M and ASTM C1157/C1157M, Type IP or IS, including the optional requirement for mortar expansion and sulfate soundness and consist of a mixture of ASTM C150/C150M Type I, or Type II cement and a complementary cementing material. The slag added to the Type IS blend must be ASTM C989/C989M ground granulated blast-furnace slag. The pozzolan added to the Type IP blend must be ASTM C618 Class F and must be interground with the cement clinker. Provide a manufacturer's statement that the amount of pozzolan in the finished cement will not vary more than plus or minus 5 mass percent of the finished cement from lot-to-lot or within a lot. Do not change the percentage and type of mineral admixture used in the blend from that submitted for the aggregate evaluation and mixture proportioning.

2.2.3 Fly Ash

Conform fly ash to ASTM C618, Class F. If pozzolan is used, it must never be less than 15 percent by weight of the total cementitious material. Report the chemical analysis of the fly ash in accordance with ASTM C311/C311M. Evaluate and classify fly ash in accordance with ASTM D5759. Comply with EPA requirements in accordance with Section 01 33 29.00 37 SUSTAINABILITY.

2.2.4 Raw or Calcined Natural Pozzolan

Natural pozzolan must be raw or calcined and conform to ASTM C618, Class N, including the optional requirements for uniformity and effectiveness in controlling Alkali-Silica reaction and must have an on ignition loss not exceeding 3 percent. Class N pozzolan for use in mitigating Alkali-Silica Reactivity must have a Calcium Oxide (CaO) content of less than 13 percent

and total equivalent alkali content less than 3 percent.

2.2.5 Ultra Fine Fly Ash and Ultra Fine Pozzolan

Conform Ultra Fine Fly Ash (UFFA) and Ultra Fine Pozzolan (UFP) ASTM C618, Class F or N, and the following additional requirements:

- a. The strength activity index at 28 days of age is at least 95 percent of the control specimens.
- b. The average particle size does not exceed 6 microns.
- c. The sum of $\text{SiO}_2 + \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3$ is greater than 77 percent.

2.2.6 Ground Granulated Blast-Furnace (GGBF) Slag

ASTM C989/C989M, Grade 100. Slag content must be a minimum of 25 percent by weight of cementitious material. Submit test results in accordance with ASTM C989/C989M for GGBF slag. Submit test results performed within 6 months of submittal date..

2.3 AGGREGATES

Test and evaluate fine and coarse aggregates for alkali-aggregate reactivity in accordance with ASTM C1260. Evaluate the fine and coarse aggregates separately and in combination, which matches the proposed mix design proportioning. All results of the separate and combination testing must have a measured expansion less than 0.10 (0.08) percent at 16 days after casting. Should the test data indicate an expansion of 0.10 (0.08) percent or greater, reject the aggregate(s) or perform additional testing using ASTM C1260 and ASTM C1567. Perform the additional testing using ASTM C1260 and ASTM C1567 using the low alkali portland cement in combination with ground granulated blast furnace (GGBF) slag, or Class F fly ash. Use GGBF slag in the range of 40 to 50 percent of the total cementitious material by mass. Use Class F fly ash in the range of 25 to 40 percent of the total cementitious material by mass.

2.3.1 Fine Aggregate

Conform to the quality and gradation requirements of ASTM C33/C33M.

2.3.2 Coarse Aggregate

Conform to ASTM C33/C33M, Class 5S, size designation 67.

2.3.3 Lightweight Aggregate

Provide lightweight fine and coarse aggregate conforming to the quality and gradation requirements of ASTM C330/C330M, size 67 for coarse aggregate. Prewet and vacuum saturate lightweight aggregate in accordance with the Manufacturer's instructions unless otherwise specified. For pumped concrete, prewet sufficiently to ensure that slump loss through the pump line does not exceed 4 inches.

2.4 CHEMICAL ADMIXTURES

When required or permitted, conform to the appropriate specification listed. Furnish admixtures in liquid form and of suitable concentration for easy, accurate control of dispensing.

2.4.1 Air-Entraining Admixture

ASTM C260/C260M and must consistently entrain the air content in the specified ranges under field conditions.

2.4.2 Accelerating Admixture

ASTM C494/C494M, Type C or E, except that calcium chloride or admixtures containing calcium chloride cannot be used.

2.4.3 Water-Reducing or Retarding Admixture

ASTM C494/C494M, Type A, B, or D, except that the 6-month and 1-year compressive strength tests are waived.

2.4.4 High-Range Water Reducer

ASTM C494/C494M, Type F or G, except that the 6-month and 1-year strength requirements are waived. Use the admixture only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.4.5 Other Chemical Admixtures

Provide chemical admixtures for use in producing flowing concrete in compliance with ASTM C1017/C1017M, Type I or II. Use these admixtures only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.5 WATER

Provide water complying with the requirements of ASTM C1602/C1602M. Provide potable water for mixing, free of injurious amounts of oil, acid, salt, or alkali. Submit test report showing water complies with ASTM C1602/C1602M.

2.6 EMBEDDED ITEMS

Provide the size and type indicated or as needed for the application. Dovetail slots must be galvanized steel. Provide hangers for suspended ceilings as specified in Section 09 51 00 ACOUSTICAL CEILINGS. Provide inserts for shelf angles and bolt hangers of malleable iron or cast or wrought steel.

2.7 PERIMETER INSULATION

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 29.00 37 SUSTAINABILITY.

2.8 VAPOR BARRIER

Polyethylene sheeting, ASTM E1745 Class A, with a minimum thickness of 15 mils or ASTM E1993/E1993M bituminous membrane or other equivalent material having a vapor permeance rating not exceeding 0.01 perms as determined in

accordance with ASTM E96/E96M.

2.9 JOINT MATERIALS

2.9.1 Joint Fillers, Sealers, and Waterstops

Provide materials for expansion joint fillers and waterstops in accordance with Section 03 15 00.00 10 CONCRETE ACCESSORIES. Provide materials for and sealing of joints conforming to the requirements of Section 07 92 00 JOINT SEALANTS.

2.9.2 Contraction Joints in Slabs

Provide materials for contraction joint inserts in accordance with Section 03 15 00.00 10 CONCRETE ACCESSORIES.

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

Before commencing concrete placement, perform the following: Clean surfaces to receive concrete, free from frost, ice, mud, and water. Place, clean, coat, and support forms in accordance with Section 03 11 13.00 10 STRUCTURAL CONCRETE FORMWORK. Place, clean, tie, and support reinforcing steel in accordance with Section 03 20 00.00 10 CONCRETE REINFORCEMENT. Transporting and conveying equipment is in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete is at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage is at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material is at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete as required in Section 03 39 00.00 10 CONCRETE CURING.

3.1.1 Foundations

3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed is clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation must be well drained, satisfactorily graded and uniformly compacted.

3.1.1.2 Excavated Surfaces in Lieu of Forms

Concrete for footings may be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of Section 31 00 00 EARTHWORK. Place the concrete without becoming contaminated by loose material, and outlined within the specified tolerances.

3.1.2 Previously Placed Concrete

Prepare concrete surfaces to which additional concrete is to be bonded for receiving the next horizontal lift by cleaning the construction joint surface with either air-water cutting, sandblasting, high-pressure water

jet, or other approved method. Prepare concrete at the side of vertical construction joints as approved by the Contracting Officer. Do not use air-water cutting on formed surfaces or surfaces congested with reinforcing steel. Regardless of the method used, the resulting surfaces must be free from all laitance and inferior concrete so that clean surfaces of well bonded coarse aggregate are exposed and make up at least 10-percent of the surface area, distributed uniformly throughout the surface. Do not undercut the edges of the coarse aggregate. Keep the surface of horizontal construction joints continuously wet for the first 12 hours during the 24-hour period prior to placing fresh concrete. Wash the surface completely clean as the last operation prior to placing the next lift.

3.1.2.1 Air-Water Cutting

Perform air-water cutting of a fresh concrete surface at the proper time and only on horizontal construction joints. The air pressure used in the jet must be 100 psi, plus or minus 10 psi, and the water pressure must be just sufficient to bring the water into effective influence of the air pressure. When approved by the Contracting Officer, a surface retarder complying with the requirements of ASTM C309 may be applied to the surface of the lift in order to prolong the period of time during which air-water cutting is effective. After cutting, wash and rinse the surface as long as there is any trace of cloudiness of the wash water. Where necessary to remove accumulated laitance, coatings, stains, debris, and other foreign material, use high-pressure waterjet or sandblasting as the last operation before placing the next lift.

3.1.2.2 High-Pressure Water Jet

Use a stream of water under a pressure of not less than 3,000 psi for cutting and cleaning. Delay its use until the concrete is sufficiently hard so that only the surface skin or mortar is removed and there is no undercutting of coarse-aggregate particles. If the waterjet is incapable of a satisfactory cleaning, clean the surface by sandblasting.

3.1.2.3 Wet Sandblasting

Use wet sandblasting after the concrete has reached sufficient strength to prevent undercutting of the coarse aggregate particles. After wet sandblasting, thoroughly wash the surface of the concrete to remove all loose materials.

3.1.2.4 Waste Disposal

Dispose of waste water employed in cutting, washing, and rinsing of concrete surfaces in a manner that the waste water does not stain, discolor, or affect exposed surfaces of the structures, or damage the environment of the project area. The method of disposal is subject to approval.

3.1.2.5 Preparation of Previously Placed Concrete

Abrade concrete surfaces to which other concrete is to be bonded in an approved manner that exposes sound aggregate uniformly without damaging the concrete. Remove laitance and loose particles. Thoroughly wash surfaces, leaving them moist but without free water when concrete is placed.

3.1.3 Vapor Barrier

Provide vapor barrier beneath the interior on-grade concrete floor slabs installed in accordance with ASTM E1643. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of 12 inches. Remove torn, punctured, or damaged vapor barrier material and provide new vapor barrier prior to placing concrete. For minor repairs, patches may be made using laps of at least 12 inches. Seal lapped joints and patch edges with pressure-sensitive adhesive or tape not less than 2 inches wide and compatible with the membrane. Place vapor barrier directly on underlying subgrade, base course, or capillary water barrier, unless it consists of crushed material or large granular material which could puncture the vapor barrier. In this case, a thin layer of approximately 1/2 inch of fine graded material should be rolled or compacted over the fill before installation of the vapor barrier to reduce the possibility of puncture. Control concrete placement so as to prevent damage to the vapor barrier.

3.1.4 Perimeter Insulation

Install perimeter insulation at locations indicated. Use adhesive where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

3.1.5 Embedded Items

Before placement of concrete, determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items must be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete is permitted only when specifically authorized or directed. Temporarily fill voids in sleeves, inserts, and anchor slots with readily removable materials to prevent the entry of concrete into voids. Do not weld on embedded metals within 12 inches of the surface of the concrete. Do not tack weld on or to embedded items.

3.2 CONCRETE PRODUCTION

3.2.1 General Requirements

Batch and mix concrete onsite or furnish from a ready-mixed concrete plant. Batch, mix, and transport ready-mixed concrete in accordance with ASTM C94/C94M, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units must comply with NRMCA TMMB 100. Ready-mix plant equipment and facilities must be certified in accordance with NRMCA QC 3. Furnish approved batch tickets for each load of ready-mixed concrete. Conform site-mixed concrete to the following subparagraphs.

3.2.2 Batching Plant

Locate the batching plant offsite close to the project. The batching, mixing and placing system must have a capacity of at least 50 cubic yards per hour. Conform the batching plant to the requirements of NRMCA CPMB 100 and as specified; however, rating plates attached to batch plant equipment are not required.

3.2.3 Batching Equipment

Use semiautomatic or automatic batching controls as defined in NRMCA CPMB 100. Provide a semiautomatic batching system with interlocks such that the discharge device cannot be actuated until the indicated material is within the applicable tolerance. Equip the batching system with accurate recorder or recorders that meet the requirements of NRMCA CPMB 100. Record the weight of water and admixtures if batched by weight. Provide separate bins or compartments for each size group of aggregate and type of cementitious material, to prevent intermingling at any time. Weigh aggregates either in separate weigh batchers with individual scales or, provided the smallest size is batched first, cumulatively in one weigh batcher on one scale. Do not weigh aggregate in the same batcher with cementitious material. If both portland cement and other cementitious material are used, they may be batched cumulatively, provided that the portland cement is batched first. Water may be measured by weight or volume. Do not weigh or measure water cumulatively with another ingredient. Interlock filling and discharging valves for the water metering or batching system so that the discharge valve cannot be opened before the filling valve is fully closed. Piping for water and for admixtures must be free from leaks and valved to prevent backflow or siphoning. Furnish admixtures as a liquid of suitable concentration for easy control of dispensing. Provide an adjustable, accurate, mechanical device for measuring and dispensing each admixture. Interlock each admixture dispenser with the batching and discharging operation of the water so that each admixture is separately batched and individually discharged automatically in a manner to obtain uniform distribution throughout the water as it is added to the batch in the specified mixing period. When use of truck mixers makes this requirement impractical, interlock the admixture dispensers with the sand batchers. Different admixtures cannot be combined prior to introduction in water and are not allowed to intermingle until in contact with the cement. Provide admixture dispensers with devices to detect and indicate flow during dispensing or have a means for visual observation. Arrange the plant so as to facilitate the inspection of all operations at all times. Provide suitable facilities for obtaining representative samples of aggregates from each bin or compartment, and for sampling and calibrating the dispensing of cementitious material, water, and admixtures. Clearly mark filling ports for cementitious materials bins or silos with a permanent sign stating the contents.

3.2.4 Scales

Conform the weighing equipment to the applicable requirements of CPMB Concrete Plant Standard, and of NIST HB 44, except that the accuracy must be plus or minus 0.2 percent of scale capacity. Provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring devices. Perform the tests at the specified frequency in the presence of a Government inspector. Arrange the weighing equipment so that the plant operator can conveniently observe all dials or indicators.

3.2.5 Batching Tolerances

a. Tolerances with Weighing Equipment

MATERIAL	PERCENT OF REQUIRED WEIGHT
Cementitious materials	0 to plus 2
Aggregate	plus or minus 2
Water	plus or minus 1
Chemical admixture	0 to plus 6

- b. Tolerances with Volumetric Equipment - For volumetric batching equipment used for water and admixtures, the following tolerances apply to the required volume of material being batched:

MATERIAL	PERCENT OF REQUIRED MATERIAL
Water	plus or minus 1
Chemical admixture	0 to plus 6

3.2.6 Moisture Control

Provide a plant capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the weights of the materials being batched.

3.2.7 Concrete Mixers

Use stationary mixers or truck mixers capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. Do not charge the mixers in excess of the capacity recommended by the manufacturer. Operate the mixers at the drum or mixing blade speed designated by the manufacturer. Maintain the mixers in satisfactory operating condition, and keep the mixer drums free of hardened concrete. Should any mixer at any time produce unsatisfactory results, promptly discontinue its use until it is repaired.

3.2.8 Stationary Mixers

Drum-type mixers of tilting, nontilting, horizontal-shaft, or vertical-shaft type, or pug mill type provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. Conform the mixing time and uniformity to all the requirements in ASTM C94/C94M applicable to central-mixed concrete.

3.2.9 Truck Mixers

Conform truck mixers, the mixing of concrete therein, and concrete uniformity to the requirements of ASTM C94/C94M. A truck mixer may be used either for complete mixing (transit-mixed) or to finish the partial mixing done in a stationary mixer (shrink-mixed). Equip each truck with two counters from which it is possible to determine the number of revolutions at mixing speed and the number of revolutions at agitating

speed. Or, if approved, mark the number of revolutions on the batch tickets. Do not add water at the placing site unless specifically approved; and in no case can it exceed the specified w/c. Inject any such water at the base of the mixer, not at the discharge end.

3.3 LIGHTWEIGHT AGGREGATE CONCRETE

In addition to the requirements specified for normal weight concrete, conform lightweight aggregate concrete to the following. Base the batching and mixing cycle on written recommendations from the aggregate supplier furnished by the Contractor. Unless otherwise directed, charge the mixer with approximately 2/3 of the total mixing water and all of the aggregate. Mix this for at least 1.5 minutes in a stationary mixer or 15 revolutions at mixing speed in a truck mixer. Add and continue mixing the remaining ingredients as specified for normal weight concrete. Do not vibrate lightweight aggregate concrete to the extent that large particles of aggregate float to the surface. During finishing, do not work lightweight aggregate concrete to the extent that mortar is driven down and lightweight coarse aggregate appears at the surface. Lightweight aggregate concrete to be pumped must have a cement content of at least 564 lb/cu. yd. Perform a field trial run of lightweight aggregate concrete placement and finishing in accordance with ACI 213R.

3.4 TRANSPORTING CONCRETE TO PROJECT SITE

Transport concrete to the placing site in truck mixers, or by approved pumping equipment. Nonagitating equipment, other than pumps, cannot be used for transporting lightweight aggregate concrete.

3.5 PLACING CONCRETE

Discharge mixed concrete within 1.5 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 85 degrees F, reduce the time to 45 minutes. Place concrete within 15 minutes after it has been discharged from the transporting unit. Handle concrete from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Provide adequate scaffolding, ramps and walkways so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities prevent proper consolidation, finishing and curing. Provide sufficient placing capacity so that concrete can be kept free of cold joints.

3.5.1 Depositing Concrete

Deposit concrete in accordance with ACI 301 Section 5 and ACI 304.2R.

3.5.2 Consolidation

Immediately after placing, consolidate each layer of concrete in accordance with ACI 301 Section 5 and ACI 309R.

3.5.3 Cold Weather Requirements

Perform cold weather concreting in accordance with ACI 306.1. Use special protection measures, approved by the Contracting Officer, if freezing temperatures are anticipated before the expiration of the specified curing

period. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete must be not less than 40 degrees F. The temperature of the concrete when placed must be not less than 50 degrees F nor more than 75 degrees F. Heat the mixing water or aggregates to regulate the concrete placing temperature. Materials entering the mixer must be free from ice, snow, or frozen lumps. Do not incorporate salt, chemicals or other materials in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C494/C494M, Type C or E may be used, provided it contains no calcium chloride. Do not use calcium chloride.

3.5.4 Hot Weather Requirements

When job-site conditions are present or anticipated that accelerate the rate of moisture loss or rate of cement hydration of freshly mixed concrete, including an ambient temperature of 80 degrees F or higher, and an evaporation rate that exceeds 0.2 lb/ft²/h, conform concrete work to all requirements of ACI 305.1.

3.5.5 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, be alert to the tendency for plastic shrinkage cracks to develop and institute measures to prevent this. Take particular care if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Conform with the requirement of ACI 305.1. In addition further protect the concrete placement by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Fill plastic shrinkage cracks that occur by injection of epoxy resin as directed, after the concrete hardens. Never trowel over plastic shrinkage cracks or fill with slurry.

3.5.6 Placing Concrete in Congested Areas

Use special care to ensure complete filling of the forms, elimination of all voids, and complete consolidation of the concrete when placing concrete in areas congested with reinforcing bars, embedded items, waterstops and other tight spacing. Use an appropriate concrete mixture, with the nominal maximum size of aggregate (NMSA) meeting the specified criteria when evaluated for the congested area. Use vibrators with heads of a size appropriate for the clearances available, and closely supervise the consolidation operation to ensure complete and thorough consolidation at all points. Where necessary, alternate splices of reinforcing bars to reduce congestion. Where two mats of closely spaced reinforcing are required, place the bars in each mat in matching alignment to reduce congestion. Reinforcing bars may be temporarily crowded to one side during concrete placement provided they are returned to exact required location before concrete placement and consolidation are completed.

3.5.7 Placing Flowable Concrete

If a plasticizing admixture conforming to ASTM C1017/C1017M is used or if a Type F or G high range water reducing admixture is permitted to increase the slump, the concrete must meet all requirements of paragraph SYSTEM DESCRIPTION. Use extreme care in conveying and placing the concrete to avoid segregation. No relaxation of requirements to accommodate flowable concrete will be permitted.

3.6 JOINTS

Locate and construct joints as indicated or approved. Locate and construct joints not indicated to minimize the impact on the strength of the structure. In general, locate such joints near the middle of the spans of supported slabs, beams, and girders unless a beam intersects a girder at this point, in which case the offset joint in the girder a distance equal to twice the width of the beam. Locate joints in walls and columns at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs, unless otherwise approved. Construct joints perpendicular to the main reinforcement. Continue and develop all reinforcement across joints; except that reinforcement or other fixed metal items must not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement must be 2 inches clear from each joint. Except where otherwise indicated, construction joints between interior slabs on grade and vertical surfaces consist of preformed expansion joint filler extending for the full depth of the slab. The perimeters of the slabs must be free of fins, rough edges, spalling, or other unsightly appearance. Form reservoir for sealant for construction and contraction joints in slabs to the dimensions indicated by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints. Clean joints to be sealed and seal as indicated and in accordance with Section 07 92 00 JOINT SEALANTS.

3.6.1 Construction Joints

For concrete other than slabs on grade, locate construction joints so that the unit of operation does not exceed 80 feet. Place concrete continuously so that each unit is monolithic in construction. Do not place fresh concrete against adjacent hardened concrete until it is at least 24 hours old. Locate construction joints as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint is subject to approval of the Contracting Officer. Unless otherwise indicated and except for slabs on grade, extend reinforcing steel through construction joints. Key or dowel construction joints in slabs on grade as indicated. Concrete columns, walls, or piers must be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, terminate lifts at the top and bottom of the opening. Terminate other lifts at such levels to conform to structural requirements or architectural details. Where horizontal construction joints in walls or columns are required, tack a strip of 1 inch square-edge lumber, beveled and oiled to facilitate removal, to the inside of the forms at the construction joint. Place concrete to a point 1 inch above the underside of the strip. Remove the strip 1 hour after the concrete has been placed, level off any irregularities in the joint line with a wood float, and remove all laitance. Prior to placing additional concrete, prepare horizontal construction joints as specified in paragraph PREVIOUSLY PLACED CONCRETE.

3.6.2 Contraction Joints in Slabs on Grade

Locate and detail contraction joints as indicated. Produce contraction joints by forming a weakened plane in the concrete slab using materials and procedures specified in Section 03 15 00.00 10 CONCRETE ACCESSORIES.

3.6.3 Expansion Joints

conform installation of expansion joints and sealing of these joints to the requirements of Section 03 15 00.00 10 CONCRETE ACCESSORIES and Section 07 92 00 JOINT SEALANTS.

3.6.4 Waterstops

Install waterstops in conformance with the locations and details indicated using materials and procedures specified in Section 03 15 00.00 10 CONCRETE ACCESSORIES.

3.6.5 Dowels and Tie Bars

Install dowels and tie bars at the locations shown on the drawings and to the details shown, using materials and procedures specified in Section 03 20 00.00 10 CONCRETE REINFORCEMENT and herein. Install conventional smooth "paving" dowels in slabs using approved methods to hold the dowel in place during concreting within a maximum alignment tolerance of 1/8 inch in 12 inches. Install "structural" type deformed bar dowels, or tie bars, to meet the specified tolerances. Take care during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel or tie bar and that the concrete completely embeds the dowel or tie bar and is thoroughly consolidated.

3.7 EXTERIOR SLAB AND RELATED ITEMS

3.7.1 Pits and Trenches

Construct pits and trenches as indicated. Place bottoms and walls monolithically or provide waterstops and keys as approved.

3.8 SETTING BASE PLATES AND BEARING PLATES

After being properly positioned, set column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates to the proper line and elevation with damp-pack bedding mortar, except where nonshrink grout is indicated. The thickness of the mortar or grout must be approximately 1/24 the width of the plate, but not less than 3/4 inch. Concrete and metal surfaces in contact with grout must be clean and free of oil and grease, and concrete surfaces in contact with grout damp and free of laitance when grout is placed. Use nonshrink grout.

3.8.1 Damp-Pack Bedding Mortar

Damp-pack bedding mortar consists of 1 part cement and 2-1/2 parts fine aggregate having water content such that a mass of mortar tightly squeezed in the hand will retain its shape but will crumble when disturbed. Pack the space between the top of the concrete and bottom of the bearing plate or base with the bedding mortar by tamping or ramming with a bar or rod until it is completely filled.

3.8.2 Nonshrink Grout

Ready-mixed material requiring only the addition of water. Water content must be the minimum that will provide a flowable mixture and completely fill the space to be grouted without segregation, bleeding, or reduction of strength.

3.8.2.1 Mixing and Placing of Nonshrink Grout

Mix and place in conformance with the material manufacturer's instructions and as specified therein. Thoroughly dry-mix ingredients before adding water. After adding water, mix the batch for 3 minutes. Size batches to allow continuous placement of freshly mixed grout. Discard grout not used within 30 minutes after mixing. Fill the space between the top of the concrete or machinery-bearing surface and the plate solid with the grout. Use wood forms or other equally suitable material for completely retain the grout on all sides and on top, remove forms after the grout has set. Carefully work the placed grout by rodding or other means to eliminate voids; however, avoid overworking and breakdown of the initial set. Do not subject grout to retempering or to vibration from any source. Where clearances are unusually small, place under pressure with a grout pump. Maintain the temperature of the grout, and of surfaces receiving the grout, at 65 to 85 degrees F until after setting.

3.8.2.2 Treatment of Exposed Surfaces

For metal-oxidizing nonshrink grout, cut back exposed surfaces 1 inch and immediately cover with a parge coat of mortar consisting of 1 part portland cement and 2-1/2 parts fine aggregate by weight, with sufficient water to make a plastic mixture. Smooth finish the parge coat. For other mortars or grouts, exposed surfaces must have a smooth-dense finish and be left untreated. Cure in compliance with Section 03 39 00.00 10 CONCRETE CURING.

3.9 TESTING AND INSPECTION FOR CQC

Perform the inspection and tests described below and, based upon the results of these inspections and tests, take the action required. Submit certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

- a. When, in the opinion of the Contracting Officer, the concreting operation is out of control, cease concrete placement and correct the operation.
- b. The laboratory performing the tests must be onsite and conform with ASTM C1077. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site.
- c. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per month thereafter for conformance with ASTM C1077.

3.9.1 Grading and Corrective Action

3.9.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there must be one sieve analysis and fineness modulus determination in accordance with ASTM C136/C136M and COE CRD-C 104 for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. Select the location at which samples are taken as the most advantageous for control. However, the Contractor is responsible for

delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, immediately resample and retest the fine aggregate. If there is another failure on any sieve, immediately report the failure to the Contracting Officer, stop concreting, and take immediate steps to correct the grading.

3.9.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, there must be a sieve analysis in accordance with ASTM C136/C136M for each size of coarse aggregate. Select the location at which samples are taken as the most advantageous for control. However, the Contractor is responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations must show the results of the current test as well as the average results of the five most recent tests including the current test. Limits may be adopted for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, immediately resample and retest the coarse aggregate. If the second sample fails on any sieve, report that failure to the Contracting Officer. Where two consecutive averages of 5 tests are outside specification limits, the operation is to be considered out of control and must be reported to the Contracting Officer. Stop concreting and take immediate steps to correct the grading.

3.9.2 Quality of Aggregates

Thirty days prior to the start of concrete placement, perform all tests for aggregate quality required by ASTM C33/C33M. In addition, after the start of concrete placement, perform tests for aggregate quality at least every three months, and when the source of aggregate or aggregate quality changes. Take samples for testing after the start of concrete placement immediately prior to entering the concrete mixer.

3.9.3 Scales, Batching and Recording

Check the accuracy of the scales by test weights prior to start of concrete operations and at least once every three months. Also conduct such tests as directed whenever there are variations in properties of the fresh concrete that could result from batching errors. Once a week check the accuracy of each batching and recording device during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. At the same time, test and ensure that the devices for dispensing admixtures are operating properly and accurately. When either the weighing accuracy or batching accuracy does not comply with specification requirements, do not operate the plant until necessary adjustments or repairs have been made. Immediately correct discrepancies in recording accuracies.

3.9.4 Batch-Plant Control

Continuously control the measurement of concrete materials, including cementitious materials, each size of aggregate, water, and admixtures. Adjust the aggregate weights and amount of added water as necessary to compensate for free moisture in the aggregates. Adjust the amount of air-entraining agent to control air content within specified limits. Prepare a report indicating type and source of cement used, type and

source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water weights per cubic yard amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic yard for each class of concrete batched during each day's plant operation.

3.9.5 Concrete Mixture

3.9.5.1 Air Content Testing

Perform air content tests when test specimens are fabricated. In addition, make at least two tests for air content on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production. Perform additional tests when excessive variation in workability is reported by the placing foreman or Government inspector. Conduct tests in accordance with ASTM C231/C231M for normal weight concrete and ASTM C173/C173M for lightweight concrete. Plot test results on control charts. Submit the control charts weekly and make them readily available to the Government. Keep copies of the current control charts in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, perform a second test immediately. Average the results of the two tests and use this average as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. Plot the result of each test, or average as noted in the previous sentence, on a separate control chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph AIR ENTRAINMENT. Set an upper warning limit and a lower warning limit line 1.0 percentage point above and below the average line, respectively. Set an upper action limit and a lower action limit line 1.5 percentage points above and below the average line, respectively. Plot the range between each two consecutive tests on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content may be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated air content. If the materials or transportation methods cause air content loss between the mixer and the placement, take correlation samples at the placement site as required by the Contracting Officer, and the control the air content at the mixer as directed.

3.9.5.2 Air Content Corrective Action

Whenever points on the control chart for percent air reach either warning limit, immediately make an adjustment in the amount of air-entraining admixture batched. As soon as practical after each adjustment, make another test to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, recalibrate the admixture dispenser to ensure that it is operating accurately and with good reproducibility. Whenever a point on either control chart reaches an action limit line, the air content is considered out of control and the concreting operation immediately halted until the air content is under control. Make additional air content tests when concreting is restarted.

3.9.5.3 Slump Testing

In addition to slump tests which are made when test specimens are fabricated during concrete placement/discharge, make at least four slump

tests on randomly selected batches in accordance with ASTM C143/C143M for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, make additional tests when excessive variation in workability is reported by the placing foreman or Government inspector. Plot test results on control charts. Submit the control charts and make them readily available to the Government. Keep copies of the current control charts in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, immediately perform a second test. Average the results of the two tests and use this average as the slump of the batch to plot on both the control charts for slump and the chart for range, and for determining need for any remedial action. Set limits on separate control charts for slump for each type of mixture. Set the upper warning limit at 1/2 inch below the maximum allowable slump specified in paragraph SLUMP in PART 1 for each type of concrete and, set an upper action limit line and lower action limit line at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. Plot the range between each consecutive slump test for each type of mixture on a single control chart for range on which an upper action limit is set at 2 inches. Take samples for slump at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump. If the materials or transportation methods cause slump loss between the mixer and the placement, take correlation samples at the placement site as required by the Contracting Officer, and the slump at the mixer controlled as directed.

3.9.5.4 Slump Corrective Action

Whenever points on the control charts for slump reach the upper warning limit, make an adjustment immediately in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c ratio specified, based on aggregates which are in a saturated surface dry condition. When a single slump reaches the upper or lower action limit, deliver no further concrete to the placing site until proper adjustments have been made. Immediately after each adjustment, make another test to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch weights, produce a point on the control chart for range at or above the upper action limit, halt the concreting operation immediately, and take appropriate steps to bring the slump under control. Make additional slump tests as directed.

3.9.5.5 Temperature

Measure the temperature of the concrete when compressive strength specimens are fabricated in accordance with ASTM C1064/C1064M. Report the temperature along with the compressive strength data.

3.9.5.6 Strength Specimens

Perform on at least one set of test specimens, for compressive strength as appropriate, on each different concrete mixture placed during the day for each 500 cubic yards or portion thereof of that concrete mixture placed each day. Perform on additional sets of test specimens, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. Develop a truly random (not haphazard) sampling plan for approval by the Contracting Officer prior to the start of construction. Show in the plan that sampling is done in a completely

random and unbiased manner.

- a. A set of test specimens for concrete with a 28-day specified strength in accordance with paragraph STRENGTH REQUIREMENTS in PART 2 consists of six specimens, two to be tested at 7 days, two at 28 days, and two cylinders held in reserve.
- b. A strength test is the average of the strengths of at least two 6 inch by 12 inch cylinders made for the same sample of concrete.
- c. Mold and cure test specimens in accordance with ASTM C31/C31M, and test in accordance with ASTM C39/C39M for test cylinders. Immediately report results of all strength tests to the Contracting Officer.
- d. Maintain quality control charts for individual strength "tests", ("test" as defined in paragraph STRENGTH REQUIREMENTS) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. Provide charts similar to those found in ACI 214R.

3.9.6 Inspection Before Placing

Inspect foundations, construction joints, forms, and embedded items in sufficient time prior to each concrete placement in order to certify to the Contracting Officer that they are ready to receive concrete. Report the results of each inspection in writing.

3.9.7 Placing

The placing foreman must supervise placing operations, determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman must not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Do not continue placing if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, take immediate steps to improve temperature controls.

3.9.8 Cold-Weather Protection

At least once each shift and once per day on non-work days, inspect all areas subject to cold-weather protection. Note any deficiencies, correct, and report.

3.9.9 Mixer Uniformity

3.9.9.1 Stationary Mixers

Prior to the start of concrete placing and once every 6 months when concrete is being placed, or once for every 75,000 cubic yards of concrete placed, whichever results in the shortest time interval, determine uniformity of concrete mixing in accordance with ASTM C94/C94M.

3.9.9.2 Truck Mixers

Prior to the start of concrete placing and at least once every 6 months when concrete is being placed, determine uniformity of concrete mixing in accordance with ASTM C94/C94M. Select the truck mixers randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.

3.9.9.3 Mixer Uniformity Corrective Action

When a mixer fails to meet mixer uniformity requirements, either increase the mixing time, change the batching sequence, reduce the batch size, or adjust the mixer until compliance is achieved.

3.9.10 Reports

Report all results of tests or inspections conducted, informally as they are completed and in writing daily. Prepare a weekly report for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, prepare daily reports of pertinent temperatures. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Confirm such reports of failures and the action taken in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

3.10 REPAIR, REHABILITATION AND REMOVAL

Before the Government accepts the structure and final payment is made, inspect the structure for cracks, damage and substandard concrete placements that may adversely affect the service life of the structure. Submit a report documenting these defects, which includes recommendations for repair, removal and/or remediation to the Contracting Officer for approval before any corrective work is accomplished.

3.10.1 Crack Repair

Prior to final acceptance, document and repair all cracks in excess of 0.02 inches wide. Submit the proposed method and materials to repair the cracks to the Contracting Officer for approval. Address the amount of movement expected in the crack due to temperature changes and loading.

3.10.2 Repair of Weak Surfaces

Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. Diamond grind concrete surfaces with weak surfaces less than 1/4 inch thick to remove the weak surface. Remove and replace surfaces containing weak surfaces greater than 1/4 inch thick, or mitigate in a manner acceptable to the Contracting Officer.

3.10.3 Failure of Quality Assurance Test Results

Do not proceed with proposed mitigation efforts to restore the service life until approved by the Contracting Officer.

-- End of Section --

PN87437, SOF Group Headquarters
Fort Bragg, North Carolina

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05/14

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SECTION 03 35 00.00 10

CONCRETE FINISHING
05/14

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 301 (2016) Specifications for Structural Concrete

ACI 305R (2010) Guide to Hot Weather Concreting

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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Recycled Content Products; (LEED)

PART 2 PRODUCTS

In accordance with Section 01 33 29.00 37 SUSTAINABILITY submit documentation indicating: distance between manufacturing facility and the project site, distance of raw material origin from the project site, percentage of post-industrial and post-consumer recycled content per unit of product and relative dollar value of recycled content products to total dollar value of products included in project. Provide submittals as specified in the subject Section.

PART 3 EXECUTION

3.1 FINISHING FORMED SURFACES

Forms, form materials, and form construction are specified in Section 03 11 13.00 10 STRUCTURAL CAST-IN-PLACE CONCRETE FORMING. Finish formed surfaces as specified herein. Unless another type of architectural or special finish is specified, leave surfaces with the texture imparted by the forms except that defective surfaces must be repaired. Apply other finishes to the following structures or portions of structures:

TYPES OF FINISH	STRUCTURE OR PORTION OF STRUCTURE
Grout-cleaned	All exposed areas except mechanical rooms

Maintain uniform color of the concrete by use of only one mixture without changes in materials or proportions for any structure or portion of structure that is exposed to view or on which a special finish is required. The form panels used to produce the finish must be orderly in arrangement, with joints between panels planned in approved relation to openings, building corners, and other architectural features. Do not reuse forms if there is any evidence of surface wear or defects that would impair the quality of the surface.

3.1.1 Class B Finish

Class B finish is required at exposed areas. Formed surfaces meet the requirements of ACI 301, surface finish SF-2.0.

3.1.2 Class C and Class D Finish

Class D finish is required at areas concealed from view. Formed surfaces meet the requirements of ACI 301, surface finish SF-1.0.

3.1.3 Architectural and Special Finishes

3.1.3.1 Grout-Cleaned Finish

The surfaces of noted in paragraph 3.1 must be given a grout-cleaned finish as described, as approved by the Contracting Officer and after all required curing, cleaning, and repairs have been completed. Moist cure surfaces to be grout-cleaned for the required period of time before application of the grout-cleaned finish. Delay grout-cleaning until near the end of construction on all surfaces not to be painted in order to achieve uniformity of appearance and reduce the chance of discoloring caused by subsequent construction operations. The temperature of the air adjacent to the surface must be not less than 40 degrees F for 24 hours prior to and 72 hours following the application of the finish. Complete the finish for any area in the same day, and make the limits of a finished area at natural breaks in the finished surface. Thoroughly wet the surface to receive grout-cleaned finish to prevent absorption of water from the grout but have no free water present. Then coat the surface with grout. Apply the grout as soon as the surface of the concrete approaches surface dryness and vigorously and thoroughly rubbed over the area with clean burlap pads, cork floats or stones, so as to fill all voids. The grout is composed of one part portland cement as used on the project, to two parts by volume of well-graded sand passing a 600- μ m (No. 30) sieve mixed with water to the consistency of thick paint. Use white portland cement for all or part of the cement as approved by the Contracting Officer to give the desired finish color. The applied coating must be uniform, completely filling all pits, air bubbles, and surface voids. While the grout is still plastic, remove all excess grout by working the surface with a rubber float, burlap pad, or other means. Then, after the surface whitens from drying (about 30 minutes at normal temperature) rub vigorously with clean burlap pads. Immediately after rubbing is completed, moist cure the finished surface for 72 hours. Tightly stretch burlap pads used for this operation around a board to prevent dishing the mortar in the voids.

3.2 REPAIRS

Repair in accordance with ACI 301, Section 5.

3.3 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces must meet the requirements of paragraph TOLERANCES in Section 03 30 00.00 10 CAST-IN-PLACE CONCRETE , when tested as specified herein.

3.3.1 General

The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed must not be less than 50 degrees F. In hot weather meet all requirements of Section 03 30 00.00 10 CAST-IN-PLACE CONCRETE paragraphs HOT WEATHER REQUIREMENTS and PREVENTION OF PLASTIC SHRINKAGE CRACKING. In hot weather when the rate of evaporation of surface moisture, as determined by use of Figure 2.1.5 of ACI 305R, may reasonably be expected to exceed 0.2 pounds per square foot per hour. Make provisions for windbreaks, shading, fog spraying, or wet covering with a light-colored material in advance of placement, and take such protective measures as quickly as finishing operations will allow. Float finish unformed surfaces that are not to be covered by additional concrete or backfill, with additional finishing as specified below, and true to the elevation indicated. Bring surfaces to receive additional concrete or backfill to the elevation indicated, properly consolidate, and leave true and regular. Unless otherwise indicated, evenly slope exterior surfaces for drainage. Where drains are provided, evenly slope interior floors to the drains. Carefully make joints with a jointing or edging tool. Protect the finished surfaces from stains or abrasions. Grate tampers or "jitterbugs" cannot be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing is not be permitted. If bleedwater is present prior to finishing, carefully drag off the excess water or remove by absorption with porous materials such as burlap. During finishing operations, take extreme care to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Remove and replace any slabs with surfaces which exhibit significant crazing. During finishing operations, check surfaces with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

3.3.2 Rough Slab Finish

In accordance with ACI 301, Section 5.

3.3.3 Float Finish

In accordance with ACI 301, Section 5.

3.3.4 Trowel Finish

In accordance with ACI 301, Section 5.

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CONCRETE CURING
05/14

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 301 (2016) Specifications for Structural Concrete

ACI 308.1 (2011) Specification for Curing Concrete

ASTM INTERNATIONAL (ASTM)

ASTM C1602/C1602M (2012) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete

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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Curing Materials

SD-06 Test Reports

Testing and Inspection for CQC

1.3 DELIVERY, STORAGE, AND HANDLING

Store materials in such a manner as to avoid contamination and deterioration. Materials must be capable of being accurately identified after bundles or containers are opened.

PART 2 PRODUCTS

2.1 CURING MATERIALS

Provide curing materials in accordance with ACI 301 Sections 5 and ACI 308.1 Section 2.

2.2 WATER

Provide water for curing that is fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of ASTM C1602/C1602M.

PART 3 EXECUTION

3.1 CURING AND PROTECTION

Cure and protect concrete in accordance with ACI 301 Section 5.

3.2 TESTING AND INSPECTION FOR CQC

Perform the inspection and tests described below and, based upon the results of these inspections and tests, take the action required. Submit certified copies of laboratory test reports, including curing compound proposed for use on this project.

3.2.1 Moist Curing Inspections

At least once each shift, and not less than twice per day on both work and non-work days, inspect all areas subject to moist curing. Note and record the surface moisture condition.

3.2.2 Moist Curing Corrective Action

When a daily inspection report lists an area of inadequate curing, take immediate corrective action, and extend the required curing period for those areas by 1 day.

3.2.3 Membrane Curing Inspection

Apply no curing compound until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, estimate the quantity of compound used by measurement of the container and the area of concrete surface covered, compute the rate of coverage in square feet/gallon, and note whether or not coverage is uniform.

3.2.4 Membrane Curing Corrective Action

When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, spray the entire surface again.

3.2.5 Sheet Curing Inspection

At least once each shift and once per day on non-work days, inspect all areas being cured using impervious sheets. Note and record the condition of the covering and the tightness of the laps and tapes.

3.2.6 Sheet Curing Corrective Action

When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, promptly repair the tears and holes or replace the sheets, close the joints, and extend the required curing period for those areas by 1 day.

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PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION
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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 211.1	(1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 211.2	(1998; R 2004) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 305R	(2010) Guide to Hot Weather Concreting
ACI 306.1	(1990; R 2002) Standard Specification for Cold Weather Concreting
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 CONCRETE PIPE ASSOCIATION (ACPA)

ACPA 01-102	(2000) Concrete Pipe Handbook
ACPA 01-110	(1984) Design Manual for Sulfide and Corrosion Prediction and Control
ACPA QPC	(202016) QCast Plant Certification Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel
AWS D1.4/D1.4M	(2011) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
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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 A615/A615M	(2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A706/A706M	(2016) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A767/A767M	(2016) Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
ASTM A775/A775M	(2017) Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A884/A884M	(2014) Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM C1064/C1064M	(2017) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1107/C1107M	(2017) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C1116/C1116M	(2010a; R 2015) Standard Specification for Fiber-Reinforced Concrete
ASTM C1244	(2011; R 2017) Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
ASTM C138/C138M	(2017a) Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143/C143M	(2015) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C1478	(2008; R 2013) Standard Specification for Storm Drain Resilient Connectors Between Reinforced Concrete Storm Sewer Structures, Pipes and Laterals
ASTM C171	(2016) Standard Specification for Sheet Materials for Curing Concrete
ASTM C173/C173M	(2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the

Volumetric Method

ASTM C192/C192M	(2016a) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C31/C31M	(2018a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C39/C39M	(2018) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C443	(2012; R 2017) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C857	(2016) Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM C858	(2010; E 2012) Standard Specification for Underground Precast Concrete Utility Structures
ASTM C877	(2008) External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections
ASTM C891	(2011) Installation of Underground Precast Concrete Utility Structures
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C923	(2008; R 2013; E 2016) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C990	(2009; R 2014) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants

CSA GROUP (CSA)

CSA A23.4	(2016; Errata 2016) Precast Concrete - Materials and Construction
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NATIONAL PRECAST CONCRETE ASSOCIATION (NPCA)

NPCA QC Manual

(2017) Quality Control Manual for Precast
and Prestressed Concrete Plants

1.2 SUBMITTALS

All submittals are the responsibility of the precast concrete producer. 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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Quality Control Procedures

SD-02 Shop Drawings

Standard Precast Units; G
Custom-Made Precast Units; G
Special Finishes

SD-03 Product Data

Standard Precast Units
Proprietary Precast Units
Embedded Items
Accessories

SD-05 Design Data

Design Calculations; G
Concrete Mix Proportions

SD-06 Test Reports

Test Reports

SD-07 Certificates

Quality Control Procedures

SD-11 Closeout Submittals

Recycled content for fly ash and pozzolan; S
Recycled content for Ground Iron Blast-Furnace Slag; S
Recycled content for Silica Fume; S
Recycled content for Synthetic Fiber Reinforcement; S
Recycled content for steel; S

1.3 QUALITY ASSURANCE

Demonstrate adherence to the standards set forth in NPCA QC Manual or ACPA QPC. Meet requirements written in the subparagraphs below.

1.3.1 Plant Certification

The precast concrete producer must be on the NCDOT approved vendor list.

1.3.2 Qualifications, Quality Control and Inspection

1.3.2.1 Qualifications

Select a precast concrete producer that has been in the business of producing precast concrete units similar to those specified for a minimum of 3 years. The precast concrete producer must maintain a permanent quality control department or retain an independent testing agency on a continuing basis.

1.3.2.2 Quality Control Procedures

Submit quality control procedures established by the precast manufacturer in accordance with NPCA QC Manual and ACPA QPC. Show that the following QC tests are performed as required and in accordance with the ASTM standards indicated.

1.3.2.2.1 Slump

Perform a slump test for each 150 cu yd of concrete produced, or once a day, whichever comes first. Perform slump tests in accordance with ASTM C143/C143M.

1.3.2.2.2 Temperature

Measure the temperature of fresh concrete when slump or air content tests are made and when compressive test specimens are made in accordance with ASTM C1064/C1064M.

1.3.2.2.3 Compressive Strength

Make at least four compressive strength specimens for each 150 cubic yards of concrete of each mix in accordance with the following Standards: ASTM C31/C31M, ASTM C192/C192M, ASTM C39/C39M.

1.3.2.2.4 Air Content

Perform tests for air content on air-entrained, wet-cast concrete for each 150 cu yd of concrete, but not less often than once each day when air-entrained concrete is used. Determine the air content in accordance with either ASTM C231/C231M or ASTM C173/C173M for normal weight aggregates and ASTM C173/C173M for lightweight aggregates.

1.3.2.2.5 Unit Weight

Perform tests for unit weight a minimum of once per week to verify the yield of batch mixes. Perform unit weight tests for each 100 cu yd of lightweight concrete in accordance with ASTM C138/C138M.

1.3.2.3 Inspection

The Contracting Officer may place an inspector in the plant when the units covered by this specification are being manufactured. The burden of payment for plant inspection will be clearly detailed in the specification. The precast concrete producer must give notice 14 days

prior to the time the units will be available for plant inspection. Neither the exercise nor waiver of inspection at the plant will affect the Government's right to enforce contractual provisions after units are transported or erected.

1.3.2.4 Test Reports

Submit the following:

1.3.2.4.1 Material Certifications or Laboratory Test Reports

Include mill tests and all other test data, for portland cement, blended cement, pozzolans, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

1.3.2.4.2 Mix Test

Submit reports showing that the mix has been successfully tested to produce concrete with the properties specified and will be suitable for the job conditions. Such tests may include compressive strength, flexural strength, plastic or hardened air content, freeze thaw durability, abrasion and absorption. Clearly detail in the specifications special tests for precast concrete or cast-in items.

1.3.2.4.3 Self-Consolidating Concrete

Submit sufficient documentation, when the use of self-consolidating concrete (SCC) is proposed, showing a minimum of 30-days production track records demonstrating that SCC is appropriate for casting of the product.

1.3.2.4.4 In-Plant QA/QC Inspection Reports

Submit inspection reports upon the request of the Contracting Officer.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver precast units to the site in accordance with the delivery schedule to avoid excessive build-up of units in storage at the site. Upon delivery to the jobsite, all precast concrete units will be inspected by the Contracting Officer for quality and final acceptance.

1.4.2 Storage

Store units off the ground or in a manner that minimizes potential damage.

1.4.3 Handling

Handle, transport, and store products in a manner to minimize damage. Lifting devices or holes must be consistent with industry standards. Perform lifting with methods or devices intended for this purpose as indicated on shop drawings.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Furnish precast concrete units designed and fabricated by an experienced and acceptable precast concrete manufacturer who has been, for at least three years, regularly and continuously engaged in the manufacture of precast concrete work similar to that indicated on the drawings. Coordinate precast work with the work of other trades. Below grade structures must comply with ASTM C858.

2.1.1 Standard Precast Units

Design standard precast concrete units to withstand indicated design load conditions in accordance with applicable industry design standards ACI 318, ASTM C857. Design must also consider stresses induced during handling, shipping and installation as to avoid product cracking or other handling damage. Indicate design loads for precast concrete units on the shop drawings. Submit drawings for standard precast concrete units furnished by the precast concrete producer for approval by the Contracting Officer. These drawings must demonstrate that the applicable industry design standards have been met. Include installation and construction information on shop drawings. Include details of steel reinforcement size and placement as well as supporting design calculations, if appropriate. Produce precast concrete units in accordance with the approved drawings. Submit cut sheets, for standard precast concrete units, showing conformance to project drawings and requirements, and to applicable industry design standards listed in this specification.

2.1.2 Custom-Made Precast Units

Submit design calculations for custom-made precast units, prepared and sealed by a registered professional engineer, for approval prior to fabrication. Include in the calculations the analysis of units for lifting stresses and the sizing of lifting devices. Submit drawings furnished by the precast concrete producer for approval by the Contracting Officer. Show on these drawings complete design, installation, and construction information in such detail as to enable the Contracting Officer to determine the adequacy of the proposed units for the intended purpose. Include details of steel reinforcement size and placement as well as supporting design calculations, if appropriate. Produce precast concrete units in accordance with the approved drawings.

2.1.3 Proprietary Precast Units

Products manufactured under franchise arrangements must conform to all the requirements specified by the franchiser. Items not included in the franchise specification, but included in this specification, must conform to the requirements in this specification. Submit standard plans or informative literature, for proprietary precast concrete units. Make available supporting calculations and design details upon request. Provide sufficient information as to demonstrate that such products will perform the intended task.

2.1.4 Joints and Sealants

Provide joints and sealants between adjacent units of the type and configuration indicated on shop drawings meeting specified design and performance requirements.

2.1.5 Concrete Mix Design

2.1.5.1 Concrete Mix Proportions

Base selection of proportions for concrete on the methodology presented in ACI 211.1 for normal weight concrete and ACI 211.2 for lightweight concrete. Develop the concrete proportions using the same type and brand of cement, the same type and brand of pozzolan, the same type and gradation of aggregates, and the same type and brand of admixture that will be used in the manufacture of precast concrete units for the project. Do not use calcium chloride in precast concrete containing reinforcing steel or other embedded metal items. At a minimum of thirty days prior to precast concrete unit manufacturing, the precast concrete producer will submit a mix design and proportions for each strength and type of concrete that will be used. Furnish a complete list of materials, including quantity, type, brand and applicable data sheets for all mix design constituents as well as applicable reference specifications. The use of self-consolidating concrete is permitted, provided that mix design proportions and constituents meet the requirements of this specification.

2.1.5.2 Concrete Strength

Provide precast concrete units with a 28-day compressive strength (f'_c) of 4000 psi.

2.1.5.3 Water-to-Cement Ratio

Where exposed to freezing and thawing, furnish concrete containing entrained air and with a water-cementitious ratio of 0.45 or less. Where not exposed to freezing, but required to have a low permeability, furnish concrete with a water-cementitious ratio of 0.48 or less. Where exposed to deicer salts, brackish water, or seawater, furnish concrete with a water-cementitious ratio of 0.40 or less, for corrosion protection.

2.1.5.4 Air Content

The air content of concrete that will be exposed to freezing conditions must be within the limits given below.

NOMINAL MAXIMUM AGGREGATE SIZE	AIR CONTENT PERCENT	
	EXPOSURE CLASS F1	EXPOSURE CLASSES F2 and F3
3/8 inch	6.0	7.5
1/2 inch	5.5	7.0
3/4 inch	5.0	6.0
1.0 inch	4.5	6.0
1.5 inch	4.5	5.5

NOMINAL MAXIMUM AGGREGATE SIZE	AIR CONTENT PERCENT	
	EXPOSURE CLASS F1	EXPOSURE CLASSES F2 and F3
Note: For specified compressive strengths greater than 5000 psi, air content may be reduced 1 percent		

2.1.5.5 Corrosion Control for Sanitary Sewer Systems

Follow design recommendations outlined in Chapter 7 of ACPA 01-102 or the ACPA 01-110 when hydrogen sulfide is indicated as a potential problem.

2.2 MATERIALS

Except as otherwise specified in the following paragraphs, conform material to Section 03 30 00.00 10 CAST-IN-PLACE CONCRETE and Section 03 20 00.00 10 CONCRETE REINFORCING.

2.2.1 Material Sustainability Criteria

For products in this section, where applicable and to extent allowed by performance criteria, provide and document the following in accordance with Section 01 33 29.00 37 SUSTAINABILITY:

- a. Recycled content for fly ash and pozzolan
- b. Recycled content for Ground Iron Blast-Furnace Slag
- c. Recycled content for Silica Fume
- d. Recycled content for Synthetic Fiber Reinforcement
- e. Recycled content for steel, 75 percent minimum

2.2.2 Pigments

Non-fading and lime-resistant

2.2.3 Reinforcement

2.2.3.1 Reinforcing Bars

- a. Deformed Billet-steel: ASTM A615/A615M
- b. Deformed Low-alloy steel: ASTM A706/A706M

2.2.3.2 Reinforcing Wire

- a. Plain Wire: ASTM A1064/A1064M
- b. Deformed Wire: ASTM A1064/A1064M

2.2.3.3 Welded Wire Reinforcement

- a. Plain Wire: ASTM A1064/A1064M
- b. Deformed Wire: ASTM A1064/A1064M

2.2.3.4 Epoxy Coated Reinforcement

- a. Reinforcing Bars: ASTM A775/A775M
- b. Wires and Welded Wire: ASTM A884/A884M

2.2.3.5 Galvanized Reinforcement

Provide galvanized reinforcement conforming to ASTM A767/A767M.

2.2.4 Synthetic Fiber Reinforcement

Provide fiber reinforced concrete in accordance with ASTM C1116/C1116M Type III, synthetic fiber reinforced concrete, and as follows. Synthetic reinforcing fibers must be monofilament polypropylene fibers, with a minimum of 10 percent post-consumer recycled content, or a minimum of 20 percent post-industrial recycled content. Provide fibers that have a specific gravity of 0.9, a minimum tensile strength of 70 ksi, graded per manufacturer, and specifically manufactured to an optimum gradation for use as concrete secondary reinforcement. Toughness indices must meet requirements for performance level I.

2.2.5 Inserts and Embedded Metal

All items embedded in concrete must be of the type required for the intended task, and meet the following standards.

- a. Structural Steel Plates, Angles, etc.: ASTM A36/A36M
- b. Hot-dipped Galvanized: ASTM A153/A153M
- c. Proprietary Items: In accordance with manufacturers published literature

2.2.6 Accessories

Submit proper installation instructions and relevant product data for items including, but not limited to, sealants, gaskets, connectors, steps, cable racks and other items installed before or after delivery.

- a. Rubber Gaskets for Circular Concrete Sewer Pipe and Culvert Pipe: ASTM C443.
- b. External Sealing Bands for Noncircular Sewer, Storm Drain and Culvert Pipe: ASTM C877.
- c. Preformed Flexible Joint Sealants for Concrete Pipe, Manholes, and Manufactured Box Sections: ASTM C990.
- d. Elastomeric Joint Sealants: ASTM C920

2.2.7 Pipe Entry Connectors

Pipe entry connectors must conform to ASTM C923 or ASTM C1478.

2.2.8 Grout

Nonshrink Grout must conform to ASTM C1107/C1107M. Cementitious grout must be a mixture of portland cement, sand, and water. Proportion one

part cement to approximately 2.5 parts sand, with the amount of water based on placement method. Provide air entrainment for grout exposed to the weather.

PART 3 EXECUTION

3.1 FABRICATION AND PLACEMENT

Perform fabrication in accordance with NPCA QC Manual or ACPA QPC unless specified otherwise.

3.1.1 Forms

Use forms, for manufacturing precast concrete products, of the type and design consistent with industry standards and practices. They should be capable of consistently providing uniform products and dimensions. Construct forms so that the forces and vibrations to which the forms will be subjected can cause no product damage. Clean forms of concrete build-up after each use. Apply form release agents according to the manufacturers recommendations and do not allow to build up on the form casting surfaces.

3.1.2 Reinforcement

Follow applicable ASTM Standard or ACI 318 for placement and splicing. Fabricate cages of reinforcement either by tying the bars, wires or welded wire reinforcement into rigid assemblies or by welding, where permissible, in accordance with AWS D1.4/D1.4M. Position reinforcing as specified by the design and so that the concrete cover conforms to requirements. The tolerance on concrete cover must be one-third of that specified but not more than 1/2 inch. Provide concrete cover not less than 1/2 inch. Take positive means to assure that the reinforcement does not move significantly during the casting operations.

3.1.3 Embedded Items

Position embedded items at locations specified in the design documents. Perform welding in accordance with AWS D1.1/D1.1M when necessary. Hold rigidly in place inserts, plates, weldments, lifting devices and other items to be imbedded in precast concrete products so that they do not move significantly during casting operations. Submit product data sheets and proper installation instruction for anchors, lifting inserts and other devices. Clearly indicate the products dimensions and safe working load.

3.1.4 Synthetic Fiber Reinforced Concrete

Add fiber reinforcement to the concrete mix at the batch plant in accordance with the applicable sections of ASTM C1116/C1116M and the recommendations of the manufacturer. Use a minimum of 1.5 pounds of fibers per cubic yard of concrete.

3.2 CONCRETE

3.2.1 Concrete Mixing

Mixing operations must produce batch-to-batch uniformity of strength, consistency, and appearance.

3.2.2 Concrete Placing

Deposit concrete into forms as near to its final location as practical. Keep the free fall of the concrete to a minimum. Consolidate concrete in such a manner that segregation of the concrete is minimized and honeycombed areas are kept to a minimum. Use vibrators to consolidate concrete with frequencies and amplitudes sufficient to produce well consolidated concrete.

3.2.2.1 Cold Weather Concreting

Perform cold weather concreting in accordance with ACI 306.1.

- a. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather.
- b. All concrete materials, reinforcement, forms, fillers, and ground with which concrete is to come in contact must be free from frost.
- c. Do not use frozen materials or materials containing ice.
- d. In cold weather the temperature of concrete at the time of placing must not be below 45 degrees F. Discard concrete that freezes before its compressive strength reaches 500 psi.

3.2.2.2 Hot Weather Concreting

Follow recommendations for hot weather concreting in ACI 305R. During hot weather, give proper attention to constituents, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures or water evaporation that could impair required strength or serviceability of the member or structure. The temperature of concrete at the time of placing must not exceed 90 degrees F.

3.2.3 Concrete Curing

Commence curing immediately following the initial set and completion of surface finishing.

3.2.3.1 Curing by Moisture Retention

Prevent moisture evaporation from exposed surfaces until adequate strength for stripping is reached by one of the following methods:

- a. Cover with polyethylene sheets a minimum of 6 mils thick in accordance with ASTM C171.
- b. Cover with burlap or other absorptive material and keep continually moist.
- c. Use a membrane-curing compound, conforming to ASTM C309 and applied at a rate not less than 200 square ft/gallon, or in accordance with manufacturers' recommendations.

3.2.3.2 Curing with Heat and Moisture

Do not subject concrete to steam or hot air until after the concrete has attained its initial set. Apply steam, if used, within a suitable enclosure, which permits free circulation of the steam in accordance with

CSA A23.4. If hot air is used for curing, take precautions to prevent moisture loss from the concrete. The temperature of the concrete must not be permitted to exceed 150 degrees F. These requirements do not apply to products cured with steam under pressure in an autoclave.

3.2.4 Surface Finish

Finish unformed surfaces of wet-cast precast concrete products as specified. If no finishing procedure is specified, finish such surfaces using a strike-off to level the concrete with the top of the form.

3.2.4.1 Formed Non-Architectural Surfaces

Cast surfaces against approved forms following industry practices in cleaning forms, designing concrete mixes, placing and curing concrete. Normal color variations, form joint marks, small surface holes caused by air bubbles, and minor chips and spalls will be accepted but no major imperfections, honeycombs or other major defects will be permitted.

3.2.4.2 Unformed Surfaces

Finish unformed surfaces with a vibrating screed, or by hand with a float. Normal color variations, minor indentations, minor chips and spalls will be accepted. Major imperfections, honeycombs, or other major defects are not permitted.

3.2.4.3 Special Finishes

Troweled, broom or other finishes must be according to the requirements of project documents and performed in accordance with industry standards or supplier specifications. Submit finishes for approval when required by the project documents. The sample finishes must be approved prior to the start of production.

3.2.5 Stripping Products from Forms

Do not remove products from the forms until the concrete reaches the compressive strength for stripping required by the design. If no such requirement exists, products may be removed from the forms after the final set of concrete provided that stripping damage is minimal.

3.2.6 Patching and Repair

No repair is required to formed surfaces that are relatively free of air voids and honeycombed areas, unless the surfaces are required by the design to be finished.

3.2.6.1 Repairing Minor Defects

Defects that will not impair the functional use or expected life of a precast concrete product may be repaired by any method that does not impair the product.

3.2.6.2 Repairing Honeycombed Areas

When honeycombed areas are to be repaired, remove all loose material and cut back the areas into essentially horizontal or vertical planes to a depth at which coarse aggregate particles break under chipping rather than being dislodged. Use proprietary repair materials in accordance with the

manufacturer's instructions. If a proprietary repair material is not used, saturate the area with water. Immediately prior to repair, the area should be damp, but free of excess water. Apply a cement-sand grout or an approved bonding agent to the chipped surfaces, followed immediately by consolidating an appropriate repair material into the cavity.

3.2.6.3 Repairing Major Defects

Evaluate, by qualified personnel, defects in precast concrete products which impair the functional use or the expected life of products to determine if repairs are feasible and, if so, to establish the repair procedure.

3.2.7 Shipping Products

Do not ship products until they are at least five days old, unless it can be shown that the concrete strength has reached at least 75 percent of the specified 28-day strength, or that damage will not result, impairing the performance of the product.

3.3 INSTALLATION

3.3.1 Site Access

It is the Contractor's responsibility to provide adequate access to the site to facilitate hauling, storage and proper handling of the precast concrete products.

3.3.2 General Requirements

- a. Install precast concrete products to the lines and grades shown in the contract documents or otherwise specified.
- b. Lift products by suitable lifting devices at points provided by the precast concrete producer.
- c. Install products in accordance with the precast concrete producer's instructions. In the absence of such instructions, install underground utility structures in accordance with ASTM C891. Install pipe and manhole sections in accordance with the procedures outlined by the American Concrete Pipe Association.
- d. Field modifications to the product will relieve the precast producer of liability even if such modifications result in the failure of the product.

3.3.3 Water Tightness

Where water tightness is a necessary performance characteristic of the precast concrete product's end use, watertight joints, connectors and inserts should be used to ensure the integrity of the entire system.

3.4 FIELD QUALITY CONTROL

3.4.1 Site Tests

When water tightness testing is required for an underground product, use one of the following methods:

3.4.2 Vacuum Testing

Prior to backfill vacuum test system according to ASTM C1244.

3.4.3 Water Testing

Perform water testing according to the contract documents and precast concrete producer's recommendations.

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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 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) |
| ACI SP-66 | (2004) ACI Detailing Manual |

ASTM INTERNATIONAL (ASTM)

- | | |
|-------------------|---|
| ASTM A1008/A1008M | (2016) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable |
| ASTM A1064/A1064M | (2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete |
| 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 | (2017) 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 B370	(2012) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM C1019	(2018) Standard Test Method for Sampling and Testing Grout
ASTM C129	(2017) Standard Specification for Nonloadbearing Concrete Masonry Units
ASTM C1384	(2012a) Standard Specification for Admixtures for Masonry Mortars
ASTM C207	(2006; R 2011) 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	(2014a) 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 C55	(2017) Standard Specification for Concrete Building Brick
ASTM C641	(2017) Standard Test Method for Iron Staining Materials in Lightweight Concrete Aggregates
ASTM C652	(2017a) Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
ASTM C67/C67M	(2018) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C780	(2017) Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C90	(2016) Standard Specification for

Loadbearing Concrete Masonry Units

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

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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Reinforcement Detail Drawings; G

SD-03 Product Data

Hot Weather Procedures; G
Cold Weather Procedures; G
Clay or Shale Brick; G
Cement; G
Cementitious Materials; G
Insulation; G

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
Insulation; 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

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
Insulation

SD-08 Manufacturer's Instructions

Admixtures for Masonry Mortar
Admixtures for Grout

SD-10 Operation and Maintenance Data

Take-Back Program

SD-11 Closeout Submittals

Recycled Content of Clay Units; S
Recycled Content of Cement; S

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 6 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 a masonry bonded corner a bond beam corner 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 glazed brick, glazed structural clay tile, and 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.

- b. Mark prefabricated lintels on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

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.

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 1500 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.

2.2.2.1.3 Recycled Content

Provide clay units containing a minimum of 5 percent post-consumer recycled content, and a minimum of 20 percent post-industrial recycled content.

2.2.2.1.4 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. Provide brick with minimum compressive strength of 3000 psi. 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.

2.2.2.3 Hollow Clay or Shale Brick

Provide hollow clay or shale brick that conforms to ASTM C652, Type HBX.

- a. Provide brick size of 3-5/8 inches thick, 2-1/4 inches high, and 7-5/8

inches long.

- b. Where vertical reinforcement is shown in hollow brick, provide hollow brick designed to provide precise vertical alignment of the cells, with minimum cell dimension of 2-1/2 inches.
- c. Provide hollow brick with minimum compressive strength of 3000 psi.

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 Cement

Use only cement that has a low alkali content and is of one brand.

2.2.3.2.2 Recycled Content

Units may contain post-consumer or post-industrial recycled content.

2.2.3.2.3 Size

Provide units with specified dimension as shown on drawings.

2.2.3.2.4 Surfaces

Provide units with exposed surfaces as shown on the drawings.

2.2.3.2.5 Weather Exposure

Provide concrete masonry units with water-repellant admixture added during manufacture where units will be exposed to weather..

2.2.3.2.6 Unit Types

- a. Hollow Load-Bearing Units: ASTM C90, normal weight. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls.
- b. Hollow Non-Load-Bearing Units: ASTM C129, lightweight, medium weight or normal weight. Load-bearing units may be provided in lieu of non-load-bearing units.
- c. Solid Load-Bearing Units: ASTM C90, lightweight, medium weight or normal weight units. Provide solid units as indicated.

2.2.3.2.7 Jamb Units

Provide jamb units of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved.

Provide sash jamb units with a 3/4 by 3/4 inch groove near the center at end of each unit.

2.2.3.3 Concrete Brick

2.2.3.3.1 Common Concrete Brick

Provide common concrete brick conforming to ASTM C55. Common concrete brick may be used where necessary for filling out in concrete masonry unit construction.

2.2.4 Precast Concrete Units

2.2.4.1 General

- a. Provide precast concrete trim, lintels, 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 00.00 10 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 Lintels

Provide precast concrete lintels, unless otherwise shown, of a thickness equal to the wall and reinforced with minimum two No. 4 bars for the full length. Provide top and bottom bars for lintels over 36 inches in length. Provide at least 8 inches bearing at each end. Label the top of lintels and clearly mark each lintel to show location in the structure.

Design reinforced lintels in conformance with ACI 318 for flexural and shear strength, using concrete with a minimum 28 day compressive strength of 4000 psi. Limit lintel deflection due to dead plus live load to $L/600$ or 0.3 inches.

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 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.

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.

2.4.1.4 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 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 cement-lime mortar or mortar cement mortar for seismic-force-resisting elements indicated.
- c. Provide Type N or S mortar for non-load-bearing, non-shear-wall interior masonry.
- d. 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.
- e. For preblended mortar, follow manufacturer's mixing instructions.

2.5.2 Grout and Ready Mix Grout Mix

Use grout that conforms to ASTM C476, fine or coarse. Use conventional grout with a slump between 8 and 11 inches. 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 W2.8 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 00.00 10 CAST-IN-PLACE CONCRETE.

2.6.2.5 Adjustable Anchors

2.6.2.5.1 Anchorage to Structural Steel

Provide hot-dip galvanized or stainless steel adjustable anchors for

connecting masonry walls to the structural steel frame as detailed on the drawings. Provide zinc-rich paint for touching up paint after welding galvanized anchors to structural steel.

2.6.2.5.2 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 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.

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.

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 except that flashing indicated to terminate in reglets shall be metal or coated-metal 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.

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 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. Do not begin installation until unacceptable conditions have been corrected.

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. Toothing 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.

3.3.1.1.2 Flush Joints

Flush cut mortar joints in concealed masonry surfaces and joints at

electrical outlet boxes in wet areas. Finish flush cut joints by cutting off the mortar flush with the face of the wall. Point joints in unparged masonry walls below grade tight. For architectural units, such as fluted units, completely fill both the head and bed joints and flush cut.

3.3.1.1.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

3.3.1.1.4 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.
- c. 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 using sash jamb units with control joint key 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. Do not interrupt the horizontal reinforcement and grout at the control joint.

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.

3.3.2 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 as shown on the drawings. 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.

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 Brick Sills

Lay brick on edge, slope not less than 3/4 inch downward to the outside, and project not less than 1/2 inch beyond the face of the wall to form a wash and drip. Fill all joints solidly with mortar and tool.

3.3.3 Anchored Veneer Construction

- a. Construct exterior masonry wythes to the thickness indicated on the drawings. Provide air space behind the masonry veneer as shown on the drawings. 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 bond pattern as shown on the drawings. Place

longitudinal reinforcement, consisting of at least one continuous hot-dip galvanized W 1.7 (9gauge) steel wire, in the veneer wythe when laid in stack bond.

- 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 vertical spacing of 16 in, and maximum horizontal spacing of 24 in. Provide additional anchors around openings larger than 16 inch in either direction. 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 ANCHORAGE

3.3.4.1 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.

3.3.4.2 Anchorage at Intersecting Walls

Anchor structural masonry walls with horizontal joint reinforcement spaced no more than 16 in on center, unless the drawings indicate a movement joint at the intersection.

3.3.5 Lintels

3.3.5.1 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.

3.3.5.2 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.

3.3.6 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.

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 Horizontal Grout Barriers

Embed horizontal grout barriers in mortar below cells of hollow units receiving grout.

3.4.2.3 Grout Holes and Cleanouts

3.4.2.3.1 Grout Holes

Provide grouting holes in slabs, spandrel beams, and other in-place overhead construction. Locate holes over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Provide additional openings spaced not more than 16 inches on centers where grouting of 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.

3.4.2.3.2 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 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

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, attaching a termination bar and applying compatible sealant at the top edge of the termination bar, 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 or terminating the fabric flashing 1/2 inch short of the outside face of masonry and adhering the flashing to a sheet metal drip edge. Provide sealant below the drip edge of through-wall flashing.

Wherever through-wall flashing occurs, provide weep holes to drain flashing to exterior at acceptable locations as indicated. Provide weeps of open head joint sweep 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. Tape or seal the joints between the boards.

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 00.00 10 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: 3 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.

3.6.1.2 Field Testing of Grout

- a. Perform grout testing at the following frequency: 3 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.

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.

3.6.2 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 and scrap 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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AMENDMENT 0002

PART 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	(2016; R 2017) Certification Standard for Steel Fabrication and Erection, and Manufacturing of Metal Components
AISC 303	(2016) Code of Standard Practice for Steel Buildings and Bridges
AISC 325	(2017) Steel Construction Manual
AISC 326	(2009) Detailing for Steel Construction
AISC 341	(2016) Seismic Provisions for Structural Steel Buildings
AISC 360	(2016) Specification for Structural Steel Buildings
AISC DESIGN GUIDE 10	(1997) Erection Bracing of Low-Rise Structural Steel Buildings

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 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 A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and
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Steel Products

ASTM A143/A143M	(2007; R 2014) Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
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 A500/A500M	(2018) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A6/A6M	(2017a) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A780/A780M	(2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A992/A992M	(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 C1107/C1107M	(2017) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C827/C827M	(2016) Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
ASTM F1136/F1136M	(2011) Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners
ASTM F1554	(2017; E 2018) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi

Yield Strength

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
ASTM F2833	(2011; R 2017) Standard Specification for Corrosion Protective Fastener Coatings with Zinc Rich Base Coat and Aluminum Organic/Inorganic Type
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
ASTM F436/F436M	(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 F959/F959M	(2017a) Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1	(2016) Shop, Field, and Maintenance Coating of Metals
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 3) Structural Engineering
UFC 3-310-04	(2013; with Change 1) Seismic Design of Buildings

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

29 CFR Part 1926, Subpart R	Steel Erection
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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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance

with Section 01 33 00 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

Direct Tension Indicator Washers

Non-Shrink Grout

Recycled Content for Structural Steel; S

Recycled Content for Structural Steel Tubing; S

Recycled Content for Steel Pipe; S

SD-05 Design Data

Shoring and Temporary Bracing; G

SD-06 Test Reports

Class B Coating

Bolts, Nuts, and Washers

Weld Inspection Reports

Embrittlement Test Reports

SD-07 Certificates

Steel

Bolts, Nuts, and Washers

Galvanizing

AISC Structural Steel Fabricator Quality Certification

AISC Structural Steel Erector 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.

Work must be erected by an AISC Structural Steel Certified Erector, in accordance with AISC 207, Category CSE. Submit AISC Structural Steel erector quality certification.

1.4 SEISMIC PROVISIONS

Provide the structural steel system in accordance with AISC 341, Chapter J as amended by UFC 3-310-04.

1.5 QUALITY ASSURANCE

1.5.1 Preconstruction Submittals

1.5.1.1 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. Erection drawings must be reviewed, stamped and sealed by a registered professional engineer.

1.5.2 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. Sign and seal fabrication drawings by a registered professional engineer. 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. Shoring and temporary bracing must be designed and sealed by a registered professional engineer and submitted for record purposes as part of the drawings. 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.

1.5.3 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.

1.5.4 Certifications

1.5.4.1 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. If the qualification date of the welder or welding operator is more than 6 months old, the welding operator's qualification

certificate must be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.

Conform to all requirements specified in AWS D1.1/D1.1M.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide the structural steel system, including shop primer or 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/A992M. Angles, Channels and Plates, ASTM A36/A36M. Provide structural steel containing a minimum of 80 percent recycled content. Submit data identifying percentage of recycled content for structural steel.

2.2.2 Structural Steel Tubing

ASTM A500/A500M, Grade B. Provide structural steel tubing containing a minimum of 25 percent recycled content. Submit data identifying percentage of recycled content for structural steel tubing.

2.2.3 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B, weight class STD (Standard). Provide steel pipe containing a minimum of 50 percent recycled content. Submit data identifying percentage of recycled content for steel pipe.

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 Common Grade Bolts

2.3.1.1 Bolts

ASTM A307, Grade A. The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications.

2.3.1.2 Nuts

ASTM A563, Grade A, heavy hex style.

2.3.1.3 Washers

ASTM F844.

2.3.2 Bolts

ASTM F3125/F3125M, Grade A325M A325 A490M A490, Type 1 3 Heavy Hex Head Style, plain finish.

2.3.3 Nuts

ASTM A563, Grade and Style as specified in the applicable ASTM bolt standard.

2.3.4 Direct Tension Indicator Washers

ASTM F959/F959M. Provide ASTM B695, Class 55, Type 1 galvanizing. Submit product data for direct tension indicator washers.

2.3.5 Washers

ASTM F436/F436M, plain carbon steel.

2.3.6 Foundation Anchorage

2.3.6.1 Anchor Rods

ASTM F1554 Gr 36, Class 1A.

2.3.6.2 Anchor Nuts

ASTM A563, Grade A, hex style.

2.3.6.3 Anchor Washers

ASTM F844.

2.3.6.4 Anchor Plate Washers

ASTM A36/A36M.

2.4 STRUCTURAL STEEL ACCESSORIES

2.4.1 Welding Electrodes and Rods

AWS D1.1/D1.1M.

2.4.2 Non-Shrink Grout

ASTM C1107/C1107M, with no ASTM C827/C827M shrinkage.

2.4.3 Welded Shear Stud Connectors

ASTM A29/A29M, Grades 1010 through 1020. AWS D1.1/D1.1M, Table 7.1, Type B.

2.5 GALVANIZING

ASTM F2329/F2329M, ASTM F1136/F1136M, ASTM F2833 or ASTM B695 for threaded parts or ASTM A123/A123M 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 and pin 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/A6M.

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.

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. Affix embossed tags to hot-dipped galvanized members.

2.6.2 Shop Primer

Amendment 0002*****

Shop prime structural steel, except as modified herein, in accordance with SSPC PA 1. Do not prime steel surfaces embedded in concrete, galvanized surfaces, 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 to a minimum dry film thickness of 2.0 mil.

*******Amendment 0002**

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. below, must be in accordance with the applicable provisions of AISC 325, AISC 303 and 29 CFR Part 1926, Subpart R.
- b. For low-rise structural steel buildings (60 feet tall or less and a maximum of 2 stories), erect the structure in accordance with AISC DESIGN GUIDE 10.

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 STORAGE

Store the material out of contact with the ground in such manner and location as to minimize deterioration.

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 Common Grade Bolts

Tighten ASTM A307 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.

3.2.2 High-Strength Bolts

Provide direct tension indicator washers in all ASTM F3125/F3125M, Grade A325 and Grade A490 bolted connections. Bolts must be installed in connection holes and initially brought to a snug tight fit.

Fastener components shall be protected from dirt and moisture in closed containers at the site of the installation. Fastener components that are not incorporated into the work shall be returned to protected storage at the end of the work shift.

3.2.2.1 Installation of Direct Tension Indicator Washers (DTIW)

Where possible, install the DTIW under the bolt head and tighten the nut. If the DTIW is installed adjacent to the turned element, provide a flat washer between the DTIW and nut when the nut is turned for tightening, and between the DTIW and bolt head when the bolt head is turned for tightening. In addition to the DTIW, provide flat washers under both the bolt head and nut when ASTM F3125/F3125M, Grade A490 bolts are used.

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/D1.1M. Grind exposed welds smooth as indicated. Provide AWS D1.1/D1.1M 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 GALVANIZING REPAIR

Repair damage to galvanized coatings using ASTM A780/A780M zinc rich paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces to which repair paint has been applied.

3.7 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.

3.7.1 Welds

3.7.1.1 Visual Inspection

AWS D1.1/D1.1M. Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification inspections. 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.

Inspect proper preparation, size, gaging location, and acceptability of all welds; identification marking; operation and current characteristics of welding sets in use.

3.7.1.2 Nondestructive Testing

Nondestructive testing must be in accordance with AWS D1.1/D1.1M. Test locations must be selected by the Contracting Officer. If more than 20 percent of welds made by a welder contain defects identified by testing, then all groove welds made by that welder must be tested by ultrasonic testing, and all fillet welds made by that welder must be inspected by magnetic particle testing (MT) testing (PT) as approved by the Contracting Officer. When groove welds made by an individual welder are required to be tested, magnetic particle or dye penetrant testing may be used only in areas inaccessible to ultrasonic testing. Retest all repaired areas. Submit weld inspection reports.

Testing frequency: Provide the following types and number of tests:

<u>Test Type</u>	<u>Number of Tests</u>
Magnetic Particle	20

3.7.2 Testing for Embrittlement

ASTM A143/A143M for steel products hot-dip galvanized after fabrication. Submit embrittlement test reports.

3.7.3 Inspection and Testing of Steel Stud Welding

Perform verification inspection and testing of steel stud welding conforming to the requirements of AWS D1.1/D1.1M, 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/D1.1M, 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.

-- End of Section --

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SECTION 05 30 00

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05/15

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-- End of Section Table of Contents --

SECTION 05 30 00

STEEL DECKS
05/15

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI D100 (1991; R 2008) Cold-Formed Steel Design Manual

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 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 A653/A653M (2017) 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 A792/A792M (2010) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

FM GLOBAL (FM)

FM APP GUIDE (updated on-line) Approval Guide
<http://www.approvalguide.com/>

FM DS 1-28R (1998) Data Sheet: Roof Systems

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 20 (2002; E 2004) Zinc-Rich Primers (Type I,

Inorganic, and Type II, Organic)

STEEL DECK INSTITUTE (SDI)

ANSI/SDI 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. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	(2013; with Change 3) Structural Engineering
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926	Safety and Health Regulations for Construction
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UNDERWRITERS LABORATORIES (UL)

UL 580	(2006; Reprint Oct 2013) Tests for Uplift Resistance of Roof Assemblies
UL Fire Resistance	(2014) Fire Resistance Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for 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 29.00 37, SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings; G

SD-03 Product Data

Accessories

Deck Units

Mechanical Fasteners

Touch-Up Paint

Welding Equipment

Welding Rods and Accessories

Recycled Content of Steel Products; S

SD-04 Samples

Metal Roof Deck Units

SD-05 Design Data

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SD-07 Certificates

Powder-Actuated Tool Operator

Welder Qualifications

Welding Procedures

Fire Safety

Wind Storm Resistance

Manufacturer's Certificate

Stud Manufacture's Certification

Stud Manufacture'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/D1.3M for sheet steel and AWS D1.1/D1.1M for stud welding.
Submit qualified Welder Qualifications in accordance with AWS D1.3/D1.3M for sheet steel and AWS D1.1/D1.1M 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

1.3.4.1 Fire Safety

Test roof deck as a part of a roof deck construction assembly of the type used for this project, listing as fire classified in the UL Fire Resistance, or listing as Class I construction in the FM APP GUIDE, and so labeled.

1.3.4.2 Wind Storm Resistance

Provide roof construction assembly capable of withstanding a nominal uplift pressure as indicated in the drawings when tested in accordance with the uplift pressure test described in the FM DS 1-28R or as described in UL 580 and in general compliance with UFC 3-301-01.

1.3.5 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 an average recycled content of steel products so postconsumer recycled content plus one half of preconsumer recycled content not less than 25 percent.

2.1.1 Roof Deck

Conform to ASTM A792/A792M or ASTM A1008/A1008M for deck used in conjunction with insulation and built-up roofing. Fabricate roof deck units of the steel design thickness required by the design drawings and ASTM A792/A792M Coating Designation AZ55. Furnish sample of Metal Roof Deck Units used to illustrate actual cross section dimensions and configurations.

2.1.2 Composite Deck

Conform to ASTM A653/A653M or ASTM A1008/A1008M for composite deck assembly. The steel design thickness required by the design drawings. Zinc-coat in conformance with ASTM A653/A653M, G90 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/A780M.

Touch-up welds with paint conforming to SSPC Paint 20 in accordance with ASTM A780/A780M. Maintain finish of deck units and accessories by using touch-up paint whenever necessary to prevent the formation of rust.

2.2 ACCESSORIES

Provide accessories of same material as deck, unless specified otherwise. Provide manufacturer's standard type accessories, as specified.

2.2.1 Adjusting Plates

Provide adjusting plates, or segments of deck units, of same thickness and configuration as deck units in locations too narrow to accommodate full size units. Provide factory cut plates of predetermined size where possible.

2.2.2 End Closures

Fabricated of sheet metal by the deck manufacturer. Provide end closures minimum 0.0295 inch thick to close open ends at eaves and openings through deck.

2.2.3 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.

2.2.4 Sheet Metal Collar

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.2.5 Cover Plates

Sheet metal to close panel edge and end conditions, and where panels change direction or butt. Polyethylene-coated, self-adhesive, 2 inch wide joint tape may be provided in lieu of cover plates on flat-surfaced decking butt joints.

2.2.6 Column Closures

Sheet metal, minimum 0.0358 inch thick or metal rib lath.

2.2.7 Access Hole Covers

Sheet metal, minimum 0.0474 inch thick.

2.2.8 Shear Connectors

Provide shear connectors in accordance with AWS D1.1/D1.1M headed stud Type B. Submit stud manufacture's certification that the studs delivered conform to the material requirements. Submit stud manufacture's test reports for the last completed in-plant quality control mechanical tests.

2.2.9 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.

2.2.10 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.

2.2.11 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.

2.2.12 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 that are designed to meet the loads indicated.

2.2.13 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. 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/D1.3M 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/D1.3M make welds. Immediately recertify, or replace qualified welders, that are producing unsatisfactory welding. Conform to the

recommendations of the Steel Deck Institute and the steel deck manufacturer 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/D1.1M 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/A780M.

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. Drive pneumatically fasteners with a low-velocity fastening tool and comply with the manufacturer's recommendations. Drive screws to properly clamp desk to supporting steel.

3.2.1.3 Sidelap Fastening

Lock sidelaps between adjacent floor deck units together by welding or screws as indicated.

3.2.2 Openings

Cut or drill all holes and openings required and be coordinated with the drawings, specifications, and other trades. Frame and reinforce openings through the deck in conformance with SDI DDP. Reinforce holes and openings 6 to 12 inch across by 0.0474 inch thick steel sheet at least 12 inch wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 6 inch on center. Reinforce holes and openings larger than 12 inch by steel channels or angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Install steel channels or angles perpendicular to the deck ribs and fasten to the channels or angles perpendicular to the steel joists.

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.

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, 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 utility system and suspended ceilings. Space devices so as to provide one device per 6.25 square feet.

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 CANT STRIPS FOR ROOF DECKS

Provide strips to be fusion welded to surface of roof decking, secured to wood nailers by galvanized screws or to steel framing by galvanized self-tapping screws or welds. Do not exceed spacing of welds and fasteners of 12 inch. Lap end joints a minimum 3 inch and secure with galvanized sheet metal screws spaced a maximum 4 inch on center.

3.4 RIDGE AND VALLEY PLATES FOR ROOF DECKS

Provide plates to be fusion welded to top surface of roof decking. Lap end joints a minimum 3 inch. For valley plates, provide endlaps to be in the direction of water flow.

3.5 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.

3.6 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.

3.7 CLEANING AND PROTECTION FOR ROOF DECKS

Upon completion of the deck, sweep surfaces clean and prepare for installation of the roofing.

3.8 FIELD QUALITY CONTROL

3.8.1 Headed Stud Inspection

In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M 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/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.8.2 Deck Weld Inspection

Visual inspect welds in accordance with AWS D1.3/D1.3M.

3.8.3 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

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 318 (2014; Errata 1-2 2014; Errata 3-5 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 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 A1003/A1003M	(2015) Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members
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 A370	(2017a) Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A653/A653M	(2017) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C1007	(2011a) Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories
ASTM C1513	(2018) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
ASTM C955	(2017) Standard Specification for Cold-Formed Steel Structural Framing Members
ASTM E119	(2018) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E329	(2018) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
ASTM E488/E488M	(2015) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
ASTM F1941	(2010) Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code
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U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01

(2013; with Change 3) 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 29.00 37, SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Framing Components; G

SD-03 Product Data

Steel Studs, Joists, Tracks, Bracing, Bridging and Accessories

Recycled Content of Steel Products; S

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 S200, "North American Standard for Cold-Formed Steel Framing - General Provision".
 - (3) AISI S201, "North American Standard for Cold-Formed Steel Framing - Product Data".
 - (4) AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing".
 - (5) AISI S211, "North American Standard for Cold-Formed Steel Framing - Wall Stud Design".
 - (6) AISI S212, "North American Standard for Cold-Formed Steel Framing - Header Design".
 - (7) AISI S213, "North American Standard for Cold-Formed Steel Framing - Lateral Design".

1.6.1 Drawing Requirements

Submit framing components to show sizes, thicknesses, layout, material designations, methods of installation, and accessories including the following:

- a. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.
- b. Connection details showing fastener type, quantity, location, and other information to assure proper installation.
- c. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

Sign and seal fabrication drawings by a registered professional engineer.

1.6.2 Design Data Required

Submit metal framing calculations with design criteria and structural loading to verify sizes, thickness, and spacing of members and connections signed and sealed by a registered professional engineer. Show methods and practices used in installation.

PART 2 PRODUCTS

2.1 STEEL STUDS, JOISTS, TRACKS, BRACING, BRIDGING AND ACCESSORIES

Framing components shall comply with ASTM C955 and the following.

- a. Provide products with an average recycled content of steel products so postconsumer recycled content plus one half of preconsumer recycled content not less than 25 percent.
- b. 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: 0.0538 inch.
 - (2) Flange Width: 1-5/8 inches, minimum at top and bottom chords connecting to sheathing or directly fastened construction.

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, G90.

2.1.2 Studs and Joists of 43 mils (0.043 Inch) and Lighter

Studs and Joists of 43 mils (0.043 Inch) and Lighter, Track, and Accessories (All thicknesses): Galvanized steel, ASTM A653/A653M and ASTM A1003/A1003M, SS, Grade 33 33,000 psi G60.

2.1.3 Sizes, Thickness, Section Modulus, and Other Structural Properties

Size and thickness as required.

2.2 MARKINGS

Studs and track shall have product markings stamped on the web of the section. The markings shall be repeated throughout the length of the member at a maximum spacing of 4 feet on center and shall be legible and easily read. The product marking shall include the following:

- a. An ICC number.
- b. Manufacturer's identification.
- c. Minimum delivered uncoated steel thickness.
- d. Protective coating designator.
- e. Minimum yield strength.

2.3 CONNECTIONS

2.3.1 Steel-To-Concrete Connections

- a. 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.
- b. 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

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.

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.

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 indicated. 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 shown on the drawings.

3.2.4 Powder-Actuated Fasteners

Powder-actuated fasteners shall be of the type, size, and location shown on the drawings.

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 Trusses

- 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.
- 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.
- Do not alter, cut, or remove framing members or connections of trusses.

3.3.4 Erection Tolerances

- 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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- 3.9 INSTALLATION OF DOWNSPOUT TERMINATIONS
- 3.10 STRUCTURAL STEEL DOOR FRAMES
- 3.11 INSTALLATION MISCELLANEOUS PLATES AND SHAPES
- 3.12 INSTALLATION OF METAL CANOPIES

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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 (2016) Code of Standard Practice for Steel
Buildings and Bridges

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.3 (2013) Operations - Safety Requirements
for Powder Actuated Fastening Systems

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016)
Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts
and Screws (Inch Series)

ASME B18.2.2 (2015) Nuts for General Applications:
Machine Screw Nuts, Hex, Square, Hex
Flange, and Coupling Nuts (Inch Series)

ASME B18.21.1 (2009; R 2016) Washers: Helical
Spring-Lock, Tooth Lock, and Plain Washers
(Inch Series)

ASME B18.21.2M (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 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 2014) 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	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A653/A653M	(2017) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A924/A924M	(2017a) 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	(2018) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
ASTM D1187/D1187M	(1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal

MASTER PAINTERS INSTITUTE (MPI)

MPI 79	(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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Structural Steel Door Frames, Fabrication Drawings; G
Bollards/Pipe Guards; G

Metal Canopies; G
Structural Steel Door Frames; G
Each Downspout Terminations Type; G
Recycled Content; S

SD-07 Certificates

Certificates of Compliance; G
Certified Mill Test Reports for Chemistry and Mechanical Properties; 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

Provide products with recycled content. Provide certificates of compliance for recycled content.

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. Submit the manufacturer's certified mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied materials.

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

2.2.5.1 Lag Screws and Bolts

Provide in accordance with ASME B18.2.1, type and grade best suited for the purpose.

2.2.5.2 Toggle Bolts

Provide in accordance with ASME B18.2.1.

2.2.5.3 Bolts, Nuts, Studs and Rivets

Provide in accordance with ASME B18.2.2 or ASTM A307.

2.2.5.4 Powder Actuated Fasteners

Follow safety provisions in accordance with ASSE/SAFE A10.3.

2.2.5.5 Screws

Provide in accordance with ASME B18.2.1, ASME B18.6.2, ASME B18.6.3 and ASTM C1513.

2.2.5.6 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.

2.2.5.7 Welded Headed Shear Studs

Provide in accordance with ASTM A108.

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 Shop Cleaning and Painting

2.3.3.1 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.

2.3.3.2 Pretreatment, Priming and Painting

Apply pre-treatment, primer, and paint in accordance with manufacturer's printed instructions.

2.3.4 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.3.5 Aluminum Surfaces

2.3.5.1 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.

2.3.5.2 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 an 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 CORNER GUARDS

For jambs and sills of openings and edges of platforms provide steel shapes and plates anchored in masonry or concrete with welded steel straps or end-weld stud anchors. Form corner guards for use with glazed or ceramic tile finish on walls with 0.0625 inch thick corrosion-resisting steel with satin finish, extend 5 feet above the top of cove base or to the top of the wainscot, whichever is less, and securely anchor to the supporting wall. Provide interior corner guards as indicated in Section 10 26 00 WALL AND DOOR PROTECTION.

2.5 BOLLARDS/PIPE GUARDS

Provide 8 inch galvanized and prime coated standard weight steel pipe in accordance with ASTM A53/A53M. Anchor posts in concrete as indicated and fill solidly with concrete with minimum compressive strength of 2500 psi.

2.6 DOWNSPOUT TERMINATIONS

Provide 4x6 inch cast iron downspout boot with cleanout access and manufacturer's standard cast iron strap.

2.7 MISCELLANEOUS PLATES AND SHAPES

Provide items that do not form a part of the structural steel framework, such as lintels, sill angles, support framing for ceiling-mounted toilet partitions, miscellaneous mountings and frames. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as 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.

2.8 STRUCTURAL STEEL DOOR FRAMES

- a. Provide frames as indicated. Unless otherwise indicated, construct frames of structural shapes, or shape and plate composite, to form a full depth channel shape with at least 1-1/2 inch outstanding legs. For single swing doors, provide continuous 5/8 by 1-1/2 inch bar stock stops at head and jambs. For freight elevator hoistway entrance, include a non-skid metal sill. Provide extruded metal frames as required by the elevator manufacturer.
- b. Provide support where track, guides, hoods, hangers, operators, and other accessories are required.
- c. Provide jamb anchors near top, bottom, and at not more than 24 inch intervals. Provide the bottom of each jamb member with a clip angle welded in place with two 1/2 inch diameter floor bolts for adjustment.

Provide frames of rolled shapes as indicated. Miter and weld heads to jambs, or provide riveted clip angle connections concealed in the finished work. Provide frames for swinging doors with 5/8 by 1-1/2 inch solid bar stops secured to the frame by welding or by 1/4 inch diameter countersunk machine screws spaced not more than 12 inches on centers. Stiffen head openings greater than 3 feet as necessary to limit deflection to not more than 1/16 inch. Secure frames to masonry with zinc-coated metal anchors spaced not more than 30 inches on centers. Where necessary to engage the threads of machine screws for fastening hardware, back frames on inside faces with steel plates of suitable thickness. Tap frames and reinforcing plates as necessary for the installation of hardware and other work. Countersink rivets and screw heads where they will be exposed in the finished work. Grind welds smooth.

2.9 METAL CANOPIES

Provide metal canopies with flat soffit as provided by Mapes Architectural Canopies or equal. Provide Super Lumideck Flat Soffit. Decking and fascia shall be extruded aluminum, alloy 6063-T6. Decking shall be 3 inch extruded 0.078 inch decking. Fascia shall be standard 8 inch extruded flat style. Canopies shall be Class II clear, anodized. All connections shall be mechanically assembled utilizing 3/16 inch fasteners with a minimum

shearstress of 350 pounds. Pre-welded or factory-welded connections are not acceptable. Decking shall be designed with interlocking extruded aluminum members with mechanical fasteners field applied to provide structural integrity for the completed assembly.

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

3.7.1 Material Coatings and Surfaces

Remove rust preventive coating just prior to field erection, using a remover approved by the metal manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matter.

3.7.2 Environmental Conditions

Do not clean or paint surfaces when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than minus 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. Metal surfaces to be painted must be dry for a minimum of 48 hours prior to the application of primer or paint.

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 OF DOWNSPOUT TERMINATIONS

Secure downspouts terminations to downspouts and substrate per manufacturer's instructions.

3.10 STRUCTURAL STEEL DOOR FRAMES

Secure door frames to the floor slab by means of angle clips and expansion bolts. Provide any necessary reinforcements and drill and tap frames as required for hardware. Clean metal shavings from finished surfaces at the end of each work day.

For freight elevator hoistway entrances, include a non-skid metal sill installed in accordance with the elevator manufacturer's written installation instructions.

3.11 INSTALLATION MISCELLANEOUS PLATES AND SHAPES

Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as required to support wall loads over openings. Provide with connections. Construct to have at least 8 inches bearing on masonry at each end.

3.12 INSTALLATION OF METAL CANOPIES

Inspection: Confirm that surrounding area is ready for the canopy installation. Installer shall confirm dimensions and elevations to be as shown on manufacturers approved shop drawings. Erection shall be performed

by an approved installer and scheduled after all roofing in area is completed.

Installation: Installation shall be in strict accordance with manufacturer's approved shop drawings. Particular attention should be given to protecting the finish during handling and erection. After Installation, entire system shall be left in clean condition.

-- End of Section --

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DIVISION 05 - METALS

SECTION 05 51 00

METAL STAIRS

02/17

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- 1.3 QUALITY CONTROL
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PART 3 EXECUTION

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PN87437, SOF Group Headquarters
Fort Bragg, North Carolina

Solicitation No. W912PM21R0001

- 3.2.3 Safety Nosings
- 3.2.4 Touchup Painting

-- End of Section Table of Contents --

SECTION 05 51 00

METAL STAIRS
02/17

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 314 (1990; R 2013) Standard Specification for
Steel Anchor Bolts

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360 (2016) Specification for Structural Steel
Buildings

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISC/AISI 121 (2004) Standard Definitions for Use in the
Design of Steel Structures

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016)
Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts
and Screws (Inch Series)

ASME B18.21.1 (2009; R 2016) Washers: Helical
Spring-Lock, Tooth Lock, and Plain Washers
(Inch Series)

ASME B18.6.1 (2016) Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M (2016) Standard Specification for Steel,
Sheet, Cold-Rolled, Carbon, Structural,
High-Strength Low-Alloy, High-Strength
Low-Alloy with Improved Formability,
Solution Hardened, and Bake Hardenable

ASTM A1011/A1011M (2017a) 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 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 A27/A27M	(2017) Standard Specification for Steel Castings, Carbon, for General Application
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 A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel
ASTM A449	(2014) Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A47/A47M	(1999; R 2014) Standard Specification for Ferritic Malleable Iron Castings
ASTM A48/A48M	(2003; R 2012) Standard Specification for Gray 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	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A653/A653M	(2017) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A924/A924M	(2017a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2018; TIA 18-1; TIA 18-2; TIA 18-3) Life Safety Code
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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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Iron and Steel Hardware; G
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
Hot-Rolled Carbon Steel Bars; G
Cold-Rolled Carbon Steel Sheets; G
Galvanized Carbon Steel Sheets; G
Gray Iron Castings; G
Malleable Iron Castings; G
Concrete Inserts; G
Masonry Anchorage Devices; G
Protective Coating; G
Steel Pan Stairs; G
Steel Stairs; G

SD-07 Certificates

Welding Procedures; G

Welder Qualification; G

SD-08 Manufacturer's Instructions

Structural-Steel Plates, Shapes, and Bars; G

Structural-Steel Tubing; G

Hot-Rolled Carbon Steel Bars; G

Cold-Rolled Carbon Steel Sheets; G

Galvanized Carbon Steel Sheets; G

Gray Iron Castings; G

Malleable Iron Castings; G

Protective Coating; G

Masonry Anchorage Devices; G

1.3 QUALITY CONTROL

1.3.1 Qualifications for Welding Work

Submit welding procedures in accordance with AWS D1.1/D1.1M. Make test specimens in the presence of the Contracting Officer, and have the specimens tested by an approved testing laboratory at the Contractor's expense.

Certify welder qualification by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. In addition, perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, ensure that two test welds are retested immediately and that each test weld is made and passes. Failure in the immediate retest requires that the welder be retested after further practice or training and a complete set of test welds be made.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Submit complete and detailed fabrication drawings for all 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.

2.2.2.4 Metal Safety Nosings

Between stringers, provide abrasive cast metal safety nosings, 4 inches wide by the full length of the step. Fabricate nosings to the thickness, profile, and surface pattern indicated. Equip each nosing with integral anchors for embedding in the pan fill material, and space the anchors not more than 4 inches from each end and not more than 15 inches on center.

2.2.2.5 Steel Floor Plate Treads and Platforms

Provide raised-pattern steel floor plate fabricated from steel complying with ASTM A36/A36M. Provide the pattern indicated or, if not indicated, as selected from the manufacturer's standard patterns.

Form treads of 1/4-inch thick steel floor plate with integral nosing and back-edge stiffener. Weld steel supporting brackets to strings, and weld treads to brackets.

Fabricate platforms of steel floor plate to the thickness indicated. Provide nosing that match treads at landings. Secure floor plates to platform framing members with welds.

2.2.2.6 Safety Nosings for Concrete Treads

Provide safety nosings of cast aluminum with plain abrasive surfaces, or extruded aluminum with abrasive inserts, at least 4 inches wide and 1/4 inch thick for metal-pan cement-filled treads extending the full length of the tread for stairs and for platforms and landings. Provide safety nosings with anchors embedded a minimum of 3/4 inch in the concrete and with tops flush with the top of the traffic surface.

2.2.2.7 Safety Treads

ASTM A1011/A1011M, steel pan for concrete tread.

2.2.2.8 Steel Framing for Concrete Stairs

When necessary, modify fabricated units to fit actual dimensions of the supporting structure. Join steel components by welding. Provide 14-gage steel risers unless otherwise indicated. Arrange components to receive finish materials as indicated.

2.2.3 Protective Coating

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.

Hot-dip galvanize steelwork as indicated in accordance with ASTM A123/A123M. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

2.3 COMPONENTS

2.3.1 Steel Stairs

Provide steel stairs complete with stringers, metal-pan concrete-filled treads, landings, columns, handrails, and necessary bolts and other fastenings. Shop-paint steel stairs and accessories.

2.3.1.1 Design Loads

Design stairs to sustain a live load of not less than 100 pounds per square foot, or a concentrated load of 300 applied where it is most critical. Except for a commercial product, design and fabricate steel stairs to conform to AISC 360. Design fire stairs to conform to NFPA 101.

2.3.1.2 Materials

Provide steel stairs of welded construction except that bolts may be used where welding is not practicable. Do not use screw or screw-type connections.

- a. Structural Steel: ASTM A36/A36M.
- b. Support metal pan for concrete fill on angle cleats welded to stringers or treads with integral cleats, welded or bolted to the stringer. Provide sheet-steel landings with angle stiffeners welded on. Close exposed ends.
- c. Before fabrication, obtain necessary field measurements and verify drawing dimensions.
- d. Clean metal surfaces free of mill scale, flake rust, and rust pitting before shop finishing. Weld permanent connections. Finish welds flush and smooth on surfaces that will be exposed after installation.

2.3.2 Soffit Clips

Provide clips with holes for attaching metal furring for plastered soffits. Space the clips not more than 12 inches on center, and weld them to stair treads and platforms as required.

2.3.3 Concrete Inserts

Threaded-type concrete inserts consisting of galvanized ferrous castings, internally threaded to receive 3/4-inch diameter machine bolts; either malleable iron conforming to ASTM A47/A47M or cast steel conforming to ASTM A27/A27M, and hot-dip-galvanized in accordance with ASTM A153/A153M.

Wedge-type concrete inserts consisting of galvanized box-type ferrous

castings designed to accept 3/4-inch diameter bolts having special wedge-shaped heads; either malleable iron conforming to ASTM A47/A47M or cast steel conforming to ASTM A27/A27M and hot-dip-galvanized in accordance with ASTM A153/A153M.

Carbon steel bolts having special wedge-shaped heads, nuts, washers, and shims and galvanized in accordance with ASTM A153/A153M. Provide slotted-type concrete inserts consisting of galvanized 1/8-inch thick pressed steel plate conforming to ASTM A283/A283M; of box-type welded construction with slot designed to receive 3/4-inch diameter square-head bolt with knockout cover; and be hot-dip-galvanized in accordance with ASTM A123/A123M.

2.3.4 Masonry Anchorage Devices

Provide masonry anchorage devices consisting of expansion shields complying with AASHTO M 314, ASTM E488/E488M and ASTM C514 as follows:

- 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. Bolt anchor expansion shields for lag bolts; zinc-alloy, long-shield anchors class, Group II, Type 1, Class 1.

Use toggle bolts of the tumble-wing type, conforming to ASTM A325, ASTM A449, and ASTM C636/C636M, type, class, and style as required.

2.3.5 Fasteners

Select galvanized zinc-coated fasteners conforming to ASTM A153/A153M for exterior applications or where the fasteners are built into exterior walls or floor systems. Select the fasteners for the type, grade, and class required for the installation of steel stair items:

- a. Standard/regular hexagon-head bolts and nuts, conforming to ASTM A307, Grade A.
- b. Square-head lag bolts conforming to ASME B18.2.1.
- c. Flat-head carbon steel wood screws, conforming to ASME B18.6.1.
- d. Plain, round, general-assembly-grade, carbon steel washers, conforming to ASME B18.21.1.
- e. Helical-spring, carbon steel lockwashers, conforming to ASME B18.2.1.

2.4 MATERIALS

2.4.1 Structural-Steel Plates, Shapes and Bars

Structural-size shapes and plates, conforming to ASTM A36/A36M, unless otherwise noted, except bent or cold-formed plates.

Steel plates - bent or cold-formed, conforming to ASTM A283/A283M, Grade C.

Steel bars and bar-size shapes, conforming to ASTM A36/A36M, unless otherwise noted for steel bars and bar-size shapes.

2.4.2 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.

2.4.3 Hot-Rolled Carbon Steel Bars

Provide the following:

- b. Hot-rolled carbon steel bars and bar-size shapes, conforming to ASTM A36/A36M, grade as selected by the fabricator.

2.4.4 Cold-Rolled Carbon Steel Sheets

Provide the following:

- a. Cold-rolled carbon steel sheets conforming to ASTM A1008/A1008M.

2.4.5 Galvanized Carbon Steel Sheets

Provide the following:

- a. Galvanized carbon steel sheets conforming to ASTM A653/A653M, with galvanizing conforming to ASTM A653/A653M and ASTM A924/A924M.

2.4.6 Gray Iron Castings

Provide the following:

- a. Gray iron castings conforming to ASTM A48/A48M, Class 30.

2.4.7 Malleable Iron Castings

Provide the following:

- a. Malleable iron castings conforming to ASTM A47/A47M, grade as selected.

2.4.8 Steel Pipe

Provide the following:

- a. Steel pipe conforming to ASTM A53/A53M, type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40).

PART 3 EXECUTION

3.1 PREPARATION

Clean surfaces thoroughly before installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. Examine materials upon arrival at site. Notify the carrier and manufacturer of any damage.

Protect installed products until completion of project. Touch up, repair or replace, damaged products before substantial completion

3.2 INSTALLATION

Install in accordance with the manufacturer's instructions and approved submittals. Install in proper relationship with adjacent construction.

Install items at locations indicated, according to the manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Ensure that exposed fastenings are compatible with generally match the color and finish of, and harmonize with the material to which they are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners is cause for rejection. Conceal fastenings where practicable. Select thickness of metal and details of assembly and supports that adequately strengthen and stiffen the construction. Form joints exposed to the weather to exclude water.

3.2.1 Field Preparation

Remove rust-preventive coating just before field erection, using a remover approved by the coating manufacturer. Provide surfaces, when assembled, free of rust, grease, dirt and other foreign matter.

3.2.2 Field Welding

Comply with AWS D1.1/D1.1M in executing manual shielded-metal arc welding, (for appearance and quality of new welds) and in correcting existing welding.

3.2.3 Safety Nosings

Completely embed nosing in concrete before the initial set of the concrete occurs and finish flush with the top of the concrete surface.

3.2.4 Touchup Painting

Immediately after installation, clean all field welds, bolted connections, and abraded areas of the shop-painted material, and repaint exposed areas with the same paint used for shop painting. Apply paint by brush or spray to provide a minimum dry-film thickness of 2 mils.

-- End of Section --

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DIVISION 05 - METALS

SECTION 05 52 00

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02/18

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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

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts
and Screws (Inch Series)

ASME B18.21.1 (2009; R 2016) Washers: Helical
Spring-Lock, Tooth Lock, and Plain Washers
(Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M (2016) Standard Specification for Zinc
Coating (Hot-Dip) on Iron and Steel
Hardware

ASTM A283/A283M (2013) Standard Specification for Low and
Intermediate Tensile Strength Carbon Steel
Plates

ASTM A307 (2014; 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 A500/A500M (2018) Standard Specification for
Cold-Formed Welded and Seamless Carbon

Steel Structural Tubing in Rounds and
Shapes

ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM 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
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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. Steel shapes, plates, bars and strips
- b. Steel railings and handrails
- c. 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. Steel railings and handrails
- d. 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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings; G

Steel Shapes, Plates, Bars and Strips; G

SD-03 Product Data

Structural-Steel Plates, Shapes, and Bars; G

Structural-Steel Tubing; 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.

2.2 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 Structural-Steel Tubing

Provide structural-steel tubing, hot-formed, welded or seamless, conforming to ASTM A500/A500M, Grade B, unless otherwise noted.

2.2.3 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 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.

2.2.4 Fasteners

Provide galvanized zinc-coated fasteners in accordance with ASTM A153/A153M used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.

Provide standard hexagon-head bolts, conforming to ASTM A307, Grade A.

Provide square-head lag bolts conforming to ASME B18.2.1.

Provide plain round, general-assembly-grade, carbon steel washers conforming to ASME B18.21.1.

Provide helical spring, carbon steel lockwashers conforming to ASME B18.2.1.

2.2.5 Steel Railings And Handrails

Design handrails to resist a concentrated load of 250 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.

2.2.5.1 Steel Handrails

Provide steel handrails, including inserts in concrete, steel pipe conforming to ASTM A53/A53M or structural tubing conforming to ASTM A500/A500M, Grade A or B of equivalent strength. Provide steel railings of 1 1/2 or 2 inch nominal size, hot-dip galvanized and

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.

Provide galvanized exterior and interior railings where indicated, including pipe, fittings, brackets, fasteners, and other ferrous metal components. Provide black steel pipe for interior railings not indicated as galvanized.

Provide galvanized 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 in concrete by means of pipe sleeves set and anchored into concrete. Provide sleeves of galvanized, standard-weight, steel pipe, not less than 6 inches long, and having an inside diameter not less than 1/2 inch greater than the outside diameter of the inserted pipe post. Provide steel plate closure secured to the bottom of the sleeve, with closure width and length not less than 1 inch greater than the outside diameter of the sleeve. After posts have been inserted into sleeves, fill the annular space between the post and sleeve with nonshrink grout or a quick-setting hydraulic cement. Cover anchorage joint with a round steel flange welded to the post.
- b. 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.
- c. Anchor rail ends into concrete and masonry with round steel flanges welded to rail ends and anchored into the wall construction with lead expansion shields and bolts.
- d. Anchor rail ends to steel with oval or round steel flanges welded to tail ends and bolted to the structural-steel members.

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 stair railing and hand rail work:

- a. Structural-steel plates, shapes, and bars
- b. Structural-steel tubing
- c. Masonry anchorage devices
- d. Steel railings and handrails
- e. Aluminum railings and handrails
- f. 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 in pipe sleeves embedded in concrete and filled with nonshrink grout or quick-setting anchoring cement with anchorage covered with standard pipe collar pinned to post or by means of pipe sleeves secured to wood with screws or by means of masonry with expansion shields and bolts or toggle bolts or 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 through-bolted to a back plate 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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SECTION 06 10 00

ROUGH 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 RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION
(AREMA)

AREMA Eng Man (2017) Manual for Railway Engineering

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

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 A653/A653M (2017) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM C1396/C1396M (2017) Standard Specification for Gypsum Board

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 DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350 (2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

FOREST STEWARDSHIP COUNCIL (FSC)

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

GREEN SEAL (GS)

GS-36 (2013) Adhesives for Commercial Use

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

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Spec (1986; Supple. No. 1, Aug 1993) Standard
Specifications for Grades of Southern
Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003 (2014) Standard Grading Rules for Southern
Pine Lumber

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)

FS UU-B-790 (Rev A; Notice 2) Building Paper Vegetable
Fiber: (Kraft, Waterproofed, Water
Repellent and Fire Resistant)

UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program
For Chemical Emissions For Building
Materials, Finishes And Furnishings

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

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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance

with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Nailers and Nailing Strips; G

Drawings of field erection details, including materials and methods of fastening nailers in conformance with Factory Mutual wind uplift rated systems specified in other Sections of these specifications.

SD-03 Product Data

Adhesives

SD-06 Test Reports

Preservative-treated Lumber and Plywood

SD-07 Certificates

Certificates of Grade

Certified Sustainably Harvested Virgin Lumber; S

Preservative Treatment

Indoor Air Quality for Aerosol Adhesives; S

Indoor Air Quality for Non-aerosol Adhesives; S

SD-10 Operation and Maintenance Data

Take-back Program

Include contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling or reuse.

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. Store wood I-beams and glue-laminated beams and joists on edge. 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. 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: Materials other than lumber; moisture content must be in accordance with standard under which the product is produced

1.7 PRESERVATIVE TREATMENT

- 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 AWPAC Quality Mark on each piece. Do not incise surfaces of lumber that will be exposed. Brush coat areas that are cut or drilled after treatment with either the same preservative used in the treatment or with a 2 percent copper naphthenate solution. All lumber and woodwork must be preservative treated. The following items must be preservative treated:
 - (1) Wood members that are in contact with water.
 - (2) 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.
 - (3) Nailers, edge strips, crickets, curbs, and cants for roof decks.

1.8 FIRE-RETARDANT TREATMENT

Fire-retardant treated wood must be pressure treated 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 Drawing Requirements

For fabricated structural members, trusses, glu-lam members, indicate materials, details of construction, methods of fastening, and erection details. Include reference to design criteria used and manufacturers design calculations. Submit drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.

1.9.2 Data Required

Submit calculations and drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.

1.10 CERTIFICATIONS

1.10.1 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.

1.10.2 Certified Sustainably Harvested Wood

Provide wood certified as sustainably harvested by FSC STD 01 001. Provide a letter of Certification of Sustainably Harvested Wood signed by the wood supplier. Identify certifying organization and their third party program name and indicate compliance with chain-of-custody program requirements. Submit sustainable wood certification data; identify each certified product on a line item basis. Submit copies of invoices bearing certification numbers.

1.10.3 Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.

1.10.3.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard), SCS Global Services Indoor Advantage or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Virgin Lumber

Lumber fabricated from old growth timber is not permitted. Avoid companies who buy, sell, or use old growth timber in their operations, when possible. Provide certified sustainably harvested virgin lumber.

2.1.2 Natural Decay- and Insect-Resistant Wood

An occasional piece with corner sapwood is permitted if 90 percent or more of the width of each side on which the sapwood occurs is heartwood.

2.2 LUMBER

2.2.1 Framing Lumber

Framing lumber such as studs, plates, caps, collar beams, cant strips, bucks, sleepers, nailing strips, and nailers and board lumber such as subflooring and wall and roof sheathing must be one of the species listed in the table below. Minimum grade of species must be as listed. Provide certified sustainably harvested framing lumber.

<u>Table of Grades for Framing and Board Lumber</u>			
<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
WWPA G-5 standard grading rules	Aspen, Douglas Fir-Larch, Douglas Fir South, Engelmann Spruce-Lodgepole Pine, Engelmann Spruce, Hem-Fir, Idaho White Pine, Lodgepole Pine, Mountain Hemlock, Mountain Hemlock-Hem-Fir, Ponderosa Pine-Sugar Pine, Ponderosa Pine-Lodgepole Pine, Subalpine Fir, White Woods, Western Woods, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common
WCLIB 17 standard grading rules	Douglas Fir-Larch, Hem-Fir, Mountain Hemlock, Sitka Spruce, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: Standard

<u>Table of Grades for Framing and Board Lumber</u>			
<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
SPIB 1003 standard grading rules	Southern Pine	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	No. 2 Boards
SCMA Spec standard specifications	Cypress	No. 2 Common	No. 2 Common
NELMA Grading Rules standard grading rules	Balsam Fir, Eastern Hemlock-Tamarack, Eastern Spruce, Eastern White Pine, Northern Pine, Northern Pine-Cedar	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common except Standard for Eastern White and Northern Pine
RIS Grade Use standard specifications	Redwood	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	Construction Heart

<u>Table of Grades for Framing and Board Lumber</u>			
<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
NHLA Rules rules for the measurement and inspection of hardwood and cypress lumber	Cypress	No. 2 Dimension	No. 2 Common

2.3 OTHER USES

2.3.1 Plywood

C-D Grade, Exposure 1. Provide certified sustainably harvested plywood for other uses.

2.4 OTHER MATERIALS

2.4.1 Gypsum Wall Sheathing

ASTM C1396/C1396M, 1/2 inch thick fire retardant (Type X) 5/8 inch thick; 4 feet wide with square edge for supports 16 inches o.c. with or without corner bracing of framing or for supports 24 inches o.c. with corner bracing of framing.

2.4.2 Building Paper

FS UU-B-790, Type I, Grade D, Style 1.

2.4.3 Miscellaneous Wood Members

2.4.3.1 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.

2.4.3.2 Wood Bumpers

AREMA Eng Man, Industrial grade cross ties

2.4.3.3 Blocking

Blocking must be standard or number 2 grade.

2.4.3.4 Rough Bucks and Frames

Rough bucks and frames must be straight standard or number 2 grade.

2.4.4 Adhesives

Comply with applicable regulations regarding toxic and hazardous materials and as specified. Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of GS-36. Provide certification or validation of indoor air quality for non-aerosol adhesives applied on the interior of the building (inside of the weatherproofing system). Provide certification or validation of indoor air quality for aerosol adhesives used on the interior of the building (inside of the weatherproofing system).

2.5 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. Nails and fastenings for fire-retardant treated lumber and woodwork exposed to the weather must be copper alloy or hot-dipped galvanized fasteners as recommended by the treated wood manufacturer.

2.5.1 Bolts, Nuts, Studs, and Rivets

ASME B18.2.1, ASME B18.5.2.1M, ASME B18.5.2.2M and ASME B18.2.2.

2.5.2 Anchor Bolts

ASTM A307, size as indicated, complete with nuts and washers.

2.5.3 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.

2.5.4 Lag Screws and Lag Bolts

ASME B18.2.1.

2.5.5 Wood Screws

ASME B18.6.1.

2.5.6 Nails

ASTM F547, size and type best suited for purpose. For sheathing and subflooring, length of nails must be sufficient to extend 1 inch into supports. 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.

2.5.7 Wire Nails

ASTM F1667.

2.5.8 Clip Angles

Steel, 3/16 inch thick, size best suited for intended use; or zinc-coated steel or iron commercial clips designed for connecting wood members.

2.5.9 Door Buck Anchors

Metal anchors, 1/8 by 1-1/4 inch steel, 12 inches long, with ends bent 2 inches. Anchors must be screwed to the backs of bucks and built into masonry or concrete. Locate 8 inches above sills and below heads and not more than 24 inches intermediately between. Anchorage of bucks to steel framing must be as necessary to suit the conditions.

2.5.10 Metal Framing Anchors

Construct anchors to the configuration shown using hot dip zinc-coated steel conforming to ASTM A653/A653M, G90. Steel must be not lighter than 18 gage. Special nails supplied by the manufacturer must be used for all nailing.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Conform to AWC WFCM unless otherwise indicated or specified. Select lumber sizes to minimize waste. Fit framing lumber and other rough carpentry, set accurately to the required lines and levels, and secure in place in a rigid manner.

3.1.1 Wall Sheathing

3.1.1.1 Gypsum Sheathing Board

Apply gypsum sheathing board either horizontally or vertically. Butt joints and locate over the centerlines of supports. Horizontally applied sheathing must be T&G, applied with tongued edge up. Stagger vertical joints and abut sheet closely to frames of openings. Nail sheathing with 11 gage, 3/8 inch head, zinc-coated nails 1-1/2 inches long for 1/2 inch sheathing and 1-3/4 inches long for 5/8 inch sheathing, spaced 3/8 inch minimum from edges. Provide 2 by 4 blocking for horizontal edges of 4 foot wide panels not otherwise supported.

- a. Gypsum Sheathing Board Used with Diagonal-Braced Framing: Sheathing must be either 2 or 4 feet wide. Apply sheathing 2 feet wide horizontally. Nail 4 inches maximum o.c. at edges and over intermediate bearings. Apply sheathing 4 feet wide either horizontally or vertically. Nail 4 inches maximum o.c. at edges and 8 inches maximum o.c. at intermediate bearings.
- b. Gypsum Sheathing Board Used with Unbraced Frames: Sheathing must be 4 feet wide and applied vertically. Extend sheathing over and nail to both sill and top plates. Nail 4 inches maximum o.c. at edges and 8 inches maximum o.c. at intermediate bearings.

3.1.1.2 Foil-Faced Insulative Sheathing

Apply sheathing vertically. Butt or overlap joints and locate over centerline of supports. Attach sheathing to framing with 1-1/4 inch, large, flat-head, 11 gage, galvanized roofing nails or 16 gage, 7/16 inch minimum crown, galvanized staples with 1-1/4 inch legs. For nonstructural application (with corner bracing), space fasteners 6 inches o.c. on all panel edges and 12 inches o.c. on intermediate supports, regardless of sheathing thickness, for studs not more than 24 inches o.c. For structural application (without corner bracing), for studs not more than 16 inches o.c., space fasteners 3 inches o.c. on all edges and 6 inches o.c. on intermediate members using minimum 0.115 inch thickness; for studs up to 24 inches o.c., space fasteners 3 inches o.c. on all edges and 3 inches o.c. on intermediate supports using minimum 0.137 inch thickness.

3.1.2 Building Paper

Provide building paper. Apply paper shingle fashion, horizontally, beginning at the bottom of the wall. Lap edges 4 inches, and nail with one inch, zinc-coated roofing nails, spaced 12 inches o.c. and driven through tin discs.

3.2 MISCELLANEOUS

3.2.1 Rough Wood Bucks

2 inch nominal thickness. Set wood bucks true and plumb. Anchor bucks to concrete or masonry with steel straps extending into the wall 8 inches minimum. Place anchors near the top and bottom of the buck and space uniformly at 2 foot maximum intervals.

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 Grounds

Provide for fastening wood trim, finish materials, and other items to plastered walls and ceilings. Install grounds in proper alignment and true with an 8 foot straightedge.

3.2.4 Wood Bumpers

Dress to the sizes indicated, and bevel edges. Bore, countersink, and bolt bumpers in place.

3.2.5 Temporary Closures

Provide with hinged doors and padlocks and install during construction at exterior doorways and other ground level openings that are not otherwise closed. Cover windows and other unprotected openings with polyethylene or other approved material, stretched on wood frames. Provide dustproof barrier partitions to isolate areas as directed.

3.3 INSTALLATION OF TIMBER CONNECTORS

Install timber connectors in conformance with requirements of AWC NDS.

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, must 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 must be within the following limits:
 - (1) Layout of walls and partitions: 1/4 inch from intended position;
 - (2) Plates and runners: 1/8 inch in 8 feet from a straight line;
 - (3) Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and
 - (4) Face of framing members: 1/8 in 8 feet from a true plane.

3.5 WASTE MANAGEMENT OF WOOD PRODUCTS

In accordance with the Waste Management Plan and as specified. Separate and reuse scrap sheet materials larger than 2 square feet, framing members larger than 16 inches, and multiple offcuts of any size larger than 12 inches. 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. Coordinate with manufacturer for take-back program and submit manufacturer's policy statement on program. Set aside scrap and return to manufacturer for recycling into new product. When such a service is not available, local recyclers must be sought after to reclaim the materials. 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.

-- End of Section --

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FINISH CARPENTRY
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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 HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995; R 2004) Basic Hardboard

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

ALSC PS 20 (2015) American Softwood Lumber Standard

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA M4 (2015) Standard for the Care of
Preservative-Treated Wood Products

AWPA U1 (2017) 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

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI AWS (2nd Edition) Architectural Woodwork
Standards

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts
and Screws (Inch Series)

ASME B18.2.2 (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)

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

HARDWOOD PLYWOOD AND VENEER ASSOCIATION (HPVA)

HPVA HP-1 (2016) American National Standard for
Hardwood and Decorative Plywood

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

UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program
For Chemical Emissions For Building
Materials, Finishes And Furnishings

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

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMPMA)

WMPMA WM 6 (2007) Quality Industry Standards Booklet

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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings Indicating All Wood Assemblies; G

SD-03 Product Data

Wood Products; G

Fascias and Trim; G

Hardware and Accessories; G

SD-07 Certificates

Certificates of Grade; G

Certified Sustainably Harvested Wood for Trim and Frames; S

Certified Sustainably Harvested Softwood Plywood; S

Certified Sustainably Harvested Hardwood Plywood; S

Certified Sustainably Harvested Hardboard; S

Indoor Air Quality for Hardwood Plywood; 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

Provide wood certified as sustainably harvested by FSC STD 01 001. Provide a letter of Certification of Sustainably Harvested Wood signed by the wood supplier. Identify certifying organization and their third party program name and indicate compliance with chain-of-custody program requirements. Submit sustainable wood certification data; identify each certified product on a line item basis. Submit copies of invoices bearing certification numbers.

1.7.1.3 Indoor Air Quality Certifications

1.7.1.3.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard), SCS Global Services Indoor Advantage or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.7.1.3.2 Composite Wood Products

For purposes of this specification, composite wood products include hardwood plywood, particleboard, medium density fiberboard (MDF), panel substrates, and door cores. Provide products certified to meet

requirements of both 40 CFR 770 and CARB 93120. 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 Hardboard

Provide materials marks or written documentation identifying the producer and the applicable standard.

1.7.5 Pressure Treated Lumber and Plywood

Inspect each treated piece in accordance with AWP A U1.

1.7.6 Non-Pressure Treated Woodwork and Millwork

Mark, stamp, or label to indicate compliance with WDMA I.S.4.

1.7.7 Fire-Retardant Treated Lumber

Each piece must bear an Underwriters Laboratories fire resistance label or comparable label of another nationally recognized independent fire retardant materials testing laboratory.

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 AWP A 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. Provide trim, except window stools and aprons

with hollow backs. Provide certified sustainably harvested wood for trim and frames.

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/>

2.1.4 Utility Shelving

Provide utility shelving in a suitable species equal to or exceeding the requirements of No. 3 common white fir under WWPA G-5, 1 inch thick; or plywood, interior type, Grade A-B, 1/2 inch thick, any species group.

2.1.5 Softwood Plywood

Provide in accordance with APA L870. Provide certified sustainably harvested softwood plywood. When located on the interior of buildings, provide products with no added urea-formaldehyde resins.

Plywood for Shelving: Interior type, A-B Grade, any species group.

2.1.6 Hardwood Plywood

HPVA HP-1, Type II (Interior), Good (1) Grade, of thickness indicated. Provide certified sustainably harvested hardwood plywood. When located on the interior of buildings, provide products with no added urea-formaldehyde resins. For products located on the interior of the building (inside of the weatherproofing system), provide certification of indoor air quality for hardwood plywood.

2.1.7 Hardboard

AHA A135.4, standard type, 1/4 inch thick. Provide certified sustainably harvested hardboard.

2.2 FASCIAS AND TRIM

2.2.1 Wood

Provide species and grades for all fasciae and trim, including exterior door and window casings, in accordance with AWPA U1 Use Category System Tables. Provide sizes indicated. Metal corners may be provided in lieu of wood corner boards for horizontal siding. If metal corners are used, provide galvanized steel or aluminum, completely coated with primer compatible for the specific metal substrate.

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 Paneling: 6 percent.
- b. 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.
- c. Exterior Treated and Untreated Finish Lumber and Trim: 4 inches Nominal or Less in Thickness: 19 percent.
- d. Exterior Wood Siding: 15 percent.
- e. Provide moisture content of other materials in accordance with the

applicable standards.

2.4 PRESERVATIVE TREATMENT OF WOOD PRODUCTS

2.4.1 Non-Pressure Treatment

Treat woodwork and millwork, such as exterior trim, door trim, and window trim, in accordance with WDMA I.S.4, with either 2 percent copper napthenate, 3 percent zinc napthenate, or 1.8 percent copper-8-quinolinolate. Provide a liberal brush coat of preservative treatment to field cuts and holes.

2.4.2 Pressure Treatment

Treat lumber and plywood used on the exterior of buildings or in contact with masonry or concrete with a waterborne preservative listed in AWPA U1 (P series is included therein by reference) as applicable, and inspected in accordance with AWPA U1. Identify treatment on each piece of material by the quality mark of an agency accredited by the Board of Review of the American Lumber Standards Committee. Provide treated plywood to a reflection level as follows:

Preservative treat exterior wood moulding and millwork that will be within 18 inches of soil or in contact with water or concrete in accordance with WMPA WM 6. Provide a field treatment in accordance with AWPA M4 of exposed areas of treated wood that have been cut or drilled. Items of all-heart material of cedar, cypress, or redwood do not require preservative treatment except when in direct contact with soil.

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 Vertical Slotted Shelf Standards

ANSI/BHMA A156.9, Type B04102, with shelf brackets Type B04112.

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 AWI AWS. Provide items not otherwise specified in a specific grade as "Custom" grade.

2.6.2 Casework with Transparent Finish (CTF)

2.6.2.1 AWI Quality Grade

Custom grade.

2.6.2.2 Construction

Provide design as shown on the drawings.

2.6.2.3 Exposed Parts

Birch specie, rotary cut.

2.6.2.4 Semi-Exposed Parts

As specified in the AWI AWS for the grade selected.

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 Exterior Finish Work

Machine sand exposed flat members and square edges. Machine finish semi-exposed surfaces. Construct joints to exclude water. In addition to nailing, glue joints with waterproof glue as necessary for weather resistant construction. Evenly distribute end joints in built-up members. Provide shoulder joints in flat work. Reinforce backs of wide-faced miters with metal rings and waterproof glue. Unless otherwise indicated, provide fasciae and other flat members 3/4 inch thick minimum. Provide door and window trim in single lengths. Provide braced, blocked, and rigidly anchored cornices for support and protection of vertical joints. Provide soffits in largest practical size. Align joints of plywood over centerlines of supports. Fasten soffits with aluminum or stainless steel nails. Back prime all concealed surfaces of exterior trim.

3.1.2 Interior Finish Work

After installation, sand exposed surfaces smooth. Provide window and door trim in single lengths.

3.2 SHELVING

Support 1 inch nominal thick wood shelf material or 3/4 or 23/32 inch thick plywood shelf material with end and intermediate supports arranged to prevent buckling and sagging. Provide cleats except where hook strips are specified or indicated. Where adjustable shelving is indicated, provide standards and brackets or shelf rests for each shelf. Anchor standards to wall at not more than 2 feet on center.

3.3 FASCIAE AND EXTERIOR TRIM

Construct, caulk, and machine sand exposed surfaces and edges to exclude water. In addition to nailing, glue joints as necessary for weather resistance. Evenly distribute end joints in built-up members. Shoulder joints in flat work. Reinforce backs of wide-faced miters with metal rings and glue. Provide fasciae and other flat members in maximum practicable lengths. Braced, block, and rigidly anchor cornices for support and protection of vertical joints.

3.4 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. Provide window and door trim in single lengths. 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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PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS
08/10

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A161.2 (1998) Decorative Laminate Countertops,
Performance Standards for Fabricated High
Pressure

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI AWS (2nd Edition) Architectural Woodwork
Standards

ASTM INTERNATIONAL (ASTM)

ASTM D1037 (2012) Evaluating Properties of Wood-Base
Fiber and Particle Panel Materials

ASTM 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

COMPOSITE PANEL ASSOCIATION (CPA)

CPA A208.1 (2016) Particleboard

CPA A208.2 (2016) Medium Density Fiberboard (MDF) for
Interior Applications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3 (2005) Standard for High-Pressure
Decorative Laminates

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED BD+C (2009; R 2010) Leadership in Energy and
Environmental Design(tm) Building Design

and Construction (LEED-NC)

UL ENVIRONMENT (ULE)

ULE Greenguard

UL Greenguard Certification Program

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

ANSI/WDMA I.S.1A

(2013) Interior Architectural Wood Flush
Doors

1.2 SYSTEM DESCRIPTION

Work in this section includes laminate clad custom casework cabinets as shown on the drawings and as described in this specification. This Section includes high-pressure laminate surfacing and cabinet hardware. Comply with EPA requirements in accordance with Section 01 33 29.00 37 SUSTAINABILITY. All exposed and semi-exposed surfaces, whose finish is not otherwise noted on the drawings or finish schedule, shall be sanded smooth and shall receive a clear finish of polyurethane. Wood finish may be shop finished or field applied in accordance with Section 09 90 00 PAINTS AND COATINGS.

1.3 SUSTAINABILITY REPORTING

Materials in this technical specification may contribute towards contract compliance with sustainability requirements. See Section 01 33 29.00 37 SUSTAINABILITY for project LEED BD+C local/regional materials, low-emitting materials, recycled content, certified wood and rapidly renewable materials LEED documentation requirements.

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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings
Installation

SD-03 Product Data

Wood Materials
Finish Schedule
Certification

SD-07 Certificates

Quality Assurance
Laminate Clad Casework

SD-11 Closeout Submittals

LEED Documentation

1.5 QUALITY ASSURANCE

1.5.1 General Requirements

Unless otherwise noted on the drawings, all materials, construction methods, and fabrication shall conform to and comply with the custom grade quality standards as outlined in AWI AWS, Section for laminate clad cabinets. These standards shall apply in lieu of omissions or specific requirements in this specification. Contractors and their personnel engaged in the work shall be able to demonstrate successful experience with work of comparable extent, complexity and quality to that shown and specified. Submit a quality control statement which illustrates compliance with and understanding of AWI AWS requirements, in general, and the specific AWI AWS requirements provided in this specification. The quality control statement shall also certify a minimum of ten years Contractor's experience in laminate clad casework fabrication and construction. The quality control statement shall provide a list of a minimum of five successfully completed projects of a similar scope, size, and complexity.

1.5.2 Sustainable Design Certification

Product shall be third party certified in accordance with ULE Greenguard, SCS Scientific Certification Systems Indoor Advantage or equal. Certification shall be performed annually and shall be current.

1.6 DELIVERY, STORAGE, AND HANDLING

Casework may be delivered knockdown or fully assembled. Deliver all units to the site in undamaged condition, stored off the ground in fully enclosed areas, and protected from damage. The storage area shall be well ventilated and not subject to extreme changes in temperature or humidity.

1.7 SEQUENCING AND SCHEDULING

Coordinate work with other trades. Units shall not be installed in any room or space until painting, and ceiling installation are complete within the room where the units are located. Floor cabinets shall be installed before finished flooring materials are installed.

PART 2 PRODUCTS

2.1 WOOD MATERIALS

2.1.1 Lumber

- a. All framing lumber shall be kiln-dried Grade III to dimensions as shown on the drawings. Frame front, where indicated on the drawings, shall be nominal 3/4 inch hardwood.
- b. Standing or running trim casework components, which are specified to receive a transparent finish, shall be hardwood species, plain sawn. AWI grade shall be custom. Location, shape, and dimensions shall be as indicated on the drawings.

2.1.2 Panel Products

2.1.2.1 Plywood

All plywood panels used for framing purposes shall be veneer core hardwood plywood, AWI AWS Grade AA. Nominal thickness of plywood panels shall be as indicated in this specification and on the drawings.

2.1.2.2 Particleboard

All particleboard shall be industrial grade, medium density (40 to 50 pounds per cubic foot), 3/4 inch thick. A moisture-resistant particleboard in grade Type 2-M-2 or 2-M-3 shall be used as the substrate for plastic laminate covered components as located on the drawings and other areas subjected to moisture. Particleboard shall meet the minimum standards listed in ASTM D1037 and CPA A208.1.

2.1.2.3 Medium Density Fiberboard

Medium density fiberboard (MDF) shall be an acceptable panel substrate where noted on the drawings. Medium density fiberboard shall meet the minimum standards listed in CPA A208.2.

2.2 SOLID POLYMER MATERIAL

Solid surfacing casework components shall conform to the requirements of Section 06 61 16 SOLID SURFACING FABRICATIONS.

2.3 HIGH PRESSURE DECORATIVE LAMINATE (HPDL)

All plastic laminates shall meet the requirements of ANSI/NEMA LD 3 and ANSI A161.2 for high-pressure decorative laminates. Design, colors, surface finish and texture, and locations shall be as indicated on the drawings. Submit two samples of each plastic laminate pattern and color. Samples shall be a minimum of 5 by 7 inches in size. Plastic laminate types and nominal minimum thicknesses for casework components shall be as indicated in the following paragraphs.

2.3.1 Horizontal General Purpose Standard (HGS) Grade

Horizontal general purpose standard grade plastic laminate shall be 0.048 inches (plus or minus 0.005 inches) in thickness. This laminate grade is intended for horizontal surfaces where postforming is not required.

2.3.2 Vertical General Purpose Standard (VGS) Grade

Vertical general purpose standard grade plastic laminate shall be 0.028 inches (plus or minus 0.004 inches) in thickness. This laminate grade is intended for exposed exterior vertical surfaces of casework components where postforming is not required.

2.3.3 Cabinet Liner Standard (CLS) Grade

Cabinet liner standard grade plastic laminate shall be 0.020 inches in thickness. This laminate grade is intended for light duty semi-exposed interior surfaces of casework components.

2.3.4 Backing Sheet (BK) Grade

Undecorated backing sheet grade laminate is formulated specifically to be used on the backside of plastic laminated panel substrates to enhance dimensional stability of the substrate. Backing sheet thickness shall be 0.020 inches. Backing sheets shall be provided for all laminated casework components where plastic laminate finish is applied to only one surface of the component substrate.

2.4 THERMOSET DECORATIVE OVERLAYS (MELAMINE)

Thermoset decorative overlays (melamine panels) shall be used for casework cabinet interior, drawer interior, and all semi-exposed surfaces.

2.5 EDGE BANDING

Edge banding for casework doors and drawer fronts shall be PVC vinyl and shall be 0.125 inch thick. Material width shall be 15/16 inches. Color and pattern shall match exposed door and drawer front laminate pattern and color.

2.6 CABINET HARDWARE

Submit one sample of each cabinet hardware item specified to include hinges, pulls, and drawer glides. All hardware shall conform to ANSI/BHMA A156.9, unless otherwise noted, and shall consist of the following components:

2.6.1 Door Hinges

Frameless concealed type, BHMA No. B11601.

2.6.2 Cabinet Pulls

Back Mounted type, BHMA No. B12011.

2.6.3 Drawer Slide

Side mounted self-closing type, BHMA No. B05091 with full extension and a minimum 100 pound load capacity. Slides shall include an integral stop to avoid accidental drawer removal.

2.6.4 Adjustable Shelf Support System

Support clips for the standards shall be open type, BHMA No. B04091.

2.7 FASTENERS

Nails, screws, and other suitable fasteners shall be the size and type best suited for the purpose and shall conform to ASTM F547 where applicable.

2.8 ADHESIVES, CAULKS, AND SEALANTS

2.8.1 Adhesives

Adhesives shall be of a formula and type recommended by AWI. Adhesives shall be selected for their ability to provide a durable, permanent bond and shall take into consideration such factors as materials to be bonded, expansion and contraction, bond strength, fire rating, and moisture

resistance. Adhesives shall meet local regulations regarding VOC emissions and off-gassing.

2.8.1.1 Wood Joinery

Adhesives used to bond wood members shall be a Type II for interior use. Adhesives shall withstand a bond test as described in ANSI/WDMA I.S.1A.

2.8.1.2 Laminate Adhesive

Adhesive used to join high-pressure decorative laminate to wood shall be adhesive consistent with AWI and laminate manufacturer's recommendations. PVC edgbanding shall be adhered using a polymer-based hot melt glue.

2.8.2 Caulk

Caulk used to fill voids and joints between laminated components and between laminated components and adjacent surfaces shall be clear, 100 percent silicone.

2.8.3 Sealant

Sealant shall be of a type and composition recommended by the substrate manufacturer to provide a moisture barrier at sink cutouts and all other locations where unfinished substrate edges may be subjected to moisture.

2.9 FABRICATION

Verify field measurements as indicated in the shop drawings before fabrication. Fabrication and assembly of components shall be accomplished at the shop site to the maximum extent possible. Construction and fabrication of cabinets and their components shall meet or exceed the requirements for AWI custom grade unless otherwise indicated in this specification. Cabinet style, in accordance with AWI AWS, Section 400-G descriptions, shall be flush overlay .

2.9.1 Base and Wall Cabinet Case Body

2.9.1.1 Cabinet Components

Frame members shall be glued-together, kiln-dried hardwood lumber. Top corners, bottom corners, and cabinet bottoms shall be braced with either hardwood blocks or water-resistant glue and nailed in place metal or plastic corner braces. Cabinet components shall be constructed from the following materials and thicknesses:

2.9.1.1.1 Body Members (Ends, Divisions, Bottoms, and Tops)

3/4 inch medium density fiberboard (MDF) panel product

2.9.1.1.2 Face Frames and Rails

3/4 inch panel product

2.9.1.1.3 Shelving

3/4 inch medium density fiberboard (MDF) panel product

2.9.1.1.4 Cabinet Backs

1/4 inch medium density fiberboard (MDF) panel product

2.9.1.1.5 Drawer Sides, Backs, and Subfronts

1/2 inch panel product

2.9.1.1.6 Drawer Bottoms

1/4 inch medium density fiberboard (MDF) panel product

2.9.1.1.7 Door and Drawer Fronts

3/4-inch medium density fiberboard (MDF) panel product

2.9.1.2 Joinery Method for Case Body Members

2.9.1.2.1 Tops, Exposed Ends, and Bottoms

- a. Steel "European" assembly screws (1-1/2 inch from end, 5 inch on center, fasteners will not be visible on exposed parts).
- b. Doweled, glued under pressure (approx. 4 dowels per 12 inches of joint).
- c. Stop dado, glued under pressure, and either nailed, stapled or screwed (fasteners will not be visible on exposed parts).
- d. Spline or biscuit, glued under pressure.

2.9.1.2.2 Exposed End Corner and Face Frame Attachment

2.9.1.2.2.1 Mitered Joint

lock miter or spline or biscuit, glued under pressure (no visible fasteners)

2.9.1.2.2.2 Non-Mitered Joint (90 degree)

butt joint glued under pressure (no visible fasteners)

2.9.1.2.2.3 Butt Joint

glued and nailed

2.9.1.2.3 Cabinet Backs (Wall Hung Cabinets)

Wall hung cabinet backs must not be relied upon to support the full weight of the cabinet and its anticipated load for hanging/mounting purposes. Method of back joinery and hanging/mounting mechanisms should transfer the load to case body members. Fabrication method shall be:

2.9.1.2.3.1 Full Bound

Full bound, captured in grooves on cabinet sides, top, and bottom. Cabinet backs for floor standing cabinets shall be side bound, captured in grooves; glued and fastened to top and bottom.

2.9.1.2.3.2 Full Overlay

Full overlay, plant-on backs with minimum back thickness of 1/2 inch and minimum No. 12 plated (no case hardened) screws spaced a minimum 3 inches on center. Edge of back shall not be exposed on finished sides. Anchor strips are not required when so attached.

2.9.1.2.3.3 Side Bound

Side bound, captured in groove or rabbetts; glued and fastened.

2.9.1.2.4 Cabinet Backs (Floor Standing Cabinets)

2.9.1.2.4.1 Side Bound

Side bound, captured in grooves; glued and fastened to top and bottom.

2.9.1.2.4.2 Full Overlay

Full overlay, plant-on backs with minimum back thickness of 1/2 inch and minimum No. 12 plated (no case hardened) screws spaced a minimum 3 inches on center. Edge of back shall not be exposed on finished sides. Anchor strips are not required when so attached.

2.9.1.2.4.3 Side Bound with Rabbetts

Side bound, placed in rabbetts; glued and fastened in rabbetts.

2.9.1.2.5 Wall Anchor Strips

Wall Anchor Strips shall be required for all cabinets with backs less than 1/2 inch thick. Strips shall consist of minimum 1/2 inch thick lumber, minimum 2-1/2 inches width; securely attached to wall side of cabinet back - top and bottom for wall hung cabinets, top only for floor standing cabinets.

2.9.2 Cabinet Floor Base

Floor cabinets shall be mounted on a base constructed of nominal 2 inch thick lumber. Base assembly components shall be treated lumber. Finished height for each cabinet base shall be as indicated on the drawings. Bottom edge of the cabinet door or drawer face shall extend below the top of the base as indicated on the drawings.

2.9.3 Cabinet Door and Drawer Fronts

Door and drawer fronts shall be fabricated from 3/4 inch medium density fiberboard (MDF). All door and drawer front edges shall be surfaced with PVC edgebanding, color and pattern to match exterior face laminate.

2.9.4 Drawer Assembly

2.9.4.1 Drawer Components

Drawer components shall consist of a removable drawer front, sides, backs, and bottom. Drawer components shall be constructed of the following materials and thicknesses:

2.9.4.1.1 Drawer Sides and Backs For Laminate Finish

1/2 inch thick 7-ply hardwood veneer core substrate

2.9.4.1.2 Drawer Bottom

1/4 inch thick veneer core panel product for transparent or plastic laminate finish

2.9.4.2 Drawer Assembly Joinery Method

- a. Multiple dovetail (all corners) or French dovetail front/dadoed back, glued under pressure.
- b. Doweled, glued under pressure.
- c. Lock shoulder, glued and pin nailed.
- d. Bottoms shall be set into sides, front, and back, 1/4 inch deep groove with a minimum 3/8 inch standing shoulder.

2.9.5 Shelving

2.9.5.1 General Requirements

Shelving shall be fabricated from 3/4 inch medium density fiberboard (MDF). All shelving top and bottom surfaces shall be finished with HPDL plastic laminate. Shelf edges shall be finished in a PVC edgebanding.

2.9.5.2 Shelf Support System

The shelf support system shall be:

2.9.5.2.1 Pin Hole Method

Drill holes on the interior surface of the cabinet side walls. Evenly space holes in two vertical columns. Space the holes in each column at 1 inch increments starting 6 inches from the cabinet interior bottom and extending to within 6 inches of the top interior surface of the cabinet. Drill holes to provide a level, stable surface when the shelf is resting on the shelf pins. Coordinate hole diameter with pin insert size to provide a firm, tight fit.

2.9.6 Edge Style

Front and exposed side countertop edges shall be in shapes and to dimensions as shown on the drawings. The countertop edge material shall be:

2.9.6.1 Post Formed Plastic Laminate

Laminate edge shall be integral with countertop surface. Shape and profile shall be bullnose and to dimensions as indicated.

2.9.6.2 Hardwood

Species, finish, profile, shape, and dimensions shall be as indicated on the drawings. Hardwood edge shall overlap the exposed countertop laminate edge and shall be installed flush with the countertop laminate surface.

2.9.6.3 Vinyl

Vinyl tee-mould edge shall be in shape, thickness, and color as indicated on the drawings. Tee mould edge shall overlap the exposed countertop laminate edge and shall be installed flush with the countertop laminate surface.

2.9.7 Laminate Application

Laminate application to substrates shall follow the recommended procedures and instructions of the laminate manufacturer and ANSI/NEMA LD 3, using tools and devices specifically designed for laminate fabrication and application. Provide a balanced backer sheet (Grade BK) wherever only one surface of the component substrate requires a plastic laminate finish. Apply required grade of laminate in full uninterrupted sheets consistent with manufactured sizes using one piece for full length only, using adhesives specified herein or as recommended by the manufacturer. Fit corners and joints hairline. All laminate edges shall be machined flush, filed, sanded, or buffed to remove machine marks and eased (sharp corners removed). Clean up at easing shall be such that no overlap of the member eased is visible. Fabrication shall conform to ANSI A161.2. Laminate types and grades for component surfaces shall be as follows unless otherwise indicated on the drawings:

2.9.7.1 Base/Wall Cabinet Case Body

- a. Exterior (exposed) surfaces to include exposed and semi-exposed face frame surfaces: HPDL Grade VGS.
- b. Interior (semi-exposed) surfaces to include interior back wall, bottom, and side walls: HPDL Grade CLS.

2.9.7.2 Adjustable Shelving

2.9.7.2.1 Top and Bottom Surfaces

HPDL Grade HGS

2.9.7.2.2 All Edges

PVC edgebanding

2.9.7.3 Fixed Shelving

2.9.7.3.1 Top and Bottom Surfaces

HPDL Grade HGS

2.9.7.3.2 Exposed Edges

PVC edgebanding

2.9.7.4 Door, Drawer Fronts, Access Panels

2.9.7.4.1 Exterior (Exposed) and Interior (Semi-Exposed) Faces

HPDL Grade VGS

2.9.7.4.2 Edges

PVC edgebanding

2.9.7.5 Drawer Assembly

All interior and exterior surfaces: HPDL Grade CLS.

2.9.7.6 Countertops and Splashes

All exposed and semi-exposed surfaces: HPDL Grade HGS

2.9.7.7 Tolerances

Flushness, flatness, and joint tolerances of laminated surfaces shall meet the AWI AWS custom grade requirements.

2.9.8 Finishing

2.9.8.1 Filling

No fasteners shall be exposed on laminated surfaces. All nails, screws, and other fasteners in non-laminated cabinet components shall be countersunk and the holes filled with wood filler consistent in color with the wood species.

2.9.8.2 Sanding

All surfaces requiring coatings shall be prepared by sanding with a grit and in a manner that scratches will not show in the final system.

2.9.8.3 Coatings

Types, method of application and location of casework finishes shall be in accordance with the finish schedule, drawings and Section 09 90 00 PAINTS AND COATINGS. All cabinet reveals shall be painted. Submit descriptive data which provides narrative written verification of all types of construction materials and finishes, methods of construction, etc. not clearly illustrated on the submitted shop drawings. Data shall provide written verification of conformance with AWI AWS for the quality indicated to include materials, tolerances, and types of construction. Both the manufacturer of materials and the fabricator shall submit available literature which describes re-cycled product content, 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.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall comply with applicable requirements for AWI AWS custom quality standards. Countertops and fabricated assemblies shall be installed level, plumb, and true to line, in locations shown on the drawings. Cabinets and other laminate clad casework assemblies shall be attached and anchored securely to the floor and walls with mechanical fasteners that are appropriate for the wall and floor construction.

3.1.1 Anchoring Systems

3.1.1.1 Floor

Anchoring and mechanical fasteners shall not be visible from the finished side of the casework assembly. Cabinet assemblies shall be attached to anchored bases without visible fasteners. Where assembly abuts a wall surface, anchoring shall include a minimum 1/2 inch thick lumber or panel product hanging strip, minimum 2-1/2 inch width; securely attached to the top of the wall side of the cabinet back.

3.1.1.2 Wall

Cabinet to be wall mounted shall utilize minimum 1/2 inch thick lumber or panel product hanging strips, minimum 2-1/2 inch width; securely attached to the wall side of the cabinet back, both top and bottom.

3.1.2 Countertops

Countertops shall be installed in locations as indicated on the drawings. Countertops shall be fastened to supporting casework structure with mechanical fasteners, hidden from view. All joints formed by the countertop or countertop splash and adjacent wall surfaces shall be filled with a clear silicone caulk. Loose back and side splashes shall be adhered to both the countertop surface perimeter and the adjacent wall surface with adhesives appropriate for the type of materials to be adhered. Joints between the countertop surface and splash shall be filled with clear silicone caulk in a smooth consistent concave bead. Bead size shall be the minimum necessary to fill the joint and any surrounding voids or cracks.

3.1.3 Hardware

Casework hardware shall be installed in types and locations as indicated on the drawings. Where fully concealed European-style hinges are specified to be used with particleboard or fiberboard doors, the use of plastic or synthetic insertion dowels shall be used to receive 3/16 inch "Euroscrews". The use of wood screws without insertion dowels is prohibited.

3.1.4 Doors, Drawers and Removable Panels

The fitting of doors, drawers and removable panels shall be accomplished within target fitting tolerances for gaps and flushness in accordance with AWI AWS custom grade requirements.

3.1.5 Plumbing Fixtures

Install sinks, sink hardware, and other plumbing fixtures in locations as indicated on the drawings and in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

-- End of Section --

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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 D5116	(2010) Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products
ASTM D570	(1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D696	(2016) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
ASTM E84	(2016) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G21	(2015) 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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SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

TILE COUNCIL OF NORTH AMERICA (TCNA)

TCNA Hdbk (2013) Handbook for Ceramic, Glass, and
Stone Tile Installation

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED BD+C (2009; R 2010) Leadership in Energy and
Environmental Design(tm) Building Design
and Construction (LEED-NC)

UL ENVIRONMENT (ULE)

ULE Greenguard UL Greenguard Certification Program

1.2 SYSTEM DESCRIPTION

- a. Work under this section includes countertops, vanities, and 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 29.00 06 SUSTAINABILITY for project LEED BD+C local/ regional materials recycled content and LEED documentation requirements.

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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G
Installation; G

SD-03 Product Data

Solid Polymer Material
Qualifications
Fabrications
Certification
VOC Content

SD-04 Samples

Material; G
Counter and Vanity Tops; G
Window Stools; G

SD-06 Test Reports

Solid Polymer Material

SD-07 Certificates

Fabrications
Qualifications

SD-10 Operation and Maintenance Data

Clean-up

SD-11 Closeout Submittals

LEED Documentation

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. Prior to final approval of shop drawings, provide a full-size mock-up of a typical vanity top, countertop, and window stool where multiple units are required. The mock-up shall include all solid polymer components required to provide a completed unit. The mock-up shall utilize finishes in patterns and colors indicated on the drawings. Should the mock-up not be approved, re-work or

remake it until approval is secured. Remove rejected units from the jobsite. Approved mock-up may remain as part of the finished work.

1.5.3 Sustainable Design Certification

Product shall be third party certified in accordance with ULE Greenguard, SCS Scientific Certification Systems Indoor Advantage or equal. VOC content and emissions shall be determined by ASTM D5116. Certification shall be performed annually and shall be current.

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

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
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.	
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/satin.

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 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

In applicable areas, fabricate backsplashes and end splashes from 1/2 inch thick solid surfacing material to be in conformance with dimensions and shapes as indicated on the drawings. Backsplashes and end splashes shall be provided at locations indicated on the drawings. Backsplashes shall be shop fabricated and be permanently attached.

2.3.3.1 Permanently Attached Backsplash

In applicable areas, permanently attached backsplashes shall be attached with seam adhesive and to form a radiused coved transition from countertop to backsplash.

2.3.3.2 End Splashes

In applicable areas, end splashes shall be provided loose for installation at the jobsite after horizontal surfaces to which they are to be attached have been installed.

2.3.4 Window Stools

Fabricate window stools from 1/2 inch thick solid surfacing, solid polymer material. Dimensions, edge shape, and other details shall be as indicated on the drawings.

2.3.5 Counter and Vanity Tops

Fabricate all solid surfacing, solid polymer counter top and vanity top components from 1/2 inch thick material. Edge details, dimensions, locations, and quantities shall be as indicated on the Drawings. Counter tops shall be complete with 4 inch high permanently attached with coved transition backsplash and loose endsplashes only where indicated on the drawings, as not all areas will include back/side splashes. 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

Stainless Steel. Countertops with sinks shall include cutouts to template as furnished by the sink manufacturer. Manufacturer's standard sink mounting hardware for stainless steel 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.

2.3.5.2 Vanity Tops With Bowls

Countertops with vitreous china bowls shall include cutouts to template as furnished by the sink manufacturer. Manufacturer's standard sink mounting hardware for vitreous china rimless installation shall be provided. Seam between sink and counter top shall be sealed with silicone sealant. Sink, faucet, and plumbing requirements shall be in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Components

Install all components and fabricated units plumb, level, and rigid. Make field joints between solid polymer components using solid polymer manufacturer's approved seam adhesives, to provide a monolithic appearance with joints inconspicuous in the finished work. Attach metal or vitreous china sinks and lavatory bowls to counter tops using solid polymer manufacturer's recommended clear silicone sealant and mounting hardware. Solid polymer sinks and bowls shall be installed using a color-matched seam adhesive. Plumbing connections to sinks and lavatories shall be made in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.1.1.1 Loose Counter Top Splashes

In applicable areas, 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.

PN87437, SOF Group Headquarters
Fort Bragg, North Carolina

Solicitation No. W912PM21R0001

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

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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

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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 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 CALCULATION

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. If the air barrier was defined during design but the air barrier envelope surface area was not calculated, calculate it during construction and submit the envelope surface area calculations and result 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

Building Component	Envelope Condition
Clothes dryer	Off
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
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
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. When testing using the building's own air handling system, ensure flow readings obtained by anemometer comply with ASTM D3464. 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 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. Indicate in the final report improvements that were made to the envelope to reduce air leaks, 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 envelop 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/NAVGRAPH/graphdoc.pdf>.

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/NAVGRAPH/graphtoc.pdf>.

Appendix A - Air Leakage Test Form

Appendix B - Air Leakage Test Results Form

Appendix C - Test Agency Qualifications Sheet

-- End of Section --

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BOARD AND BLOCK INSULATION
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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 C1289	(2017) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C203	(2005; R 2012) Breaking Load and Flexural Properties of Block-Type Thermal Insulation
ASTM C272/C272M	(2016) Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions
ASTM C578	(2018) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C591	(2017) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate 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 E84	(2018) 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	(2018) International Building Code
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	(2016) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
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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) National Electrical Code

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program
For Chemical Emissions For Building
Materials, Finishes And Furnishings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for 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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Block or Board Insulation; G

Protection Board or Coatings; G

Accessories including sealants; G

SD-07 Certificates

Block or Board Insulation; G

Protection Board or Coating; G

Draft Special Warranties; G

Final Special Warranties; G

SD-08 Manufacturer's Instructions

Block or Board Insulation

Adhesive

SD-11 Closeout Submittals

Recycled Content for Block or Board Insulation; S

Indoor Air Quality For Block Or Board Insulation; S

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 CERTIFICATIONS

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard), SCS Global Services Indoor Advantage or provide certification by other third-party programs. Provide current product certification documentation from certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 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.

1.6.2 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.

1.7 SAFETY PRECAUTIONS

1.7.1 Other Safety Considerations

Comply with the safety requirements of ASTM C930.

1.8 SPECIAL WARRANTIES

1.8.1 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 CLOSEOUT SUBMITTALS and 01 78 23 OPERATION AND MAINTENANCE DATA.

1.8.2 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 CLOSEOUT SUBMITTALS and 01 78 23 OPERATION AND MAINTENANCE DATA.

PART 2 PRODUCTS

2.1 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. Unfaced Preformed Rigid Polyurethane and Polyisocyanurate Board: ASTM C591
- e. Faced Rigid Cellular Polyisocyanurate and Polyurethane Insulation: ASTM C1289 REV A
 - (1) Type II Fibrous felt or glass fiber mat membrane on both major surfaces of the core foam.

2.1.1 Thermal Resistance

As indicated on the drawings. Use polyisocyanurate on the walls and extruded polystyrene in areas that come in contact with the ground.

2.1.2 Fire Protection Requirements

- a. Flame spread index of 75 or less when tested in accordance with ASTM E84.
- b. Smoke developed index of 150 or less when tested in accordance with ASTM E84.
- c. Provide insulated assemblies in accordance ICC IBC Chapter Fire and Smoke Protection Features.

2.1.3 Other Material Properties

Provide thermal insulating materials with the following properties:

- a. Rigid cellular plastics: Compressive Resistance at Yield: Not less than 10 pounds per square inch (psi) when measured according to ASTM D1621.
- b. Block-type insulation: Block-type insulation: Flexural strength: Not less than 25 psi when measured according to ASTM C203 REV A.
- 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.
- d. Water Absorption: Not more than 2 percent by total immersion, by

volume, when measured according to ASTM C272/C272M.

2.1.4 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
Phenolic Rigid Foam:	5 percent
Perlite Board:	75 percent post consumer paper

Provide data identifying percentage of recycled content for block or board insulation.

2.1.5 Indoor Air Quality

Provide certification of indoor air quality for block or board insulation.

2.1.6 Prohibited Materials

Do not provide materials containing asbestos.

2.2 PROTECTION BOARD OR COATING

As recommended by insulation manufacturer.

2.3 ACCESSORIES

2.3.1 Adhesive

As recommended by insulation manufacturer.

2.3.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

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 in accordance with ICC IBC Section 2111.12 Fireplace Blocking and with 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.

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 using Furring Strips

Install insulation between members as recommended by insulation manufacturer.

3.4.2 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.

3.4.3 Adhesive Attachment to Concrete and Masonry Walls

Apply adhesive to wall and completely cover wall with insulation.

- a. As recommended by the insulation manufacturer.
- b. Use only full back method for pieces of 1 square foot or less.
- c. Butt all edges of insulation and seal edges with tape.

3.4.4 Mechanical Attachment on Concrete and Masonry Walls

Cut insulation to cover walls. Apply adhesive to wall and set clip or other mechanical fastener in adhesive as recommended by manufacturer. After curing of adhesive, install insulation over fasteners and bend split prongs to provide a flush condition with the insulation. Butt all edges of insulation and seal with tape.

3.4.5 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 INSTALLATION ON UNDERSIDE OF CONCRETE FLOOR SLAB

3.5.1 Mechanically Fastened Systems

Size insulation to cover underside of slab. Apply adhesive to slab and set fasteners in adhesive as recommended by manufacturer. After curing of adhesive, install insulation over fasteners and bend split prongs to provide a flush condition with the insulation. Butt all edges of insulation and seal with tape.

3.5.2 Adhesively Bonded Systems

Apply adhesive to underside of slab and completely cover wall with insulation.

- a. Spot method: Provide at least six spots having a diameter of approximately 4 inches, located at each corner and mid-point of each of the longer sides.
- b. As recommended by insulation manufacturer.
- c. Use full back method for insulation pieces 1 square foot or less.

- d. Butt all edges of insulation and seal with tape.

3.6 PERIMETER AND UNDER SLAB INSULATION

Install perimeter thermal insulation where heated spaces are adjacent to exterior walls, slab edges in slab-on-grade, or floating slab construction.

3.6.1 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.

3.6.2 Insulation on Vertical Surfaces

Provide thermal insulation as indicated. Fasten insulation with adhesive or mechanical fasteners.

3.6.3 Insulation Under Slab

Provide insulation horizontally under slab on grade as indicated. Install insulation on top of vapor retarder and turn retarder up over the outside edge of insulation to top of slab.

3.6.4 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. Extend protection at least 1 foot below grade.

3.7 ACCESS PANELS AND DOORS

Attach insulation to all access panels greater than 1 square foot and all access doors in insulated floors and ceilings. Use insulation with same R-Value as that for the floor or ceiling in which each panel occurs.

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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 D3575	(2014) Flexible Cellular Materials Made From Olefin Polymers
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 D5359	(2015) Standard Specification for Glass Cullet Recovered from Waste for Use in Manufacture of Glass Fiber
ASTM E136	(2016) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E84	(2018) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
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GREEN SEAL (GS)

GS-36

(2013) Adhesives for Commercial Use

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211

(2016) Standard for Chimneys, Fireplaces,
Vents, and Solid Fuel-Burning Appliances

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) National Electrical Code

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS

SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168

(2017) Adhesive and Sealant Applications

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

29 CFR 1910.134

Respiratory Protection

UNDERWRITERS LABORATORIES (UL)

UL 2818

(2013) GREENGUARD Certification Program
For Chemical Emissions For Building
Materials, Finishes And Furnishings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for 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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Blanket Insulation

Recycled Content for Insulation Materials; S

Sill Sealer Insulation

Vapor Retarder

Pressure Sensitive Tape

Accessories

SD-07 Certificates

Indoor Air Quality for Insulation Materials; S

Indoor Air Quality for Adhesives; S

SD-08 Manufacturer's Instructions

Insulation

SD-11 Closeout Submittals

Recycled Content for Insulation Materials; S

1.3 CERTIFICATIONS

Submit required indoor air quality certifications and validations in one submittal package.

1.3.1 Insulation Products

Provide product certified to meet indoor air quality requirements by UL 2818 (Greenguard), SCS Global Services Indoor Advantage or provide certification by other third-party programs. Provide current product certification from certification body.

1.3.2 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard), SCS Global Services Indoor Advantage or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

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 BLANKET INSULATION

ASTM C665, Type I, blankets without membrane coverings; Class A, membrane-faced surface with a flame spread of 25 or less, except a flame spread rating of 75 or less and a smoke developed rating of 150 or less when tested in accordance with ASTM E84.

2.1.1 Thermal Resistance Value (R-VALUE)

The R-Value must be as indicated on drawings.

2.1.2 Recycled Materials

Provide insulation materials containing the following minimum percentage of recycled material content by weight:

Fiberglass: 20 percent glass cullet complying with ASTM D5359

Provide data identifying percentage of recycled content for insulation materials.

2.1.3 Prohibited Materials

Do not provide asbestos-containing materials.

2.1.4 Reduced Volatile Organic Compounds (VOC) for Insulation Materials

Provide certification of indoor air quality for insulation materials.

2.2 SILL SEALER INSULATION

Provide polyethylene foam sill sealer 3.5 inches in width with the following characteristics:.

<u>Physical Properties</u>	<u>Test Method</u>	<u>Measurement</u>
Nominal Thickness	ASTM D3575	3/16 inch
Compressive Strength	ASTM D3575	1.2 psi
- Vertical Direction	Suffix D	
Tensile Strength	ASTM D3575	32 psi
	Suffix T	

2.3 BLOCKING

Wood, metal, unfaced mineral fiber blankets in accordance with ASTM C665,

Type I, or other approved materials. Use only non-combustible materials meeting the requirements of ASTM E136 for blocking around chimneys and heat producing devices.

2.4 VAPOR RETARDER

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.

2.5 PRESSURE SENSITIVE TAPE

As recommended by the vapor retarder manufacturer and having a water vapor permeance rating of one perm or less when tested in accordance with ASTM D3833/D3833M.

2.6 ACCESSORIES

2.6.1 Adhesive

As recommended by the insulation manufacturer. Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building that meet either emissions requirements of CDPH SECTION 01350 (use the office or classroom requirements, regardless of space type) or VOC content requirements of GS-36. Provide certification or validation of indoor air quality for adhesives.

2.6.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

2.6.3 Wire Mesh

Corrosion resistant and as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

Before installing insulation, ensure that areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If moisture or other conditions are found that do not allow the workmanlike installation of the insulation, do not proceed but notify Contracting Officer of such conditions.

3.2 PREPARATION

3.2.1 Blocking at Attic Vents and Access Doors

Prior to installation of insulation, install permanent blocking to prevent insulation from slipping over, clogging, or restricting air flow through soffit vents at eaves. Install permanent blocking to maintain accessibility to equipment or controls that require maintenance or

adjustment.

3.2.2 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

- a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless these are certified by the manufacturer for installation surrounded by insulation: 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 24 inches above fixture.
- b. Vents and vent connectors used for venting the products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.

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. Where insulation required is thicker than depth of joist, provide full width blankets to cover across top of joists. Provide continuity and integrity of insulation at corners, wall to ceiling joints, roof, and floor. Avoid creating thermal bridges.

3.3.1.3 Installation at Bridging and Cross Bracing

Insulate at bridging and cross bracing by splitting blanket vertically at center and packing one half into each opening. Butt insulation at bridging and cross bracing; fill in bridged area with loose or scrap insulation.

3.3.1.4 Cold Climate Requirement

Place insulation to the outside of pipes.

3.3.1.5 Insulation Blanket with Affixed Vapor Retarder

Locate vapor retarder as indicated. Do not install blankets with affixed vapor retarders unless so specified. Unless the insulation manufacturer's instructions specifically recommend not to staple the flanges of the vapor

retarder facing, staple flanges of vapor retarder at 6 inch intervals flush with face or set in the side of truss, joist, or stud. Avoid gaps and bulges in insulation and "fishmouth" in vapor retarders. Overlap both flanges when using face method. Seal joints and edges of vapor retarder with pressure sensitive tape. Stuff pieces of insulation into small cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills, band joists, and headers. Cover these insulated cracks with vapor retarder material and tape all joints with pressure sensitive tape to provide air and vapor tightness.

3.3.1.6 Insulation without Affixed Vapor Retarder

Provide snug friction fit to hold insulation in place. Stuff pieces of insulation into cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills, band joists, and headers.

3.3.1.7 Sizing of Blankets

Provide only full width blankets when insulating between trusses, joists, or studs. Size width of blankets for a snug fit where trusses, joists or studs are irregularly spaced.

3.3.1.8 Special Requirements for Ceilings

Place insulation under electrical wiring occurring across joists. Pack insulation into narrowly spaced framing. Do not block flow of air through soffit vents.

3.3.1.9 Installation of Sill Sealer

Size sill sealer insulation and place insulation over top of masonry or concrete perimeter walls or concrete perimeter floor slab on grade. Fasten sill plate over insulation.

3.3.1.10 Special Requirements for Floors

Hold insulation in place with corrosion resistant wire mesh, wire fasteners, or wire lacing.

3.3.1.11 Access Panels and Doors

Affix blanket insulation to access panels greater than one square foot and access doors in insulated floors and ceilings. Use insulation with same R-Value as that for floor or ceiling.

3.3.2 Installation of Separate Vapor Retarder

Apply continuous vapor retarder as indicated. Overlap joints at least 6 inches and seal with pressure sensitive tape. Seal at sill, header, windows, doors and utility penetrations. Repair punctures or tears with pressure sensitive tape.

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EXTERIOR INSULATION AND FINISH SYSTEMS
05/11

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2016) Standard Practice for Operating Salt Spray (Fog) Apparatus
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 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 C67/C67M	(2018) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
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 D968	(2017) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
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 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 E84	(2018) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G153	(2013) Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 268	(2012) Standard Test Method for Determining Ignitability 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, 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 color and finish as noted on the finish schedule.

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). The minimum test pressure shall be the maximum components and cladding wall wind pressure loading shown on contract drawings. 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. It is the responsibility of the Contractor to locate mock-up installation(s) in the location and size.
- 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

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 50-89 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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 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, projecting features, and roof/wall intersections.

SD-03 Product Data

Sheathing Board

Thermal Insulation

Adhesive

Mechanical Fasteners

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
- 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 MECHANICAL FASTENERS

Corrosion resistant and as approved by EIFS manufacturer. Select fastener type and pattern based on applicable wind loads and substrate into which fastener will be attached, to provide the necessary pull-out, tensile, and shear strengths.

2.5 THERMAL INSULATION

2.5.1 Manufacturer's Recommendations

Provide only thermal insulation recommended by the EIFS manufacturer for the type of application intended.

2.5.2 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.

2.6 BASE COAT

Manufacturer's standard product and compatible with other systems components.

2.7 PORTLAND CEMENT

Conform to ASTM C150/C150M, Type I or II as required, fresh and free of lumps, and approved by the systems manufacturer.

2.8 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.

2.9 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.

2.10 SEALANT PRIMER

Non-staining, quick-drying type recommended by sealant manufacturer and EIFS manufacturer.

2.11 ACCESSORIES

Conform to recommendations of EIFS manufacturer, including trim, edging, anchors, and expansion joints. All metal items and fasteners to be corrosion resistant.

2.12 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.

2.13 BOND BREAKER

As required by EIFS manufacturer and recommended by sealant manufacturer and EIFS manufacturer.

2.14 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. 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 and to concrete or masonry with corrosion resistant metal fasteners. Place fasteners sufficiently close to support imposed loads, but not more than:

- a. Maximum of 8 inches apart on each supporting stud
- b. Maximum of 12 inches apart horizontally and vertically into masonry.

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 Mechanically Fastened Insulation Boards

Fasten with manufacturer's standard corrosion resistant anchors, spaced as recommended by manufacturer, but not more than 2 feet horizontally and vertically.

3.3.2.2 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 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.	_____

CHECK LIST

<u>Item</u>	<u>Description</u>	<u>Appr'd/Date</u>
	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.	
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.	

CHECK LIST

<u>Item</u>	<u>Description</u>	<u>Appr'd/Date</u>
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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.

-- End of Section --

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DIVISION 07 - THERMAL AND MOISTURE PROTECTION

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05/14

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-- End of Section Table of Contents --

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
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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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Design Review Report; G, DO

Two copies not later than 14 days after approval of the Air Barrier Inspector Qualifications.

Testing and Inspection; G, RO

SD-07 Certificates

Air Barrier Inspector; G, RO

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 1	
Surface Area	146,371 square feet
Architectural Only Test:	
Allowable leakage rate	0.25 CFM/sq.ft
Maximum leakage	36592.75 total CFM
Architectural Plus HVAC System Test:	
Allowable leakage rate	0.30 CFM/sq.ft
Maximum leakage	43911.3 total CFM

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 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).
 - 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

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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 D1876

(2008; R 2015; E 2015) Standard Test Method for Peel Resistance of Adhesives (T-Peel Test)

ASTM D412

(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension

ASTM D4263

(1983; R 2012) 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 D570

(1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics

ASTM D903

(1998; R 2010) 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 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

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 E84	(2017) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials

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
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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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 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 and Adhesives; G

Safety Data Sheets; G

SD-04 Samples

Self-adhering Air Barrier Mockup; 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 and Adhesives; G

SD-11 Closeout Submittals

Volatile Organic Compound (VOC) Content; S

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 Mockup

Provide a mockup of the self-adhering air barrier system specified. 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 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 REDUCED VOLATILE ORGANIC COMPOUND (VOC) CONTENT

Provide products with reduced VOC content and provide documentation in accordance with Section 01 33 29.00 37 SUSTAINABILITY.

2.2 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.

2.2.1 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.

2.3 PRIMERS AND ADHESIVES

Provide primers, adhesives, 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.

2.4 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. 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.
- c. Prime 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.

- 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, 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. Do not allow materials to come in contact with chemically incompatible materials.
- n. 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

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3.6 CLEANUP OF SPILLS

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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) 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 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

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 E84

(2018) Standard Test Method for Surface
Burning Characteristics of Building
Materials

ASTM E96/E96M

(2016) Standard Test Methods for Water
Vapor Transmission of Materials

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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 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-06 Test Reports

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 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 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.

1.7 AIR BARRIER TESTING

Perform air barrier testing in accordance with Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM 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 manufacturer of fluid-applied membrane air barrier is currently accredited by the Air Barrier Association of America (ABAA Accreditation <https://www.airbarrier.org/>).

1.8.2 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/>).

1.9 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 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.

1.10 ENVIRONMENTAL CONDITIONS

1.10.1 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.

1.10.2 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.

-- End of Section --

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

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

ASHRAE 90.1 - IP (2013) Energy Standard for Buildings
Except Low-Rise Residential Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS D1.2/D1.2M (2014) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A308/A308M (2010) Standard Specification for Steel
Sheet, Terne (Lead-Tin Alloy) Coated by
the Hot Dip Process

ASTM A480/A480M (2017) Standard Specification for General
Requirements for Flat-Rolled Stainless and
Heat-Resisting Steel Plate, Sheet, and
Strip

ASTM A653/A653M (2017) 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 B221 (2014) Standard Specification for Aluminum
and Aluminum-Alloy Extruded Bars, Rods,
Wire, Profiles, and Tubes

ASTM B32 (2008; R 2014) Standard Specification for
Solder Metal

ASTM B370 (2012) Standard Specification for Copper
Sheet and Strip for Building Construction

ASTM B69 (2013) Standard Specification for Rolled

Zinc

ASTM C1549	(2016) Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
ASTM E1918	(2016) Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
ASTM E1980	(2011) Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
ASTM E408	(2013) Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
ASTM E971	(2011) Standard Practice for Calculation of Photometric Transmittance and Reflectance of Materials to Solar Radiation

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

SMACNA 1793	(2012) Architectural Sheet Metal Manual, 7th Edition
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U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)
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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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Exposed Sheet Metal Coverings; G

Gutters; G

Downspouts; G

Expansion Joints; G

Base Flashing; G

Counterflashing; G

Flashing at Roof Penetrations and Equipment Supports; G

Drip Edges; G

Open Valley Flashing; G

Eave Flashing; G

Recycled Content; S

SD-04 Samples

Finish Samples; G

SD-08 Manufacturer's Instructions

Instructions for Installation; G

Quality Control Plan; G

SD-10 Operation and Maintenance Data

Cleaning and Maintenance; G

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. Provide data for each product with recycled content, identifying percentage of recycled content.

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; 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 Copper, Sheet and Strip

Provide in accordance with ASTM B370, cold-rolled temper, H 00 (standard).

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 Terne-Coated Steel

Provide in accordance with ASTM A308/A308M, a minimum of 14 by 20 inch with minimum of 40 pound coating per double base box. ASTM A308/A308M.

2.2.8 Aluminum Alloy Sheet and Plate

Provide in accordance with ASTM B209 anodized color form alloy, and temper appropriate for use.

2.2.9 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 full range of color choices as indicated on the Drawings. Field applications of color coatings are prohibited and will be rejected.

2.2.10 Cool Roof Finishes

Provide cool roof finish coatings and colors in accordance with one of the following methods of analysis:

2.2.10.1 Energy Star Certification

Provide roof finishes having an initial solar reflectance of 0.25 for steep slope roofs with a greater than 2:12 pitch when tested in accordance with ASTM E971 and an initial emissivity of in compliance with Energy Star's website when tested in accordance with ASTM E408, or as certified by Energy Star for the particular product proposed. Certified Energy Star roof products are listed at <https://www.energystar.gov/productfinder/product/certified-roof-products/results>

2.2.10.2 ASHRAE 189.1 Compliance

Provide roof finishes having a minimum initial Solar Reflectance Index of 29 for steep slope roofs with a greater than 2:12 pitch when tested in accordance with ASTM E971, to comply with ASHRAE 189.1.

2.2.10.3 ASHRAE 90.1 Compliance

Provide roof finishes having a minimum 3-year aged solar reflectance of 0.55 when tested in accordance with ASTM C1549 or ASTM E1918, and a minimum 3-year aged thermal emittance of 0.75 when tested in accordance with ASTM E971 or ASTM E408, or, a minimum 3-year aged Solar Reflectance Index of 64 when determined in accordance with the Solar Reflectance Index method in ASTM E1980 using a convection coefficient of 2.1 BTU per h ft², to comply with ASHRAE 90.1 - IP.

2.2.11 Aluminum Alloy, Extruded Bars, Rods, Shapes, and Tubes

ASTM B221.

2.2.12 Solder

Provide in accordance with ASTM B32, 95-5 tin-antimony.

2.2.13 Fasteners

Use the same metal as, or a metal compatible with the item fastened. Use stainless steel fasteners to fasten. Confirm compatibility of fasteners and items to be fastened to avoid galvanic corrosion due to dissimilar materials.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Metal Roofing

3.1.1.1 Standing-seam Method

Make standing seams parallel with slope of roof. Fabricate sheets into long lengths at shop by locking short dimensions together and thoroughly soldering joints thus formed. In applying metal, turn up one edge of course at each side seam at right angles 1.5 inch. Then install 2 by 3 inch cleats spaced 12 inches apart by fastening one end of each cleat to roof with two one inch long nails and folding roof end back over nail heads. Turn end adjoining turned-up side seam up over upstanding edge of course. Turn up adjoining edge of next course 1.75 inches and abutting upstanding edges locked, turned over, and flattened against one side of standing seam. Make standing seams straight, rounded neatly at the top edges, and stand about one inch above roof deck. All sheets must be same length, except as required to complete run or maintain pattern. Locate transverse joints of each panel half way between joints in adjacent sheets. Align joints of alternate sheets horizontally to produce uniform pattern, as shown in SMACNA 1793.

3.1.2 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.

3.1.3 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.

3.1.4 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. Pre-tin cleats for soldered seams.

3.1.5 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.

3.1.6 Seams

Straight and uniform in width and height with no solder showing on the face.

3.1.6.1 Flat-lock Seams

Finish not less than 3/4 inch wide.

3.1.6.2 Lap Seams

Finish soldered seams not less than one inch wide. Overlap seams not soldered, not less than 3 inches.

3.1.6.3 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.

3.1.6.4 Standing Seams

Not less than one inch high, double locked without solder.

3.1.6.5 Flat Seams

Make seams in the direction of the flow.

3.1.7 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.

3.1.7.1 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.

3.1.8 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.

3.1.8.1 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.

3.1.8.2 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.

3.1.9 Protection from Contact with Dissimilar Materials

3.1.9.1 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.

3.1.9.2 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.

3.1.9.3 Metal Surfaces

Paint surfaces in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

3.1.9.4 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.

3.1.10 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.

3.1.11 Base Flashing

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 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 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.

3.1.12 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 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.

3.1.13 Edge Strip

Hook the lower edge of fasciae at least 3/4 inch over a continuous strip of the same material bent outward at an angle not more than 45 degrees to form a drip. Nail hook strip to a wood nailer at 6 inches maximum on center. Where fastening is made to concrete or masonry, use screws spaced 12 inches on center driven in expansion shields set in the concrete or masonry. Where horizontal wood nailers are slotted to provide for insulation venting, install strips to prevent obstruction of vent slots. Where necessary, install strips over 1/16 inch thick compatible spacer or washers.

3.1.14 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. 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.

3.1.15 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 as indicated. Adjust gutters to slope uniformly to outlets, with high points occurring midway between outlets. Fabricate hangers and fastenings from compatible metals.

3.1.16 Downspouts

Space supports for downspouts according to the manufacturer's recommendation for the masonry or steel 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.

3.1.16.1 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.

3.1.17 Open Valley Flashing

Provide valley flashing free of longitudinal seams, of width sufficient to extend not less than 6 inches under the roof covering on each side. Provide a 1/2 inch fold on each side of the valley flashing. Lap the sheets not less than 6 inches in the direction of flow and secure to roofing construction with cleats attached to the fold on each side. Nail the tops of sheets to roof sheathing. Space the cleats not more than 12 inches on center. Provide exposed flashing not less than 4 inches in width at the top and increase one inch in width for each additional 8 feet in length. Where the slope of the valley is 4.5 inches or less per foot, or the intersecting roofs are on different slopes, provide an inverted V-joint, one inch high, along the centerline of the valley; and extend the edge of the valley sheets 8 inches under the roof covering on each side.

3.1.18 Eave Flashing

One piece in width, applied in 8 to 10 foot lengths with expansion joints spaced as specified in paragraph EXPANSION AND CONTRACTION. Provide a 3/4 inch continuous fold in the upper edge of the sheet to engage cleats spaced not more than 10 inches on center. Locate the upper edge of flashing not less than 18 inches from the outside face of the building, measured along the roof slope. Fold lower edge of the flashing over and loose-lock into a continuous edge strip on the fascia. Where eave flashing intersects metal valley flashing, secure with one inch flat locked joints with cleats that are 10 inches on center.

3.1.19 Expansion Joints

Provide expansion joints for roofs, walls, and floors as indicated. Provide expansion joints in continuous sheet metal at 40 foot intervals for copper and stainless steel. 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.

3.1.20 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.

3.1.21 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.

3.2 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.

3.3 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	Copper kilograms per square foot	Aluminum, inch	Stainless Steel, inch	Terne-Coated Stainless Steel, inch	Zinc-Coated Steel, U.S. Std. Gage
Building Expansion Joints					
Cover	16	.032	.015	.015	24
Waterstop-bellows or flanged, U-type.	16	-	.015	.015	-
Covering on minor flat, pitched or curved surfaces	20	.040	.018	.018	-
Downspouts and leaders	16	.032	.015	.015	24
Downspout clips and anchors	-	.040 clip .125 anchor	-	-	-

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES					
Sheet Metal Items	Copper kilograms per square foot	Aluminum, inch	Stainless Steel, inch	Terne-Coated Stainless Steel, inch	Zinc-Coated Steel, U.S. Std. Gage
Downspout straps, 2-inch	48 (a)	.060	.050	-	-
Flashings:					
Base	20	.040	.018	.018	24
Cap (Counter-flashing)	16	.032	.015	.015	26
Eave	16	-	.015	.015	24
Valley	16	.032	.015	.015	-
Roof drain	16 (b)				
Pipe vent sleeve (d)					
Gutters:					
Gutter section	16	.032	.015	.015	24
Continuous cleat	16	.032	.015	.015	24
Hangers, dimensions	1 inch by 1/8 inch (a)	1 inch by . inch (c)	1 inch by .0 inch	-	-
Joint Cover plates (See Table II)	16	.032	.015	.015	24
(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.
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.
Valley	6 inch lap cleated	6 inch lap cleated	--
Edge strip	Butt	Butt	--
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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STEEL STANDING SEAM ROOFING
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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 SG03-3 (2002; Suppl 2001-2004; R 2008)
Cold-Formed Steel Design Manual Set

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M (2016) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM A1011/A1011M (2017a) 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 A36/A36M (2014) Standard Specification for Carbon Structural Steel

ASTM A653/A653M (2017) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A792/A792M (2010) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM B117 (2016) Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM D1654 (2008; R 2016; E 2017) Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

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 D4214	(2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D522/D522M	(2014) Mandrel Bend Test of Attached Organic Coatings
ASTM D523	(2014; R 2018) Standard Test Method for Specular Gloss
ASTM D714	(2002; R 2017) Standard Test Method for Evaluating Degree of Blistering of Paints
ASTM D968	(2017) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E1592	(2005; R 2012) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E84	(2018) Standard Test Method for Surface Burning Characteristics of Building Materials
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

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

SMACNA 1793	(2012) Architectural Sheet Metal Manual, 7th Edition
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1.2 DEFINITIONS

1.2.1 Field-Formed Seam

Seams of panels so configured that when adjacent sheets are installed the seam is sealed utilizing mechanical or hand seamers. Crimped (45 degree bend), roll formed (180 degree bend), double roll formed (2 - 180 degree bends), and roll and lock systems are types of field-formed seam systems.

1.2.2 Snap Together Seam

Panels so configured that the male and female portions of the seam interlock through the application of foot pressure or tamping with a mallet. Snap-on cap configurations are a type of snap together system.

1.2.3 Pre-Formed

Formed to the final, less field-formed seam, profile and configuration in the factory.

1.2.4 Field-Formed

Formed to the final, less field-formed seam, profile and configuration at the site of work prior to installation.

1.2.5 Roofing System

The roofing system is defined as the assembly of roofing components, including roofing panels, flashing, fasteners, and accessories which, when assembled properly result in a watertight installation.

1.2.6 SSMRS

Standing Seam Metal Roof System (SSMRS) is abbreviation of the entire roof system specified herein with all components and parts coming from a single manufacturer's system.

1.3 SYSTEM DESCRIPTION

1.3.1 Design Requirements

- a. Panels must be continuous lengths up to manufacturer's standard longest lengths, with no joints or seams, except where indicated or specified. Ribs of adjoining sheets must be in continuous contact from eave to ridge. Individual panels of snap together type systems must be removable for replacement of damaged material.
- b. There must be no exposed or penetrating fasteners except where shown on approved shop drawings. Fasteners into steel must be stainless steel, zinc cast head, or cadmium plated steel screws inserted into predrilled holes. There must be a minimum of two fasteners per clip. Single fasteners will be allowed when supporting structural members are prepunched or predrilled.
- c. Snap together type systems must have a capillary break and a positive side lap locking device. Field-formed seam type systems must be mechanically locked closed by the manufacturer's locking tool. The seam must include a continuous factory applied sealant when required by the manufacturer to withstand the wind loads specified.
- d. Roof panel anchor clips must be concealed and designed to allow for longitudinal thermal movement of the panels, except where specific fixed points are indicated. Provide for lateral thermal movement in panel configuration or with clips designed for lateral and longitudinal movement.

1.3.2 Design Conditions

Design the system to resist positive and negative loads specified herein in accordance with the AISI SG03-3. Panels must support walking loads without permanent distortion or telegraphing of the structural supports.

1.3.2.1 Wind Uplift

Compute and apply the design uplift pressures for the roof system using a basic wind speed of 119 miles per hour (mph). Roof system and attachments must resist the wind loads shown on contract drawings.

The design uplift force for each connection assembly must be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly, and multiplied by the appropriate factor of safety, as follows:

- a. Single fastener in a connection: 3.0
- b. Two or more fasteners in each connection: 2.25

1.3.2.2 Roof Live Loads

Loads must be applied on the horizontal projection of the roof structure. The minimum roof design live load must be 20 psf.

1.3.2.3 Thermal Movement

System must be capable of withstanding thermal movement based on a temperature range of 10 degrees F below 115 degrees F and 180 degrees F.

1.3.2.4 Deflection

Panels must be capable of supporting design loads between unsupported spans with deflection of not greater than $L/180$ of the span.

1.3.3 Structural Performance

The structural performance test methods and requirements of the Standing Seam Roofing Systems (SSRS) must be in accordance with ASTM E1592.

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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Roofing; G

SD-03 Product Data

Roofing Panels; G

Recycled Content for Steel Roofing Product; S

Attachment Clips

Closures

Accessories

Fasteners

Sealants

Sample Warranty Certificate; G

Submit for materials to be provided. Submit data sufficient to indicate conformance to specified requirements.

SD-04 Samples

Roofing Panel

Submit a 12 inch long by full width section of typical panel.

Accessories

Submit each type of accessory item used in the project including, but not limited to each type of anchor clip, closure, fastener, and leg clamp.

Sealants

Intermediate Support Section

Submit full size samples of each intermediate support section, 12 inches long.

SD-05 Design Data

Design Calculations

SD-06 Test Reports

Field Inspection; G

Submit manufacturer's technical representative's field inspection reports as specified in paragraph MANUFACTURER'S FIELD INSPECTION.

Structural Performance Tests

Finish Tests

SD-07 Certificates

Manufacturer's Technical Representative's Qualifications

Statement of Installer's Qualifications

Submit documentation from roofing manufacturer proving the manufacturer's technical representative meets below specified requirements. Include name, address, telephone number, and experience record.

Submit documentation proving the installer is factory-trained, has the specified experience, and authorized by the manufacturer

to install the products specified.

Coil Stock Compatibility; G

Provide certification of coil compatibility with roll forming machinery to be used for forming panels without warping, waviness, and rippling not part of panel profile; to be done without damage, abrasion or marking of finish coating.

SD-08 Manufacturer's Instructions

Installation Manual; G

Submit manufacturers printed installation manual, instructions, and standard details.

SD-11 Closeout Submittals

Information Card

For each roofing installation, submit a typewritten card or photoengraved aluminum card containing the information listed on Form 1 located at the end of this section.

Warranty

1.5 DESIGN CALCULATIONS

Provide design calculations prepared by a professional engineer specializing in structural engineering verifying that system supplied and any additional framing meets design load criteria indicated. Coordinate calculations with manufacturer's test results. Include calculations for:

Wind load uplift design pressure at roof locations specified in paragraph WIND UPLIFT.

Clip spacing and allowable load per clip.

Fastening of clips to structure or intermediate supports.

Intermediate support spacing and framing and fastening to structure when required.

Allowable panel span at anchorage spacing indicated.

Safety factor used in design loading.

Governing code requirements or criteria.

Edge and termination details.

1.6 QUALITY ASSURANCE

1.6.1 Preroofing Conference

After submittals are received and approved but before roofing work, including associated work, is preformed, the Contracting Officer will hold a preroofing conference to review the following:

- a. The drawings and specifications
- b. Procedure for on site inspection and acceptance of the roofing substrate and pertinent structural details relating to the roofing system
- c. 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
- d. Safety requirements

The prerooting conference must be attended by the Contractor and personnel directly responsible for the roofing installation, mechanical and electrical work, and the roofing manufacturer's technical representative. Conflicts among those attending the prerooting conference must be resolved and confirmed in writing before roofing work, including associated work, is begun. Prepare written minutes of the prerooting conference and submit to the Contracting Officer.

1.6.2 Manufacturer

The SSMRS must be the product of a metal roofing industry - recognized manufacturer who has been in the practice of manufacturing SSMRS for a period of not less than 5 years and who has been involved in at least 5 projects similar in size and complexity to this project.

1.6.3 Manufacturer's Technical Representative

The representative must have authorization from manufacturer to approve field changes and be thoroughly familiar with the products and with installations in the geographical area where construction will take place. The manufacturer's representative must be an employee of the manufacturer with at least 5 years experience in installing the roof system. The representative must be available to perform field inspections and attend meetings as required herein, and as requested by the Contracting Officer.

1.6.4 Installer's Qualifications

The roofing system installer must be factory-trained, approved by the steel roofing system manufacturer to install the system, and must have a minimum of three years experience as an approved applicator with that manufacturer. The applicator must have applied five installations of similar size and scope as this project within the previous 3 years.

1.6.5 Single Source

Roofing panels, clips, closures, and other accessories must be standard products of the same manufacturer; must be the latest design by the manufacturer; and must have been designed by the manufacturer to operate as a complete system for the intended use.

1.6.6 Laboratory Tests For Panel Finish

The term "appearance of base metal" refers to the metal coating on steel. Panels must meet the following test requirements:

- a. Formability Test: When subjected to a 180 degree bend over a 1/8 inch

diameter mandrel in accordance with ASTM D522/D522M, exterior coating film may show only slight microchecking and no loss of adhesion.

- b. Accelerated Weathering Test: Withstand a weathering test for a minimum of 2000 hours in accordance with ASTM G152 and ASTM G153, Method 1 without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with a penknife blade or similar instrument will be considered to indicate loss of adhesion.
- c. Chalking Resistance: After the 2000-hour weatherometer test, exterior coating may not chalk greater than No. 8 rating when measured in accordance with ASTM D4214 test procedures.

- d. Color Change Test:

After the 3000-hour weatherometer test, exterior coating color change must not exceed 5 NBS units when measured in accordance with ASTM D2244 test procedure.

- e. Salt Spray Test: Withstand a salt spray test for a minimum of 1000 hours in accordance with ASTM B117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating must receive a rating of 10, no blisters in field as determined by ASTM D714; and an average rating of 7, 1/16 inch failure at scribe, as determined by ASTM D1654. Rating Schedule No. 1.
- f. Abrasion Resistance Test for Color Coating: When subjected to the falling sand test in accordance with ASTM D968, coating system must withstand a minimum of 100 liters of sand per mil thickness before appearance of base metal.
- g. Humidity Test: When subjected to a humidity cabinet test in accordance with ASTM D2247 for 1000 hours, a scored panel must show no signs of blistering, cracking, creepage, or corrosion.
- h. Gloss Test: The gloss of the finish must be 30 plus or minus 5 at an angle of 60 degrees, when measured in accordance with ASTM D523.

1.6.7 Shop Drawing Requirements

Submit roofing drawings to supplement the instructions and diagrams. Include design and erection drawings containing an isometric view of the roof showing the design uplift pressures and dimensions of edge, ridge and corner zones; and show typical and special conditions including flashings, materials and thickness, dimensions, fixing lines, anchoring methods, sealant locations, sealant tape locations, fastener layout, sizes, and spacing, terminations, penetrations, attachments, and provisions for thermal movement. Details of installation must be in accordance with the manufacturer's Standard Instructions and details or the SMACNA 1793. Prior to submitting shop drawings, have drawings reviewed and approved by the manufacturer's technical engineering department.

1.7 WARRANTY

Furnish manufacturer's no-dollar-limit materials and workmanship warranty for the roofing system. The warranty period must be not less than 20 years from the date of Government acceptance of the work. The warranty

must be issued directly to the Government. The warranty must provide that if within the warranty period the metal roofing system becomes non-watertight or shows evidence of corrosion, perforation, rupture or excess weathering due to deterioration of the roofing system resulting from defective materials or installed workmanship the repair or replacement of the defective materials and correction of the defective workmanship must be the responsibility of the roofing system manufacturer. Repairs that become necessary because of defective materials and workmanship while roofing is under warranty must be performed within 7 days after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within the specified period of time will constitute grounds for having the repairs performed by others and the cost billed to the manufacturer. In addition, provide a 2 year contractor installation warranty.

1.8 DELIVERY, STORAGE AND HANDLING

Deliver, store, and handle preformed panels, bulk roofing products and other manufactured items in a manner to prevent damage or deformation.

1.8.1 Delivery

Provide adequate packaging to protect materials during shipment. Crated materials must not be uncrated until ready for use, except for inspection. Immediately upon arrival of materials at the jobsite, inspect materials for damage, dampness, and staining. Replace damaged or permanently stained materials that cannot be restored to like-new condition with satisfactory material. If materials are wet, remove the moisture and re-stack and protect the panels until used.

1.8.2 Storage

Stack materials on platforms or pallets and cover with tarpaulins or other suitable weathertight covering which prevents water trapping or condensation. Store materials so that water which might have accumulated during transit or storage will drain off. Do not store the panels in contact with materials that might cause staining, such as mud, lime, cement, fresh concrete or chemicals. Protect stored panels from wind damage.

1.8.3 Handling

Handle material carefully to avoid damage to surfaces, edges and ends.

PART 2 PRODUCTS

2.1 ROOFING PANELS

Provide panels with interlocking ribs for securing adjacent sheets and with concealed clip fastening system for securing the roof covering to structural framing members. Fasteners must not penetrate the panels except at the ridge, eave, rakes, penetrations, and end laps. Backing plates and ends of panels at end laps must be predrilled or prepunched. Factory prepare ends of panels to be lapped by trimming part of seam, die-setting, or swaging ends of panels. Individual sheets must be sufficiently long to cover the entire length of any unbroken roof slope when such slope is 30 feet or less. Provide panels that extend over two or more spans when length of run exceeds 30 feet. Obtain Contracting Officer (KO) approval for sheets longer than 30 feet before submitting

shop drawings. Sheets must provide not less than 18 inches of coverage (width) in place. Provide panels with three striations. Provide panels with a minimum corrugation height of 3.0 inches (nominal). Make provisions for expansion and contraction at either ridge or eave, consistent with the type of system to be used. Form panels from coil stock without warping, waviness or ripples not part of the panel profile, and free of damage to the finish coating system.

2.1.1 Material

Zinc-coated steel conforming to ASTM A653/A653M, G90 coating designation or aluminum-zinc alloy coated steel conforming to ASTM A792/A792M, AZ 55 coating. Provide material with a minimum thickness of 0.023 inch thick (24 gage) minimum except when mid field of roof is subject to design wind uplift pressures of 60 psf or greater, entire roof system must have a minimum thickness of 0.030 inch (22 gage). Provide data identifying percentage of recycled content for steel roofing product. Prior to shipment, treat mill finish panels with a passivating chemical and oil to inhibit the formation of oxide corrosion products. Dry, retreat, and re-oil panels that have become wet during shipment or storage but have not started to oxidize.

2.1.2 Texture

Smooth.

2.1.3 Finish

Factory color finish.

2.1.3.1 Factory Color Finish

Provide factory applied, thermally cured coating to exterior and interior of metal roof and wall panels and metal accessories. Provide exterior finish top coat of 70 percent resin polyvinylidene fluoride with not less than 0.8 mil dry film thickness. Interior finish must consist of the same coating and dry film thickness as the exterior coating. Provide exterior and interior coating meeting test requirements specified below. Tests must have been performed on the same factory finish and thickness provided.

2.2 INTERMEDIATE SUPPORTS

Fabricate panel subgirts, subpurlins, T-bars, Z-bars and tracks from galvanized steel conforming to ASTM A653/A653M, G90, Grade D (16 gage and heavier), Grade A (18 gage and lighter); or steel conforming to ASTM A36/A36M, ASTM A1011/A1011M, or ASTM A1008/A1008M prime painted with zinc-rich primer. Size, shape, thickness and capacity as required to meet the load, insulation thickness and deflection criteria specified.

2.3 ATTACHMENT CLIPS

Fabricate clips from ASTM A1011/A1011M, or ASTM A1008/A1008M steel hot-dip galvanized in accordance with ASTM A653/A653M, G 90, or Series 300 stainless steel. Size, shape, thickness and capacity as required to meet the load, insulation thickness and deflection criteria specified.

2.4 ACCESSORIES

Sheet metal flashings, trim, moldings, closure strips, pre-formed

crickets, caps, equipment curbs, and other similar sheet metal accessories used in conjunction with preformed metal panels must be of the same material as used for the panels. Provide metal accessories with a factory color finish to match the roofing panels, except that such items which will be concealed after installation may be provided without the finish if they are stainless steel. Metal must be of a thickness not less than that used for the panels. Thermal spacer blocks and other thermal barriers at concealed clip fasteners must be as recommended by the manufacturer except that wood spacer blocks are not allowed.

2.4.1 Closures

2.4.1.1 Rib Closures

Corrosion resisting steel, closed-cell or solid-cell synthetic rubber, neoprene or polyvinyl chloride pre-molded to match configuration of rib opening. Material for closures must not absorb water.

2.4.1.2 Ridge Closures

Metal-clad foam or metal closure with foam secondary closure matching panel configuration for installation on surface of roof panel between panel ribs at ridge and headwall roof panel flashing conditions and terminations. Foam material must not absorb water.

2.4.2 Fasteners

Zinc-coated steel, corrosion resisting steel, zinc cast head, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Design the fastening system to withstand the design loads specified. Exposed fasteners must be gasketed or have gasketed washers on the exterior side of the covering to waterproof the penetration. Washer material must be compatible with the covering; have a minimum diameter of 3/8 inch for structural connections; and gasketed portion of fasteners or washers must be neoprene or other equally durable elastomeric material approximately 1/8 inch thick.

2.4.2.1 Screws

Not smaller than No. 14 diameter if self-tapping type and not smaller than No. 12 diameter if self-drilling and self-tapping.

2.4.2.2 Rivets

Blind rivets must be stainless steel with 1/8 inch nominal diameter shank. Rivets must be threaded stem type if used for other than the fastening of trim. Rivets with hollow stems must have closed ends.

2.4.3 Sealants

Elastomeric type containing no oil or asphalt. Exposed sealant must cure to a rubberlike consistency. Concealed sealant must be the non-hardening type. Seam sealant must be factory-applied, non-skinning, non-drying, and must conform to the roofing manufacturer's recommendations. Silicone-based sealants must not be used in contact with finished metal panels and components unless approved otherwise by the Contracting Officer.

2.4.4 GASKETS AND INSULATING COMPOUNDS

Nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds must be nonrunning after drying.

2.5 THERMAL INSULATION

Flexible blanket, rigid, or semi-rigid faced with a flexible vapor retarder. Insulation and facing must have a flame-spread rating of 50 or less in accordance with ASTM E84. Vapor retarder facing must have a permeance rating of 0.05 perm or less. Provide a thermal resistance "R" value of 5 or more per inch of insulation.

PART 3 EXECUTION

Do not install building construction materials that show visible evidence of biological growth.

3.1 EXAMINATION

Examine surfaces to receive standing seam metal roofing and flashing. Ensure that surfaces are plumb and true, clean, even, smooth, as dry and free from defects and projections which might affect the installation.

3.2 PROTECTION FROM CONTACT WITH DISSIMILAR MATERIALS

3.2.1 Cementitious Materials

Paint metal surfaces which will be in contact with mortar, concrete, or other masonry materials with one coat of alkali-resistant coating such as heavy-bodied bituminous paint.

3.2.2 Contact with Wood

Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.3 INSTALLATION

Install in accordance with the approved manufacturer's erection instructions, shop drawings, and diagrams. Panels must be in full and firm contact with attachment clips. Where prefinished panels are cut in the field, or where any of the factory applied coverings or coatings are abraded or damaged in handling or installation, they must, after necessary repairs have been made with material of the same color as the weather coating, be approved before being installed. Seal completely openings through panels. Correct defects or errors in the materials. Replace materials which cannot be corrected in an approved manner with nondefective materials. Provide molded closure strips where indicated and where necessary to provide weathertight construction. Use shims as required to ensure attachment clip line is true. Use a spacing gage at each row of panels to ensure that panel width is not stretched or shortened.

3.3.1 Roof Panels

Apply roofing panels with the standing seams parallel to the slope of the roof. Provide roofing panels in longest practical lengths from ridge to

eaves (top to eaves on shed roofs), with no transverse joints except at the junction of ventilators, curbs, skylights, chimneys, and similar openings. Install flashing to assure positive water drainage away from roof penetrations. Locate panel end laps such that fasteners do not engage supports or otherwise restrain the longitudinal thermal movement of panels. Form field-formed seam type system seams in the field with an automatic mechanical seamer approved by the manufacturer. Attach panels to the structure with concealed clips incorporated into panel seams. Clip attachment must allow roof to move independently of the structure, except at fixed points as indicated.

3.3.2 Insulation Installation

Install between covering and supporting members to present a neat appearance. Fold and staple and tape seams unless approved otherwise by the Contracting Officer.

3.3.2.1 Rigid or Semi-Rigid Insulation

Install in areas where insulation is exposed to view. Fasten securely without loose joints or unsightly sags.

3.3.3 Flashings

Provide flashing, related closures and accessories as indicated and as necessary to provide a weathertight installation. Install flashing to ensure positive water drainage away from roof penetrations. Flash and seal the roof at the ridge, eaves and rakes, and projections through the roof. Place closure strips, flashing, and sealing material in an approved manner that will assure complete weathertightness. Details of installation which are not indicated must be in accordance with the SMACNA 1793, panel manufacturer's approved printed instructions and details, or the approved shop drawings. Allow for expansion and contraction of flashing.

3.3.4 Flashing Fasteners

Fastener spacings must be in accordance with the panel manufacturer's recommendations and as necessary to withstand the design loads indicated. Install fasteners in roof valleys as recommended by the manufacturer of the panels. Install fasteners in straight lines within a tolerance of 1/2 inch in the length of a bay. Drive exposed penetrating type fasteners normal to the surface and to a uniform depth to seat gasketed washers properly and drive so as not to damage factory applied coating. Exercise extreme care in drilling pilot holes for fastenings to keep drills perpendicular and centered. Do not drill through sealant tape. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Torque used in applying fasteners must not exceed that recommended by the manufacturer. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels.

3.3.5 Rib and Ridge Closure/Closure Strips

Set closure/closure strips in joint sealant material and apply sealant to mating surfaces prior to adding panel.

3.4 PROTECTION OF APPLIED ROOFING

Do not permit storing, walking, wheeling, and trucking directly on applied

roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to indicated live load limits of roof construction.

3.5 CLEANING

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.

3.6 MANUFACTURER'S FIELD INSPECTION

Manufacturer's technical representative must visit the site as necessary during the installation process to assure panels, flashings, and other components are being installed in a satisfactory manner. Manufacturer's technical representative must perform a field inspection during the first 20 squares of roof panel installation and at substantial completion prior to issuance of warranty, as a minimum, and as otherwise requested by the Contracting Officer. Additional inspections must not exceed one for 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. Each inspection visit must include a review of the entire installation to date. After each inspection, submit a report, signed by the manufacturer's technical representative, to the Contracting Officer noting the overall quality of work, deficiencies and any other concerns, and recommended corrective actions in detail. Notify Contracting Officer a minimum of 2 working days prior to site visit by manufacturer's technical representative.

3.7 COMPLETED WORK

Completed work must be plumb and true without oil canning, dents, ripples, abrasion, rust, staining, or other damage detrimental to the performance or aesthetics of the completed roof assembly.

3.8 INFORMATION CARD

For each roof, provide a typewritten card, laminated in plastic and framed for interior display or a photoengraved 0.032 inch thick aluminum card for exterior display. Card to be 8 1/2 by 11 inches minimum and contain the information listed on Form 1 at end of this section. Install card near point of access to roof, or where indicated.

3.9 FORM ONE

FORM 1 - PREFORMED STEEL STANDING SEAM ROOFING SYSTEM COMPONENTS

1. Contract Number:
2. Building Number & Location:
3. NAVFAC Specification Number:
4. Deck/Substrate Type:
5. Slopes of Deck/Roof Structure:
6. Insulation Type & Thickness:
7. Insulation Manufacturer:
8. Vapor Retarder: () Yes () No
9. Vapor Retarder Type:
10. Preformed Steel Standing Seam Roofing Description:
 - a. Manufacturer (Name, Address, & Phone No.):
 - b. Product Name:
 - c. Width:
 - d. Gage:
 - e. Base Metal:
 - f. Method of Attachment:
11. Repair of Color Coating:
 - a. Coating Manufacturer (Name, Address & Phone No.):
 - b. Product Name:
 - c. Surface Preparation:
 - d. Recoating Formula:
 - e. Application Method:
12. Statement of Compliance or Exception: _____

13. Date Roof Completed:
14. Warranty Period: From _____ To _____
15. Roofing Contractor (Name & Address):
16. Prime Contractor (Name & Address):

Contractor's Signature _____ Date:

Inspector's Signature _____ Date:

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-- End of Section Table of Contents --

SECTION 07 84 00

FIRESTOPPING
05/10

PART 1 GENERAL

1.1 SUMMARY

Furnish and install tested and listed firestopping systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.

- a. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.
- b. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above and at the intersection of shaft assemblies and adjoining fire resistance rated assemblies.

1.2 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM E119	(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	(2018) Standard Test Method for Surface

Burning Characteristics of Building
Materials

FM GLOBAL (FM)

FM 4991 (2013) Approval of Firestop Contractors

FM APP GUIDE (updated on-line) Approval Guide
<http://www.approvalguide.com/>

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2018) 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. 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 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping System; G

SD-03 Product Data

Firestopping Materials; G

SD-06 Test Reports

Inspection; G

SD-07 Certificates

Inspector Qualifications
Firestopping Materials
Installer Qualifications; G

1.5 QUALITY ASSURANCE

1.5.1 Installer

Engage an experienced Installer who is:

- a. FM Research approved in accordance with FM 4991, operating as a UL Certified Firestop Contractor, or
- b. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products in accordance with specified requirements. 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.

1.5.2 Inspector Qualifications

The inspector shall have a minimum of two years experience in construction field inspections of firestopping systems, products, and assemblies. The inspector shall be completely independent of, and divested from, the installer, the manufacturer, and the supplier of any material or item being inspected. The inspector shall not be a competitor of the installer, the contractor, the manufacturer, or supplier of any material or item being inspected. Include in the qualifications submittal a notarized statement assuring compliance with the requirements stated herein.

1.6 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

VOC content of firestop materials installed on project is limited to < 250 g/l as calculated by EPA method 24.

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

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.

2.2.3.2 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 Fire Dampers

Install and firestop fire dampers in accordance with Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM. Firestop installed with fire damper must be tested and approved for use in fire damper system. Firestop installed with fire damper must be tested and approved for use in fire damper system.

3.2.3 Data and Communication Cabling

Cabling for data and communication applications shall be sealed with re-enterable firestopping products.

3.2.3.1 Re-Enterable Devices

Firestopping devices shall be pre-manufactured modular devices, containing built-in self-sealing intumescent inserts. Firestopping devices shall allow for cable moves, additions or changes without the need to remove or replace any firestop materials. Devices must be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants; while maintaining "L" rating of <10 cfm/sf at 0 percent to 100 percent visual fill.

3.2.3.2 Re-Sealable Products

Provide firestopping pre-manufactured modular products, containing self-sealing intumescent inserts. Firestopping products shall allow for cable moves, additions or changes. Devices shall be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants.

3.3 INSPECTION

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.

-- End of Section --

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SECTION 07 92 00

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SECTION 07 92 00

JOINT SEALANTS

08/16

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM C1193	(2013) Standard Guide for Use of Joint Sealants
ASTM 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 D1667	(2017) Standard Specification for Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D217	(2017) Standard Test Methods for Cone Penetration of Lubricating Grease
ASTM E84	(2018) Standard Test Method for Surface Burning Characteristics of Building Materials

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor
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Sources using Environmental Chambers

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168 (2017) Adhesive and Sealant Applications

UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program
For Chemical Emissions For Building
Materials, Finishes And Furnishings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for 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 with Section 01 33 29.00 37 SUSTAINABILITY. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants; G

Primers; G

Bond Breakers; G

Backstops; G

SD-06 Test Reports

Field Adhesion; G

SD-07 Certificates

Indoor Air Quality For Interior Sealants; S

Indoor Air Quality For Interior Floor Joint Sealants; S

Indoor Air Quality For Interior Acoustical Sealants; S

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 CERTIFICATIONS

1.4.1 Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.

1.4.1.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard), SCS Global Services Indoor Advantage or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body.. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.5 ENVIRONMENTAL CONDITIONS

Apply sealant when the ambient temperature is between 40 and 90 degrees F.

1.6 DELIVERY AND STORAGE

Deliver materials to the jobsite in unopened manufacturers' sealed shipping containers, with brand name, date of manufacture, color, and material designation clearly marked thereon. Label elastomeric sealant containers to identify type, class, grade, and use. Handle and store materials in accordance with manufacturer's printed instructions. Prevent exposure to foreign materials or subjection to sustained temperatures exceeding 90 degrees F or lower than 0 degrees F. Keep materials and containers closed and separated from absorptive materials such as wood and insulation.

1.7 QUALITY ASSURANCE

1.7.1 Compatibility with Substrate

Verify that each sealant is compatible for use with each joint substrate in accordance with sealant manufacturer's printed recommendations for each application.

1.7.2 Joint Tolerance

Provide joint tolerances in accordance with manufacturer's printed instructions.

1.7.3 Adhesion

Provide in accordance with ASTM C1193 or ASTM C1521.

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant products that have been tested, found suitable, and documented as such by the manufacturer for the particular substrates to which they will be applied.

2.1.1 Interior Sealants

Provide ASTM C920, Type S or M, Grade NS, Class 12.5, Use NT. Provide sealant products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of

SCAQMD Rule 1168. Provide certification or validation 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 Surface Color
b. Perimeter of frames at doors, windows, and access panels which adjoin exposed interior concrete and masonry surfaces.	Match Adjacent Surface Color
c. Joints of interior masonry walls and partitions which adjoin columns, pilasters, concrete walls, and exterior walls unless otherwise detailed.	Match Adjacent Surface Color
d. Joints between edge members for acoustical tile and adjoining vertical surfaces.	Match Adjacent Surface Color
e. Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.	Match Adjacent Surface Color
f. Joints between shower receptors and ceramic tile; joints formed where non-planar tile surfaces meet.	Match Adjacent Surface Color
g. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.	Match Adjacent Surface Color
h. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.	Match Adjacent Surface 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

LOCATION	COLOR
b. Masonry joints where shelf angles occur.	Match Adjacent Surface Color
c. Joints in wash surfaces of stonework.	Match Adjacent Surface Color
d. Expansion and control joints.	Match Adjacent Surface Color
e. Interior face of expansion joints in exterior concrete or masonry walls where metal expansion joint covers are not required.	Match Adjacent Surface Color
f. Voids where items pass through exterior walls.	Match Adjacent Surface Color
g. Metal-to-metal joints where sealant is indicated or specified.	Match Adjacent Surface Color

2.1.3 Floor Joint Sealants

ASTM C920, Type S or M, Grade P, Class 25, Use T. Provide sealant products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide certification or validation 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.	Match Adjacent Surface 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 sealant products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements

of SCAQMD Rule 1168. Provide certification or validation 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 as necessary for specific application.

2.1.5.2 Bead

Bead sealant: Provide cross section dimensions as necessary for specific application.

2.1.5.3 Foam Strip

Provide foam strip of polyurethane foam with cross section dimensions of as necessary for specific application. 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 1, open cell, Class A, Grade,

round cross section for cellular rubber sponge backing.

2.4.2 PVC

Provide in accordance with ASTM D1667, Grade VO 12, open-cell foam, round cross section for polyvinyl chloride (PVC) backing.

2.4.3 Synthetic Rubber

Provide in accordance with ASTM C509, Option II, Type II preformed rods or tubes for synthetic rubber backing.

2.4.4 Neoprene

Provide in accordance with ASTM D1056, closed cell expanded neoprene cord Type 2, Class C, Grade 2C2 for neoprene backing.

2.4.5 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.

2.4.6 Silicone Rubber Base

Provide in accordance with ASTM C920, from a single component, with solvent release, Non-sag. 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.

3.3 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 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 --