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SECTION 01 11 00

SUMMARY OF WORK
08/15, CHG 2: 08/21

PART 1 GENERAL

As set forth in UFC 1-300-02, 2-3.1, in project specifications directed to the Construction Contractor, replace the word **"shall"** with the word **"must"**.

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. DEPARTMENT OF DEFENSE (DOD)

UFC 1-300-02	(2014; with Change 3, 2021) Unified Facilities Guide Specifications (UFGS) Format Standard

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Salvage Plan; G

1.3 WORK COVERED BY CONTRACT DOCUMENTS

1.3.1 Project Description

The work includes the replacement of 18 arch type magazines built between 1968 and 1974, that are not configured for storage of modern containerized ordnance and will construct six (6) containerized long weapons storage (CLWS), two (2) Type G magazines, one (1) Type H magazine; will replace Building 524 (Ordnance Operations Building), Building 393 (Truck Inspection and Sentry Building), and install overhead cranes in all new magazines (the CLWS magazines require 25-ton capacity cranes; the Type G and H magazines require 5-ton capacity cranes) and incidental related work.

1.3.2 Location

The work is located within the existing Weapons Storage Compound located at the northern end of the Naval Submarine Base New London along Triton Drive SUBASE New London, Groton, CT, approximately as indicated. The exact location will be shown by the Contracting Officer.

1.4 OCCUPANCY OF PREMISES

Building(s) will be occupied during performance of work under this Contract.

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

1.5 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.

1.6 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 48 hours 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.

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 or encased 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.

1.6.1 Notification Prior to Excavation

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

1.7 GOVERNMENT-FURNISHED MATERIAL AND EQUIPMENT

Pursuant to Contract Clause FAR 52.245-1 Government Property, the Government will furnish the following materials and equipment for installation by the Contractor:

DESIGNATION NO.	DESCRIPTION	QUANTITY	NOTES
Internal Lock Device (ILD	Magazine Door Lock	9	Internal Lock Contractor to supply all door boltwork components with the exception of the ILD. Complete the Contractor Magazine Bid Information: Door Locking System form and submit to the DoD Lock Program.

Quantities indicated for the above-listed items marked with an asterisk are estimates. It is the intention of the Government to furnish all quantities of the asterisk items required to complete the work as specified, and the various quantities will be adjusted when necessary. Quantities stated for the above items not marked with an asterisk are all that will be furnished by the Government. Provide any additional quantities that are required.

1.7.1 Delivery Schedule

Notify the Contracting Officer in writing at least 60 calendar days in advance of the date on which the materials and equipment are required. Pick up materials and equipment no later than 30 calendar days after such date.

1.7.2 Delivery Location

The materials and equipment will be delivered to the job site.

1.8 GOVERNMENT-INSTALLED WORK

The Government will be responsible for the handling of all ordnance and will ensure that ordnance has been removed from existing magazines prior to the start of work/demolition of a particular magazine.

1.9 NAVY AND MARINE CORPS INTRANET(NMCI) COORDINATION REQUIREMENTS

1.9.1 NMCI Contractor Access

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

1.10 SALVAGE MATERIAL AND EQUIPMENT

Items designated by the Contracting Officer to be salvaged remain the property of the Government. Segregate, itemize, deliver and off-load the salvaged property at the Government designated storage area located within 1 mile of the construction site.

Provide a salvage plan, listing material and equipment to be salvaged, and

their storage location. Maintain property control records for material or equipment designated as salvage. Provide a system for property control in the salvage plan. Store and protect salvaged materials and equipment until disposition by the Contracting Officer.

The manual chain falls on all existing cranes within existing magazines **are to be salvaged and returned to the government at the Rigging Loft in Building B460. The remaining crane components, including rails, beams, and trolleys are** to be demolished **and disposed of off government property**.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 14 00

WORK RESTRICTIONS
11/22

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. DEPARTMENT OF DEFENSE (DOD)

DESR 6055.09, Edition 1	(2019) Defense Explosive Safety Regulation 6055.09, Edition 1

NEW LONDON INSTRUCTION

SUBASE 8020.IG	SUBASE NEW LONDON INSTRUCTION 8020.IG

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Contact Personnel

Personnel List

Phasing Plan; G

1.3 SPECIAL SCHEDULING REQUIREMENTS

All ground disturbance and work in the wetlands will be restricted for 90 days after award in order to obtain both the NPDES and wetlands permit approvals.

All work must be phased in such a way as to minimize impacts to installation weapons handling operations. The new Operations must be constructed, and all staff relocated from the existing Operations Building (B524) into the new operations Building as early as possible in the construction phasing. Physical security requirements (fencing, cameras, intrusion detection/access control, etc.) for the weapons compound (magazine area/compound) and all existing magazines still in operation must be maintained or provided by the contractor. During all phases of construction, the Government shall maintain access control to all magazines that are still in operation; the contractor shall maintain separate construction entrances independent from the weapons compound (magazine area/compound) secured entry. Prior to the start of construction and within 15 days of contract award, provide a Phasing Plan for review and approval by the Contracting Officer and the Weapons Officer. A preliminary Phasing Plan has been provided on the Civil drawings to help

inform the contractor of phasing requirements.

The Construction Phasing drawings indicate which magazines are to be demolished during the respective construction phasing. The other magazines not indicated for demolition must remain operational during the corresponding construction phase. **Each phase has a separate milestone and activity completion date in the schedule.**

The Contractor shall be required to (a) commence work under this contract within fifteen (15) calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 1,587 calendar days. The time stated for completion shall include final cleanup of the site

The calendar days for the milestones are as follows:

Milestone #	Title	Time for Completion
Milestone 1	Phase 1A	294 calendar days
Milestone 2	Phase 1B	190 calendar days
Milestone 3	Phase 1C	35 calendar days
Milestone 4	Phase 2	210 calendar days
Milestone 5	Phase 3	269 calendar days
Milestone 6	Work in Areas E, F, G, H, I, J & K	1587 calendar days

The milestones are **described** as follows:

Milestone 1 (Phase 1A):

No construction activities or demolition associated with the existing magazines in Phase 1A can be performed until government receives Request to Terminate Existing Site Approval from NOSSA. Please allow 14 days for government to receive approval.

Work includes but is not limited to provide temporary construction access and security fencing to ensure a secure perimeter around existing magazines to remain in place during Phase 1 operations (Magazines A94-A97, A100-A104, A105-A109, A113 and A114). Demolition of existing magazines A98, A99, A110 and A111 and including associated pavements and utilities. Install temporary sediment Traps 1 and 3. Rock blasting and excavation for Ordnance Operations Facility and near Magazines A98, A99, A110 and A111. Construct permanent storm water Facility A East of EXST-001 (A114). Maintain treatment chambers offline until final site stabilization. Ordnance Operations Facility construction including site preparation, drainage infrastructure, utility installation, access road, and parking lot. Convert temporary sediment Trap 1 to permanent storm water facility. Maintain treatment chambers offline until final site stabilization.

Milestone 2 (Phase 1B): Work includes but is not limited to install temporary sediment Trap 2. Reroute and demolish existing utilities necessary to construct Type H magazine. Site preparation, utility

installation, and construct Type H magazine. Convert temporary sediment Trap 2 to permanent storm water facility. Maintain treatment chambers offline until final site stabilization.

Milestone 3 (Phase 1C): Work includes but is not limited to demolition of existing Building 524, utilities and pavements.

Milestone 4 (Phase 2):

No construction activities or demolition associated with the existing magazines in Phase 2 can be performed until government receives Request to Terminate Existing Site Approval from NOSSA. Please allow 14 days for government to receive approval.

Work includes but is not limited to maintain temporary construction access and provide temporary security fencing to ensure a secure perimeter around existing magazines to remain in place during Phase 2 operations (A100-A104, A105-A109, A113, A114, and Type H-001). Demolish pavement west of EXT-002 (A113), install temporary sediment Trap 4. Demolish existing magazines A94, A95, A96 and A97 including associated pavements and utilities. Rock blasting and excavation for Type G magazines near magazines A94, A95, A96 and A97. Construct Type G magazines (Type G-001 and Type G-002) adjacent to EXT-002 (A113), including associated pavements and utilities. Replace EXST-002 ground ring during pavement demolition and replacement associated with Type G magazine construction. Site preparation, including utility installation and construction of Sentry Building. Installation of power and telecommunications equipment and intrusion detection system in Sentry Building.

Milestone 5 (Phase 3):

No construction activities or demolition associated with the existing magazines in Phase 3 can be performed until government receives Request to Terminate Existing Site Approval from NOSSA. Please allow 14 days for government to receive approval.

Work includes but is not limited to provide temporary construction access and security fencing to ensure a secure perimeter around existing magazines to remain in place during Phase 3 operations (A113, A114, Type H-001, Type G-001, and Type G-002). Demolish existing pavement East of Magazine A105 and install temporary sediment Trap 5. Demolish existing magazines A100 to A104 and A105 to A109 including associated pavements and utilities. Construct six (6) CLWS magazines including utilities and associated pavement. Ensure Type H magazine is complete and operational and EXT-001 is empty prior to demolition and replacement of EXST-001 concrete apron. Replace EXT-001 ground ring during pavement demolition and replacement. Demolish existing Building 393 including associated utilities and pavements. Ensure power equipment and intrusion detection system have been relocated and are operational prior to demolition of Building 393.

Milestone 6 (Remainder of Work): The remainder of work not listed in the previous milestones including but not limited to work in Areas E, F, G, H, I, J, and K located on the Site Drawing **Sheet C-003. Work for milestone 6 can be performed concurrently with Milestones 1 - 5**.

1.3.1 Termination of Existing Magazine Operations Between Construction Phases

No construction activities or demolition associated with the existing magazines in Phases 1A, 2, and 3 can be performed until government receives Request to Terminate Existing Site Approval from NOSSA. Please allow 14 days for government to receive approval for each of the aforementioned Phases.

1.3.2 Goose Run Golf Course

The Contractor will be working within a portion of Goose Rune Golf Course. Trenching and installation of new underground utilities are to be conducted within the following time period:

a. 01 November through 30 March

Do not enter the golf course grounds without prior approval of the Contracting Officer and golf course management. All work within the golf course will require a minimum of 30 calendar day advance notice and can not proceed without written authorization from the Contracting Officer and golf course management.

1.3.3 Procedure for Blasting During Construction

Blasting operations are to be conducted in accordance with SUBASE 8020.IG and specification 31 23 06.00 BLASTING - SURFACE.

1.3.4 Time of Year Restriction on Tree Clearing and Blasting

Tree clearing and rock blasting will not be permitted during nesting times of sensitive and endangered species. Tree clearing restrictions is between April 01 and October 31, and blasting restrictions is between April 01 and October 31, due to the presence of habitat for the northern long eared and tricolored bat.

All work associated with the removal or disturbance of vegetation (tree removal, pruning, etc.) is prohibited between April 01 and October 31 of any given year. All timber removed from the project site shall become the property of the Contractor. The Contractor shall reimburse the Government for the value of the timber. The Contractor shall submit payment to the Contracting Officer by cashier's or certified check in the amount of $760.00 made payable to the U.S. Treasury. Payment shall be made no less than five (5) days prior to the start of land clearing operations. See the Temporary Environmental Control specifications 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS and 31 11 00 CLEARING AND GRUBBING, paragraph 3.3.1 for additional requirements.

1.3.5 Wetland Permitting

The contractor is responsible for complying with the wetland permit as NAVFAC's representative. No work within the wetland limits is permitted (including laydown) until the wetland permit is received. A copy of approved permit is to be submitted tot he Public Works New London Environment (PW NLON EV) Division.

The contractor is responsible for completing and submitting all required monitoring and inspection reports. Any natural resource damage claim resulting from construction is the sole responsibility of the construction

contractor at no additional cost to the government. A copy of any monitoring or inspection reports require by this permit are to be submitted to the Public Works New London Environment (PW NLON EV) Division.

1.3.6 Ribbon Snake Mitigation Plan

The limits of disturbance extend into known habitat of State Protected Species. The contractor serves as the environmental monitor for this effort to ensure that the measures described in the Eastern Ribbon Snake Construction Impact Protection Plan are implemented properly. All work must be completed (and scheduled) in accordance with the contractor provided Ribbon Snake Mitigation Plan. Schedule an meeting with Public Works New London Environment (PW NLON EV) Division a minimum of 21 calendar days in advance of executing the mitigation plan to review the plan and discuss any questions/concerns that might hinder or threaten full plan compliance. The Construction Impact Protection Plan is included as an attachment to these specifications.

1.4 CONTRACTOR ACCESS AND USE OF PREMISES

1.4.1 Activity Regulations

Ensure that Contractor personnel employed on the Activity become familiar with and obey Activity regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. Wear appropriate personal protective equipment (PPE) in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. Ensure all Contractor equipment, include delivery vehicles, are clearly identified with their company name.

Occupants of any construction trailers near the job site must be directly involved with the project construction. Administrative personnel are not permitted in job site trailers and must be located outside of all installation inhabited building distance (IBD) arcs. Any windows utilized in construction trailers must meet the criteria of OP5 para 8-3. Brake rooms must be outside the IBD as well.

1.4.1.1 Subcontractors and Personnel Contacts

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

1.4.1.2 Installation Access

Obtain access to Navy installations through participation in the Defense Biometrics Identification System (DBIDS). Requirements for Contractor employee registration, and transition for employees currently under Navy Commercial Access Control System (NCACS), are available at https://www.cnic.navy.mil/Operations-and-Management/Base-Support/DBIDS/. No fees are associated with obtaining a DBIDS credential.

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

1.4.1.2.1 Registration for DBIDS

Registration for DBIDS is available at https://www.cnic.navy.mil/Operations-and-Management/Base-Support/DBIDS/. Procedure includes:

a. Present a letter or official award document (i.e. DD Form 1155 or SF 1442) from the Contracting Officer, that provides the purpose for access, to the base Visitor Control Center representative.

b. Present valid identification, such as a passport or Real ID Act-compliant state driver's license.

c. Provide completed SECNAV FORM 5512/1 to the base Visitor Control Center representative to obtain a background check. This form is available for download at https://www.cnic.navy.mil/Operations-and-Management/Base-Support/DBIDS/.

d. Upon successful completion of the background check, the Government will complete the DBIDS enrollment process, which includes Contractor employee photo, fingerprints, base restriction and several other assessments.

e. Upon successful completion of the enrollment process, the Contractor employee will be issued a DBIDS credential, and will be allowed to proceed to worksite.

1.4.1.2.2 DBIDS Eligibility Requirements

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

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

1.4.1.2.3 DBIDS Notification Requirements

a. Immediately report instances of lost or stolen badges to the Contracting Officer.

b. Immediately collect DBIDS credentials and notify the Contracting Officer in writing under the following circumstances:

(1) An employee has departed the company without having properly returned or surrendered their DBIDS credentials.

(2) There is a reasonable basis to conclude that an employee, or former employee, might pose a risk, compromise, or threat to the safety or security of the Installation or anyone therein.

1.4.1.2.4 One-Day Passes

Personnel applying for One-Day passes at the Base Visitor Control Office

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

1.4.1.3 NCACS Identification Badges and Installation Access

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

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

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

The following documents will be required to be presented for base access:

a. Verified license

b. Passport

c. Birth Certificate with SSN card

1.4.1.4 Gate Information

Contractors/Commercial vehicles must use Commercial Gate 7 (CVIS) located

separately from main gate between the hours of 5:45am - 1:30pm, Monday through Friday. Closed weekends and holidays. Phone number: 860-694-4360

1.4.1.5 No Smoking Policy

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

1.4.2 Working Hours

Regular working hours will consist of a 9 hour period, between 6:30 a.m. and 4:30 p.m. Monday through Friday, excluding Government holidays.

1.4.3 Work Outside Regular Hours

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

1.4.4 Occupied and Existing Buildings

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

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

1.4.5 Utility Cutovers and Interruptions

a. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in paragraph WORK OUTSIDE REGULAR HOURS.

b. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.

c. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, compressed air, and security systems are considered utility cutovers pursuant to the paragraph WORK OUTSIDE REGULAR HOURS.

d. Operation of Station Utilities: The Contractor must not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor must notify the Contracting Officer giving reasonable advance notice when such operation is required.

e. Connection to Existing Sanitary Sewer Line: Provide positive verification that the existing line conveys sanitary sewer; verify line is not incorrectly connected to a storm drain. Obtain Installation's Sanitary Sewer Connection Permit 2 weeks prior to connection and in accordance with Section 33 30 00 SANITARY SEWERAGE.

1.5 SECURITY REQUIREMENTS

Contract Clause FAR 52.204-2 Security Requirements and Alternate II and the following apply:

Installation Security Requirements.

1.5.1 Personnel List

Submit for approval, at least 15 days prior to the desired date of entry, an original alphabetical list of personnel who require entry into Government property to perform work on the project. Furnish for each person:

a. Name

b. Citizenship

c. Company employee works for

"I hereby certify that all personnel on this list are either born U.S. citizens, naturalized U.S. citizens with the naturalization number shown."

Signature/Firm Name

1.5.1.1 Citizenship Requirements

Aliens are not allowed on the project site. Work under this contract is restricted to U.S. citizens.

1.6 EXPLOSIVE SAFETY TRAINING

Contractor personnel shall participate in explosive safety training set forth on the requirements of DESR 6055.09, Edition 1, "Ammunition and Explosives Safety Standards". Coordinate with Naval Submarine Base New London on training requirements and scheduling.

Existing ordnance magazines will remain in service during construction. Construction activities shall not impact ordnance operations.

1.6.1 Hazards of Electromagnetic Radiation to Ordnance (HERO)

All contractor personnel must adhere to HERO requirements associated with the use of mobile and hand-held transmitters. Coordinate with Naval Submarine Base New London safety personnel on training and guidance.

1.6.2 Explosive Safety Requirements

All work must be conducted in accordance with Navy Explosive Safety Requirements for working within explosive arcs and conducting blast operations. No explosives may be brought and stored on the Installation without the approval of the Installation Explosive Safety Officer.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 31 23.13 20

ELECTRONIC CONSTRUCTION AND FACILITY SUPPORT CONTRACT MANAGEMENT SYSTEM
05/17, CHG 7: 11/21

PART 1 GENERAL

1.1 CONTRACT ADMINISTRATION

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

1.1.1 Format Naming Convention for Files Uploaded Into eCMS

Include the identification number of the document, the type of document, the name/subject or title, and for daily reports, the date (day of work) with format YYYY/MM/DD in the filename. For example, for RFI's, 0011_RFI_Roof_Leaking.doc; for submittals, 0032a_Submittals_Light_Fixture.pdf; for Daily Reports, 0132_Daily_Report_20190504.xls. Contact the Contracting Officer's Representative (COR) regarding availability of eCMS training and reference materials.

1.1.2 Uploading Documents Processed Outside of eCMS

When specifically requested to provide documents outside of eCMS, upload all final project documentation (e.g., documents that are signed and/or adjudicated by the Government) mentioned in Table 1 into eCMS by creating a record in the module associated with that document type and uploading the document(s). Subject/title of the record should include the type of record i.e., RFI/Submittal/Other, the identification number(s), and the statement "Processed Outside of eCMS". For example, "RFI 001-012 Processed Outside of eCMS".

1.2 USER PRIVILEGES

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

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Contractor's Personnel; G

1.4 SYSTEM REQUIREMENTS AND CONNECTIVITY

1.4.1 General

The eCMS requires a web-browser (platform-neutral) and Internet connection. Obtain from an approved vendor an External Certification Authority (ECA), Primary Key Infrastructure (PKI) certificate, or other similar digital identification to support two-factor authentication and access to eCMS. Provide and maintain computer hardware and software for the eCMS access throughout the duration of the contract for all Contractor-designated users. Provide connectivity, speed, bandwidth, and access to the Internet to ensure adequate functionality. 70 mbps download speed recommended, 40 mbps minimum for loading large files. Neither upgrading of the Contractor's computer system nor delays associated from the usage of the eCMS will be justification or grounds for a time extension or cost adjustment to the Contract.

1.4.2 Contractor Personnel List

Within 20 calendar days of contract award, provide to the Contracting Officer a list of Contractor's personnel who will have the responsibility for the transfer, sharing and management of electronic technical submittals and documents and will require access to the eCMS. Project personnel roles to be filled in the eCMS include the Contractor's Project Manager, Superintendent, Quality Control (QC) Manager, and Site Safety and Health Officer (SSHO). Personnel must be capable of electronic document management. Notify the COR immediately of any personnel changes to the project. The Contracting Officer reserves the right to perform a security check on all potential users. Provide the following information:

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

1.5 SECURITY CLASSIFICATION

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

The eCMS and tablet computer must only be used for the transaction of unclassified information associated with construction projects. In conformance with the Freedom of Information Act (FOIA), DoD INSTRUCTION 5200.48 CONTROLLED UNCLASSIFIED INFORMATION (CUI), and DoD requirements, any unclassified project documentation uploaded into the eCMS must be designated either "U - UNCLASSIFIED" (U) or "CUI - CONTROLLED UNCLASSIFIED INFORMATION"
(CUI).

1.6 ECMS UTILIZATION

Establish, maintain, and update data and documentation in the eCMS

throughout the duration of the contract.

Personally Identifiable Information (PII) transmittal is not permitted in the eCMS.

1.6.1 Information Security Classification/Identification

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

Table 1 also identifies which eCMS application is to be used in the transmittal of data (these are subject to change based on the latest software configuration). If a designated application is not functional within 4 hours of initial attempt, defer to the Submittal application and submit the required data as an uploaded portable document (e.g. PDF), word processor, spreadsheet, drawing, or other appropriate format. Hard copy or e-mail submission of these items is acceptable only if eCMS is documented to be not available or not functional or specifically requested in addition to electronic submission. After uploading documents to the Submittal application, transmit the submittals and attachments to the COR via the Transmittal application. For Submittals, select the following:

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

Table 1 - Project Documentation Types

SUBJECT/NAME	DESIG	REMARKS	ECMS APPLICATION
As-Built Drawings	U	Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager	Submittals and Transmittals
Building Information Modeling (BIM)	U	1. Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager 2. Design reviews will be performed in existing "Dr Checks"	Submittals and Transmittals

SUBJECT/NAME	DESIG	REMARKS	ECMS APPLICATION
Construction Permits	U	Refer to rules of the issuing activity, state or jurisdiction	Submittals and Transmittals
Construction Schedules (Activities and Milestones)	U	After the schedule submittal is approved by the COR, import the schedule file into the scheduling application, and select "Approve" to establish a new schedule baseline	Submittals, Transmittals and Scheduling App
Construction Schedules (Cost-Loaded)	**U**	After the schedule submittal is approved by the COR, import the schedule file into the scheduling application, and select "Approve" to establish a new schedule baseline	Submittals, Transmittals and Scheduling App
Construction Schedules (3-Week Lookahead)	U	Import the schedule file into the scheduling application, and select "Approve" to establish a new schedule baseline	Scheduling App
DD 1354 Transfer of Real Property	U		Submittals and Transmittals
Daily Production Reports	**U**	Provide weather conditions, crew size, man-hours, equipment, and materials information	Daily Report
Daily Quality Control (QC) Reports	**U**	Provide QC Phase, Definable Features of Work Identify visitors	Daily Report
Designs and Specifications	U	1. Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager 2. Design reviews will be performed in existing "Dr Checks"	Submittals and Transmittals
Environmental Notice of Violation (NOV), Corrective Action Plan	U	Refer to rules of the issuing activity, state or jurisdiction	Submittals and Transmittals
Environmental Protection Plan (EPP)	**U**		Submittals and Transmittals

SUBJECT/NAME	DESIG	REMARKS	ECMS APPLICATION
Invoice (Supporting Documentation)	**U**	Applies to supporting documentation only. Invoices are submitted in Wide-Area Workflow (WAWF)	Submittals and Transmittals
Jobsite Documentation, Bulletin Board, Labor Laws, SDS	U		Submittals and Transmittals
Meeting Minutes	**U**		Meeting Minutes
Modification Documents	**U**	Provide final modification documents for the project. Upload into "Modifications - RFPs	Document Management
Operations & Maintenance Support Information (OMSI/eOMSI), Facility Data Worksheet	U	1. Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager 2. Design reviews will be performed in existing "Dr Checks"	Submittals and Transmittals
Photographs	U	Subject to base/installation restrictions	Submittals and Transmittals
QCM Initial Phase Checklists	**U**		Checklists (Site Management)
QCM Preparatory Phase Checklists	**U**		Checklists (Site Management)
Quality Control Plans	**U**		Submittals and Transmittals
QC Certifications	U		Submittals and Transmittals
QC Punch List	U		Punch Lists (Testing Logs)
Red-Zone Checklist	U		Checklists (Site Management)
Rework Items List	**U**		Punch Lists (Testing Logs)

SUBJECT/NAME	DESIG	REMARKS	ECMS APPLICATION
Request for Information (RFI) Post-Award	**U**		RFIs
Safety Plan	**U**		Daily Report
Safety - Activity Hazard Analyses (AHA)	**U**		Daily Report
Safety - Mishap Reports	**U**		Daily Report
SCIF/SAPF Accreditation Support Documents	**U**	Note: Some Construction Security plans may be classified as Secret. Classified information must not be uploaded into eCMS. Refer to the Site Security Manager, as applicable.	Submittals and Transmittals
Shop Drawings	U	Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager	Submittals and Transmittals
Storm Water Pollution Prevention (Notice of Intent - Notice of Termination)	U	Refer to rules of the issuing activity, state or jurisdiction	Submittals and Transmittals
Submittals and Submittal Log	U		Submittals and Transmittals
Testing Plans, Logs, and Reports	**U**		Submittals and Transmittals
Training/Reference Materials	U		Submittals and Transmittals
Training Records (Personnel)	**U**		Submittals and Transmittals
Utility Outage/Tie-In Request/Approval	**U**		Submittals and Transmittals
Warranties/BOD Letter	**U**		Submittals and Transmittals

SUBJECT/NAME	DESIG	REMARKS	ECMS APPLICATION
Quality Assurance Reports	**U**		Checklists (Government initiated)
Non-Compliance Notices	**U**		Non-Compliance Notices (Government initiated)
Other Government-prepared documents	**U**		GOV ONLY
All Othere Documents	**U**	Refer to FOIA guidelines and contact the FOIA official to determine whether exemptions exist	As applicable

1.6.2 Markings on CUI documents

a. Only CUI documents being electronically uploaded into the eCMS (.docx, .xlsx, .ppt and others as appropriate), and associated paper documents described in the paragraph CONTRACT ADMINISTRATION require CUI markings as indicated in the subparagraphs below.

b. CUI documents that are originally created within the eCMS application using the web-based forms (RFIs, Daily Reports, and others as appropriate) will be automatically watermarked by the eCMS software, and these do not require additional markings.

c. CUI documents must be marked "CONTROLLED UNCLASSIFIED INFORMATION" at the bottom of the outside of the front cover (if there is one), the title page, the first page, and the outside of the back cover (if there is one).

d. CUI documents must be marked on the internal pages of the document as "CONTROLLED UNCLASSIFIED INFORMATION" at top and bottom.

e. Where Installations require digital photographs to be designated CUI, place the markings on the face of the photograph.

f. For visual documentation, other than photographs and audio documentation, mark with either visual or audio statements as appropriate at both the beginning and end of the file.

1.7 QUALITY ASSURANCE

Requested Government response dates on Transmittals and Submittals must be in accordance with the terms and conditions of the Contract. Requesting response dates earlier than the required review and response time, without concurrence by the Government COR, may be cause for rejection.

Incomplete submittals will be rejected without further review and must be resubmitted. Required Government response dates for resubmittals must reflect the date of resubmittal, not the original submittal date.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
11/20, CHG 2: 08/22

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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023) National Electrical Code
NFPA 241	(2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety -- Safety and Occupational Health (SOH) Requirements

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD	(2009; Rev 2012) Manual on Uniform Traffic Control Devices

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Site Plan; G

Traffic Control Plan; G

Haul Road Plan; G

Contractor Computer Cybersecurity Compliance Statements; G

Contractor Temporary Network Cybersecurity Compliance Statements; G

SD-03 Product Data

Backflow Preventers; G

SD-06 Test Reports

Backflow Preventer Tests

SD-07 Certificates

Backflow Tester Certification

Backflow Preventers Certificate of Full Approval

1.3 CONSTRUCTION SITE PLAN

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

1.4 BACKFLOW PREVENTERS CERTIFICATE

1.4.1 Backflow Tester Certificate

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

1.4.2 Backflow Prevention Training Certificate

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

1.5 DOD CONDITION OF READINESS (COR)

DOD will set the Condition of Readiness (COR) based on the weather forecast for sustained winds 50 knots (58 mph) 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 58 mph 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 3.3 feet high. Remove all debris, trash, or objects

that could become missile hazards. Review requirements pertaining to "Condition THREE" and continue action as necessary to attain "Condition FOUR" readiness. Contact Contracting Officer for weather and COR updates and completion of required actions.

b. Condition THREE (Sustained winds of 58 mph 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. Reinforce or remove formwork and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact Contracting Officer for weather and COR updates and completion of required actions. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness.

c. Condition TWO (Sustained winds of 58 mph or greater expected within 24 hours): Secure the jobsite, and leave Government premises.

d. Condition ONE. (Sustained winds of 58 mph or greater expected within 12 hours): Contractor access to the jobsite and Government premises is prohibited.

1.6 CYBERSECURITY DURING CONSTRUCTION

Meet the following requirements throughout the construction process.

1.6.1 Contractor Computer Equipment

Contractor owned computers may be used for construction. When used, contractor computers must meet the following requirements:

1.6.1.1 Operating System

The operating system must be an operating system currently supported by the manufacturer of the operating system. The operating system must be current on security patches and operating system manufacturer required updates.

1.6.1.2 Anti-Malware Software

The computer must run anti-malware software from a reputable software manufacturer. Anti-malware software must be a version currently supported by the software manufacturer, must be current on all patches and updates, and must use the latest definitions file. All computers used on this project must be scanned using the installed software at least once per day.

1.6.1.3 Passwords and Passphrases

The passwords and passphrases for all computers must be changed from their default values. Passwords must be a minimum of eight characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

1.6.1.4 Contractor Computer Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Computer Cybersecurity Compliance Statements for each company using contractor owned computers. Contractor Computer Cybersecurity Compliance Statements must use the template published at http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables. Each Statement must be signed by a cybersecurity representative for the relevant company.

1.6.2 Temporary IP Networks

Temporary contractor-installed IP networks may be used during construction. When used, temporary contractor-installed IP networks must meet the following requirements:

1.6.2.1 Network Boundaries and Connections

The network must not extend outside the project site and must not connect to any IP network other than IP networks provided under this project or Government furnished IP networks provided for this purpose. Any and all network access from outside the project site is prohibited.

1.6.3 Government Access to Network

Government personnel, as defined, prescribed, and identified by the Contracting Officer, must be allowed to have complete and immediate access to the network at any time in order to verify compliance with this specification. Or if there is a Government agency that's responsible, identify that agency.

1.6.4 Temporary Wireless IP Networks

In addition to the other requirements on temporary IP networks, temporary wireless IP (WiFi) networks must not interfere with existing wireless network and must use WPA2 security. Network names (SSID) for wireless networks must be changed from their default values.

1.6.5 Passwords and Passphrases

The passwords and passphrases for all network devices and network access must be changed from their default values. Passwords must be a minimum 8 characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

1.6.6 Contractor Temporary Network Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Temporary Network Cybersecurity Compliance Statements for each company implementing a temporary IP network. Contractor Temporary Network Cybersecurity Compliance Statements must use the template published at http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables. Each Statement must be signed by a cybersecurity representative for the relevant company. If no temporary IP networks will be used, provide a single copy of the Statement indicating this.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNAGE

2.1.1 Bulletin Board

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

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. Post signs at all points of entry designating the construction site as a hard hat area.

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; avoid sharp curves, blind corners, and dangerous cross traffic. 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 haul 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. Barricades are required 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. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of

the hazard during both day and night.

2.3 FENCING

Provide fencing along the construction site and at all open excavations and tunnels to control access by unauthorized personnel. Safety fencing must be highly visible to be seen by pedestrians and vehicular traffic. All fencing must meet the requirements of EM 385-1-1. Remove the fence upon completion and acceptance of the work.

To block public view of the construction, enclose the project work area and Contractor lay-down area with a 8 ft high chain link fence and gates with brown, UV light resistant, plastic fabric mesh netting (similar to tennis court or other screening).

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 8 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.

Subpart "Post-Driven Chain Link Fencing" Deleted.

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

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 is not acceptable.

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.

PART 3 EXECUTION

3.1 EMPLOYEE PARKING

Construction Contract employees must park privately owned vehicles in an area designated by the Contracting Officer. Employee parking must not interfere with existing and established parking requirements of the Government installation.

3.2 AVAILABILITY AND USE OF UTILITY SERVICES

3.2.1 Temporary Utilities

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

3.2.2 Payment for Utility Services

a. The Government will make all reasonably required utilities available from existing outlets and supplies, as specified in the Contract. Unless otherwise provided in the Contract, the amount of each utility service consumed will be charged to or paid at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. Carefully conserve utilities furnished without charge.

b. Reasonable amounts of the following utilities will be made available at the prevailing rates.

c. The point at which the Government will deliver such utilities or services and the quantity available must be coordinated with the Contracting Officer. Pay all costs incurred in connecting, converting, and transferring the utilities to the work. Make connections, including providing backflow-preventing devices on connections to domestic water lines; providing meters; and providing transformers; and make disconnections. Under no circumstances will taps to base fire hydrants be allowed for obtaining domestic water.

d. The Contractor must provide their own utilities.

3.2.3 Meters and Temporary Connections

Provide and maintain necessary temporary connections, distribution lines, and meter bases (Government will provide meters) required to measure the amount of each utility used for the purpose of determining charges. Notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired so that a utilities contract can be established. The Government will provide a meter and make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. Do not make the final electrical connection.

3.2.4 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of $50.00 will be required. The last monthly bills for the fiscal year will normally be offset by the deposit and adjustments will be billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning 1 October, will require a new deposit.

Notification of the due date for this deposit will be mailed prior to the end of the current fiscal year.

3.2.5 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading, disconnect service, and remove the meters. Then remove all the temporary distribution lines, meter bases, and associated appurtenances. Pay all outstanding utility bills before final acceptance of the work by the Government.

3.2.6 Sanitation

Provide and maintain within the construction area minimum field-type sanitary facilities in accordance with EM 385-1-1 Section 02. Locate the facilities behind the construction fence or out of the public view. Clean units and empty wastes at least once a week or more frequently 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 a municipal, district, or commercial sanitary sewer system. 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.

3.2.7 Telephone

Make arrangements and pay all costs for telephone facilities desired.

3.2.8 Fire Protection

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

3.3 STATION OPERATION AFFECT ON CONTRACTOR OPERATIONS

The Government access to active magazines during construction. The contractor will ensure that the Government access to active magazines is maintained independent of construction access to the construction site..

3.3.1 Restricted Access Areas

The Government will monitor work in areas listed below. Notify Contracting Officer at least 14 calendar days prior to starting work in these areas.

Weapons and Magazine Compound.

3.4 TRAFFIC PROVISIONS

3.4.1 Maintenance of Traffic

a. Conduct operations in a manner that will not close a thoroughfare or interfere 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 for Government approval detailing the proposed controls to traffic movement for approval. The plan must be in accordance with State and local regulations and the MUTCD, Part VI. Make all notifications and obtain all permits required for modification to traffic movements outside Station's jurisdiction. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met.

b. Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic.

c. Provide, erect, and maintain, at Contractor's expense, lights, barriers, signals, passageways, detours, and other items, that may be required by the Life Safety Signage, overhead protection authority having jurisdiction.

d. Provide cones, signs, barricades, lights, or other traffic control devices and personnel required to control traffic. Do not use foil-backed material for temporary pavement marking because of its potential to conduct electricity during accidents involving downed power lines.

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. Provide self-illuminated (lighted) barricades during hours of darkness. Brightly-colored (orange) vests are required for all personnel working in roadways. 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 damage to roads caused by construction operations.

3.4.3 Rush Hour Restrictions

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

3.4.4 Dust Control

Dust control methods and procedures must be approved by the Contracting Officer. Coordinate dust control methods with 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

3.5 REDUCED PRESSURE BACKFLOW PREVENTERS

Provide an approved reduced pressure backflow prevention assembly at each location where the Contractor taps into the Government potable water supply.

Perform backflow preventer tests using test equipment, procedures, and certification forms conforming to those outlined in the latest edition of the Manual of Cross-Connection Control published by the FCCCHR Manual. Test and tag each reduced pressure backflow preventer upon initial installation (prior to continued water use) and monthly thereafter. Tag must contain the following information: make, model, serial number, dates of tests, results, maintenance performed, and signature of tester. Record test results on certification forms conforming to requirements cited earlier in this paragraph.

3.6 CONTRACTOR'S TEMPORARY FACILITIES

Temporary facilities must meet requirements as identified in EM 385-1-1 Section 04.

Contractor is responsible for security of their property. Provide adequate outside security lighting at the temporary facilities. Trailers must be anchored to resist high winds and meet applicable state or local standards for anchoring mobile trailers. Coordinate anchoring with EM 385-1-1 Section 04. The Contract Clause entitled "FAR 52.236-10, Operations and Storage Areas" and the following apply:

3.6.1 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.

In the event a new building is constructed for the temporary project field office, it must 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. Provide approved sanitary facilities. Screen the windows and doors and provide the doors with deadbolt type locking devices or a padlock and heavy-duty hasp bolted to the door. Door hinge pins must 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, provide 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. Unless otherwise directed by the Contracting Officer, remove the building from the site upon completion and acceptance of the work.

3.6.2 Quality Control Manager Records and Field Office

Provide on the jobsite an office with approximately 100 square feet of useful floor area for the exclusive use of the QC Manager. Provide a weathertight structure with adequate heating and cooling, toilet facilities, lighting, ventilation, a 4 by 8 foot plan table, a standard size office desk and chair, computer station, and working communications

facilities. Provide a door with a cylinder lock and windows with locking hardware. Make utility connections. Locate as directed. File quality control records in the office and make available at all times to the Government. After completion of the work, remove the entire structure from the site.

3.6.3 Storage Area

Construct a temporary **8 foot** high chain link fence around trailers and materials. Include **UV light resistant, plastic fabric mesh netting**, 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 the current 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.

Keep fencing in a state of good repair and proper alignment. If the Contractor elects to traverse grassed or unpaved areas which are not established roadways with construction equipment or other vehicles, cover the grassed or unpaved areas with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation must be at the Contractor's discretion.. Mow and maintain grass located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, structures, under trailers, and in areas not accessible to mowers must be edged or trimmed neatly.

3.6.4 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. Maintain the area in a clean and orderly fashion and secured if needed to protect supplies and equipment. Utilities will not be provided to this area by the Government.

3.6.5 Appearance of Trailers

a. Trailers must be roadworthy and comply with all appropriate state and local vehicle requirements. Trailers which are rusted, have peeling paint or are otherwise in need of repair will not be allowed on Installation property. Trailers must present a clean and neat exterior appearance and be in a state of good repair.

b. Maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal at the Contractor's expense.

3.6.6 Trailers or Storage Buildings

a. Trailers or storage buildings will be permitted, where space is available, subject to the approval of the Contracting Officer.

b. Mount a sign not smaller than 24 by 24 inches on the trailer or building that shows the company name, business phone number, emergency phone number and conforms to the following requirements and sketch:

Graphic panel	Aluminum, painted blue
Copy	Screen painted or vinyl die-cut, white
Typeface	Univers 65 u/lc
See Sketch No. 01500 (graphic).	

3.6.7 Safety Systems

Protect the integrity of all installed safety systems or personnel safety devices. Obtain prior approval from the 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.

3.6.8 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.

3.6.8.1 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.

3.7 PLANT COMMUNICATIONS

Whenever the individual elements of the plant are located so that operation by normal voice between these elements is not satisfactory, install a satisfactory means of communication, such as telephone or other suitable devices and make available for use by Government personnel.

3.8 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.

3.9 DUMPSTERS

Equip dumpsters with a secure cover and paint the standard installation color. Keep dumpster closed, except when being loaded with trash and debris. Locate dumpsters behind the construction fence and out of the public view. Empty site dumpsters at least once a week, or as needed to keep the site free of debris and trash. If necessary, provide 55 gallon trash containers painted the darker installation color to collect debris in the construction site area. For large demolitions, large dumpsters without lids are acceptable, but must not have debris higher than the sides before emptying.

3.10 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 all 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.

3.11 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and all other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence. Restore areas used during the performance of the Contract to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary.

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SECTION 01 57 19

TEMPORARY ENVIRONMENTAL CONTROLS
08/22

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 1910.1053	Respirable Crystalline Silica
29 CFR 1910.1200	Hazard Communication
29 CFR 1926.1153	Respirable Crystalline Silica
40 CFR 50	National Primary and Secondary Ambient Air Quality Standards
40 CFR 60	Standards of Performance for New Stationary Sources
40 CFR 63	National Emission Standards for Hazardous Air Pollutants for Source Categories
40 CFR 64	Compliance Assurance Monitoring
40 CFR 82	Protection of Stratospheric Ozone
40 CFR 112	Oil Pollution Prevention
40 CFR 122.26	Storm Water Discharges (Applicable to State NPDES Programs, see section 123.25)
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 262.11	Hazardous Waste Determination and Recordkeeping
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 273	Standards for Universal Waste Management
40 CFR 273.2	Standards for Universal Waste Management - Batteries
40 CFR 273.4	Standards for Universal Waste Management - Mercury Containing Equipment
40 CFR 273.5	Standards for Universal Waste Management - Lamps
40 CFR 273.6	Applicability - Aerosol Cans
40 CFR 279	Standards for the Management of Used Oil
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 300.125	National Oil and Hazardous Substances Pollution Contingency Plan - Notification and Communications
40 CFR 355	Emergency Planning and Notification
40 CFR 403	General Pretreatment Regulations for Existing and New Sources of Pollution
40 CFR 745	Lead-Based Paint Poisoning Prevention in Certain Residential Structures
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials

	Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Class I and II Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act. A list of Class I ODS can be found on the EPA website at the following weblink. https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances.

Class II ODS is defined in Section 602(s) of The Clean Air Act. A list of Class II ODS can be found on the EPA website at the following weblink. https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances.

1.2.2 Contractor Generated Hazardous Waste

Contractor generated hazardous waste is materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e., methyl ethyl ketone, toluene), waste thinners, excess paints, excess solvents, waste solvents, excess pesticides, and contaminated pesticide equipment rinse water.

1.2.3 Electronics Waste

Electronics waste is discarded electronic devices intended for salvage, recycling, or disposal.

1.2.4 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally or historically.

1.2.5 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2.6 Hazardous Debris

As defined in paragraph SOLID WASTE, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore structure) in accordance with 40 CFR 261. Hazardous debris also includes

debris that exhibits a characteristic of hazardous waste in accordance with 40 CFR 261.

1.2.7 Hazardous Materials

Hazardous material is any material that: Is defined in 49 CFR 171, listed in 49 CFR 172, regulated as a hazardous material in accordance with 49 CFR 173; or requires a Safety Data Sheet (SDS) in accordance with 29 CFR 1910.1200; 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 exhibits 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, or meets a state, local, or host nation definition of a hazardous waste.

1.2.9 Land Application

Land Application means spreading or spraying discharge water at a rate that allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" must occur. Comply with federal, state, and local laws and regulations.

1.2.10 Municipal Separate Storm Sewer System (MS4) Permit

MS4 permits are those held by municipalities or installations to obtain NPDES permit coverage for their stormwater discharges.

1.2.11 National Pollutant Discharge Elimination System (NPDES)

The NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

1.2.12 Oily Waste

Oily waste are those materials that are, or were, mixed with Petroleum, Oils, and Lubricants (POLs) and have become separated from that POLs. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, POLs and may be appropriately tested and discarded in a manner which is in compliance with other state and local requirements.

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land

filled provided that: It is not prohibited in other state regulations or local ordinances; the amount generated is "de minimus" (a small amount); it is the result of minor leaks or spills resulting from normal process operations; and free-flowing oil has been removed to the practicable extent possible. Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, perform a hazardous waste determination prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

1.2.13 Regulated Waste

Regulated waste are solid wastes that have specific additional federal, state, or local controls for handling, storage, or disposal.

1.2.14 Sediment

Sediment is soil and other debris that have eroded and have been transported by runoff water or wind.

1.2.15 Solid Waste

Solid waste is a solid, liquid, semi-solid or contained gaseous waste. A solid waste can be a hazardous waste, non-hazardous waste, or non-Resource Conservation and Recovery Act (RCRA) regulated waste. Types of solid waste typically generated at construction sites may include, but not limited to, surplus soil, soil aggregate, contaminant impacted concrete, contaminant impacted materials, concrete, utility debris, and dewatering treatment system media.

1.2.15.1 Debris

Debris is non-hazardous solid material generated during the construction, demolition, or renovation of a structure that exceeds 2.5-inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (for example, cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may not be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.

1.2.15.2 Green Waste

Green waste is the vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.

1.2.15.3 Material Not Regulated As Solid Waste

Material not regulated as solid waste is nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas

or crude oil exploration or production.

1.2.15.4 Non-Hazardous Waste

Non-hazardous waste is waste that is excluded from, or does not meet, hazardous waste criteria in accordance with 40 CFR 261.

1.2.15.5 Recyclables

Recyclables are materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable, wiring, insulated/non-insulated copper wire cable, wire rope, and structural components. It also includes commercial-grade refrigeration equipment with Freon removed, household appliances where the basic material content is metal, clean polyethylene terephthalate bottles, cooking oil, used fuel oil, textiles, high-grade paper products and corrugated cardboard, stackable pallets in good condition, clean crating material, and clean rubber/vehicle tires. Metal meeting the definition of lead contaminated or lead based paint contaminated may 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.

1.2.15.6 Surplus Soil

Surplus soil is existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars, and paving. Surplus soil is not a salvageable material. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included and must be managed in accordance with paragraph HAZARDOUS MATERIAL MANAGEMENT.

1.2.15.7 Scrap Metal

This includes scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe, and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

1.2.15.8 Wood

Wood is dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included. Treated wood includes, but is not limited to, lumber, utility poles, crossties, and other wood products with chemical treatment.

1.2.16 Surface Discharge

Surface discharge means discharge of water into drainage ditches, storm sewers, sanitary sewers, vegetated surfaces, or creeks meeting the definition of "waters of the United States". Surface discharges from construction sites are discrete, identifiable sources and require a permit from the governing agency. Comply with federal, state, and local laws and regulations.

1.2.17 Wastewater

Wastewater is the used water and solids that flow through a sanitary sewer to a treatment plant or generated by construction activities. Any wastewater generated by construction activities must be containerized, characterized, and taken offsite site to a permitted facility.

1.2.17.1 Stormwater

Stormwater is any precipitation in an urban or suburban area that does not evaporate or soak into the ground, but instead collects and flows into storm drains, rivers, and streams.

1.2.18 Waters of the United States

Waters of the United States means Federally jurisdictional waters, including wetlands, that are subject to regulation under Section 404 of the Clean Water Act or navigable waters, as defined under the Rivers and Harbors Act.

1.2.19 Wetlands

Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

1.2.20 Universal Waste

The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (for example, thermostats), and lamps (for example, fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal. These regulations can be found at 40 CFR 273.

1.2.21 Location Specific Universal Waste

Any of the following dangerous waste that are subject to the universal waste requirements of Connecticut State Code; Universal waste and/or special waste may include, but not limited to, Batteries; Lamps; PFAS impacted materials, and Mercury-containing equipment.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control and/or closeout approval. The Contracting Officer must assign the Installation Environmental Department representatives and Government Environmental Design Specialist within eCMS as Step 1 reviewers for the Environmental related submittals listed within this Specification. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preconstruction Survey

Regulatory Notifications; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Environmental Manager Qualifications; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Employee Training Records; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Environmental Protection Plan; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Dirt and Dust Control Plan; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Solid Waste Management Permit; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Stormwater Pollution Control Plan (SWPCP); G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Stormwater Notice of Intent (for NPDES coverage under the general permit for construction activities); G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Spill Prevention Control And Countermeasure (SPCC) Plan; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Post-construction Stormwater Management General Permit; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Wastewater Collection System; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Inland Wetlands and Watercourse; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Water Quality; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Water Distribution System; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Hazardous Waste Treatment, Storage, Disposal, and Handling; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental

Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Clearing; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Endangered Species/Critical Habitat - Habitat Protection Plan related to the Eastern Ribbon Snake; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal. Refer to the Eastern Ribbon Snake Construction Impact Protection Plan included as an attachment to 01 14 00 WORK RESTRICTIONS.

Payment of Standing Timber Removal to Real Property; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Pollution Generating Equipment; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Stationary Internal Combustion Engines; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Soil Management Plan; G

Imported Fill Management Plan; G

Imported Fill Summary Report; G

Dewatering Plan for OU 2 and 3; G

SD-06 Test Reports

Monthly Solid Waste Disposal Report; G
Submit copies for review and approval to the Government

Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Inspection Reports

Laboratory Analysis Results

Submit copies of groundwater sampling PFAS testing results to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

SD-07 Certificates

ECATTS Certificate Of Completion; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Employee Training Records; G

Erosion and Sediment Control Inspector Qualifications

Laboratory Certifications and Accreditations

Submit copies of groundwater sampling PFAS testing laboratory certifications and accreditations to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

SD-11 Closeout Submittals

Regulatory Notifications; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Assembled Employee Training Records; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation

Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Solid Waste Management Permit; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Stormwater Pollution Control Plan Compliance Notebook; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Stormwater Notice of Termination (for NPDES coverage under the general permit for construction activities); G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Eastern Ribbon Snake Protection Plan Report; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal. Refer to the Eastern Ribbon Snake Construction Impact Protection Plan included as an attachment to Section 01 14 00 WORK RESTRICTIONS.

As-Built Topographic Survey

Waste Determination Documentation; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Project Solid Waste Disposal Documentation Report; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Sales Documentation; G

Submit copies for review and approval to the Government

Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Hazardous Waste/Debris Management; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Disposal Documentation for Hazardous and Regulated Waste; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

Contractor Hazardous Material Inventory Log; G

Submit copies for review and approval to the Government Environmental Design Specialist and the Installation Environmental Department. The Contracting Officer must assign the Installation Environmental Department representatives within eCMS as Step 1 reviewers for this submittal.

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Protect the environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire duration of this Contract. Comply with federal, state, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

Tests and procedures assessing whether construction operations comply with Applicable Environmental Laws may be required. Analytical work must be performed by qualified laboratories; and where required by law, the laboratories must be certified.

1.4.1 Training in Environmental Compliance Assessment Training and Tracking System (ECATTS)

1.4.1.1 Personnel Requirements

The Environmental Manager is responsible for environmental compliance on projects. The Environmental Manager and other staff must complete applicable ECATTS training modules (installation specific or general) prior to starting respective portions of on-site work under this Contract. If personnel changes occur for any of these positions after starting work, replacement personnel must complete applicable ECATTS

training within 14 days of assignment to the project.

1.4.1.2 Certification

Submit an ECATTS certificate of completion for personnel who have completed the required ECATTS training. This training is web-based and can be accessed from any computer with Internet access using the following instructions.

Register for NAVFAC Environmental Compliance Assessment, Training, and Tracking System, by logging on to https://environmentaltraining.ecatts.com/. Obtain the password for registration from the Contracting Officer.

1.4.1.3 Refresher Training

This training has been structured to allow contractor personnel to receive credit under this contract and to carry forward credit to future contracts. Ensure the Environmental Manager review their training plans for new modules or updated training requirements prior to beginning work. Some training modules are tailored for specific state regulatory requirements; therefore, Contractors working in multiple states will be required to retake modules tailored to the state where the contract work is being performed.

1.4.2 Conformance with the Environmental Management System

Perform work under this contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). Perform work in a manner that conforms to objectives and targets of the environmental programs and operational controls identified by the EMS. Support Government personnel when environmental compliance and EMS audits are conducted by escorting auditors at the Project site, answering questions, and providing proof of records being maintained. Provide monitoring and measurement information as necessary to address environmental performance relative to environmental, energy, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, take corrective and preventative actions. In addition, employees must be aware of their roles and responsibilities under the installation EMS and of how these EMS roles and responsibilities affect work performed under the contract.

Coordinate with the installation's EMS coordinator to identify training needs associated with environmental aspects and the EMS and arrange training or take other action to meet these needs. Provide training documentation to the Contracting Officer. The Installation Environmental Office will retain associated environmental compliance records. Make EMS Awareness training completion certificates available to Government auditors during EMS audits and include the certificates in the Employee Training Records. See paragraph EMPLOYEE TRAINING RECORDS.

1.5 SPECIAL ENVIRONMENTAL REQUIREMENTS

Comply with the special environmental requirements listed within project permits (Stormwater management permit, general construction permit, utility permits, Installation specific Management Plans, Construction Worker Authorization, project specific NEPA documentation (signed Environmental Checklist and Site approval documentation), project specific wetland permit, and demolition permits) and standards of care. See the

Permit Record of Decision Form attached to this Specification for additional information.

Due to the presence of known residual contamination within soil and groundwater at the site, all site workers who come in contact with contaminated soil and groundwater must be 29 CFR 1910.120 HAZWOPER certified personnel with current 8-hr HAZWOPER refresher certificates. All certificates of site workers must be kept onsite within the Environmental Manager documentation and submitted as an Appendix within the Environmental Protection Plan.

The publicly accessible DENIX database should be used as a starting point when selecting a laboratory for a project. It does not provide all information needed (e.g., version of method or requirements and list of analyte lists under accreditation). To ensure the laboratory you select is accredited for your project analytes, the project manager/chemist must review the laboratory’s scope of accreditation, which is found on their accreditation body’s website.

To find a DoD-ELAP accredited laboratory, use the following link under the heading “Search Accredited Labs” on the EDQW page on the DENIX website:https://www.denix.osd.mil/edqw/accreditation/accreditedlabs/index.html

To determine the version of EPA Method the laboratory is accredited for, the laboratory’s DoD-ELAP Scope of Accreditation Certificate must be reviewed and approved by Installation Environmental Department through the Contracting Officer.

All site environmental monitoring wells must be protected throughout construction. Any damage to the site environmental monitoring wells is the sole responsibility of the construction contractor. Any repairs, replacement, and/or abandonment must meet all State of Connecticut and Environmental Restoration Program requirements.

1.5.1 Mid-Atlantic

Comply with the following state, regional, and local requirements.

1.5.1.1 Naval Submarine Base New London, Connecticut

Comply with all Installation specific and applicable State and Local Requirements.

1.5.1.1.1 Dig Permit

A “Request for Permit to Excavate” form, also known as a dig permit, is required to be submitted to and approved by the Public Works Department (PWD) prior to initiating any ground-disturbing activities. Excavation work shall be performed in accordance with the site excavation procedures identified in the dig permit and shall be recorded on the soil tracking form (Attachment 1).

1.5.1.1.2 **Excavation**

The contractor must develop and submit a Soil Management Plan for review and approval by the Installation Environmental Department and the NAVFAC Environmental Design Specialist. This plan must specify any pre-characterization/in-situ sample analysis, identifying the sample locations, depths, analysis, accredited laboratory (please note, the

contracted laboratories must be accredited for every analyte/test method listed below), evaluation of representative of soils to be excavated in accordance with RCRA, worker safety requirements, stockpile and storage areas, appropriate containment, etc.

The contractor must expect that all excavated soils at the site are assumed to be impacted by contaminants within the Sites 2A, 2B, and 3 areas (including but not limited to petroleum, VOCs, PFAS, and metals) and considered characteristic non-hazardous solid waste. All excavated soils must be disposed of at a permitted, lined landfill with an active leachate and gas collection system that accepts co-mingled (including metals, VOCs, petroleum, and PFAS) impacted materials. Due to the presence of petroleum, TPH (GRO and DRO) samples must be collected every 250 cubic yards for offsite disposal. All other waste characterization samples must be collected for every 1,000 cubic yards; the actual frequency of disposal will depend on the offsite receiving facility. Typical analysis includes ignitability, corrosivity, reactivity, toxicity based on TCLP (metals, VOCs, SVOCs, pesticides and herbicides) results, PCBs, BTEX, TOX, PFAS, and paint filter per validated EPA methods and in accordance with the most recent version of the Department of Defense Quality Systems Manual. All analysis must be completed by a ELAP accredited laboratory for each analysis conducted by that lab and all laboratory certifications and accreditations must be current and submitted to the government for review and approval. All laboratory analysis results must be submitted to the Government for review and approval. The only authorized department who may sign the waste manifest is a representative from the New London Environmental Department. The only allowable PFAS analytical method for sampling is EPA Method 1633 by a ELAP laboratory accredited for that method.

Soils outside of the Site 2A, 2B, and 3 boundaries must be sampled to determine if reuse is an option. If results for all analytes are below current Connecticut Remediation Standard Regulations (RSRs) direct exposure criteria for residential soil and GA pollutant mobility criteria (RCSA §§22a-133k-1—22a-133k-3), the excess soil meets the State requirements for reuse. Soil eligible for reuse may be placed at a location within the SUBASE main installation, pending submission to the EV IR Program Manager of the analytical results, a map denoting the project location and the proposed location for reuse, and an estimate of the volume of soil to be relocated. All this information must be included within the Imported Fill Management Plan and Summary Report. Excess soil must be reused within 60 days of the excavation date.

Excavated soil must be stored in a manner that prevents rain from infiltrating the soil matrix and preventing any runoff into the surrounding soil or pavement or in lined, covered dumpsters. A single contaminated soil stockpile should not contain more than 250 cubic yards. Excavated soil may not be stored on-site for more than 60 days.

1.5.1.1.3 Imported Fill

An Imported Fill Management Plan must be reviewed and approved by Installation Environmental through the contracting office; in addition to requirements listed within the Earthwork specification and applicable CIVIL and LANDSCAPE ARCHITECTURE specifications for this project. The Imported Fill Management Plan must include the following information:

- Fill source location/history (Phase I if available, current aerials, etc.)

- Sampling and Analysis plan
- Analytical lab certifications (lab must be ELAP accredited for each analysis)
- Sample frequency for each analysis
- Resumes of field sampling team
- A table designating screening criteria (Current CT Clean Fill Requirements; all PFAS constituent goals are the detection limit of the laboratory selected for EPA Method 1633)

Soil Import Sampling Requirements:
At least one REPRESENTATIVE 3-point composite sample from EACH area of planned import must be provided to Installation Environmental for review and approval through the Contracting Officer. If the area of planned import changes, another sample must be collected and provided to Installation Environmental for review and approval. Clean fill borrow source samples must be collected within 3 months of borrow source use.

Sample Analysis required by the State of Connecticut for clean fill as defined in the Regulations of Connecticut State Agencies (RCSA) §§ 22a-209-1; screening criteria are the GA pollutant mobility criteria and direct exposure criteria for residential soil established in the RSRs:

Target Analyte List (TAL) Inorganics (total metals)
Target Compound List (TCL) Volatile Organic Compounds (VOCs), including benzene, toluene, ethylbenzene, and xylene
TCL Semi-Volatile Organic Compounds (SVOCs)
TCL Polychlorinated Biphenyl's (PCBs)
TCL Pesticides
Chlorinated Dioxins
Total Petroleum Hydrocarbons (TPH)
Total Organic Halogen/Halide (TOX)
Per and Polyfluoroalkyl Substances (PFAS)

*** Additional analysis and reporting is required by the project specific wetland permit. It is the sole responsibility of the contractor to ensure the fill material used to fill in permitted wetland areas meets the criteria listed within the wetland permit ***

All analysis, methods, and sample collection must be conducted in accordance with EPA SW-846 test methods for evaluating Physical/Chemical methods. PFAS must be analyzed and collected via EPA Method 1633 standard operating procedures and in accordance with the DoD QSM. Analytical laboratories must be ELAP certified/accredited and provided to the Installation Environmental Hazardous Waste program manager for approval prior to sample collection.

PFAS sampling protocols have stringent requirements, very low detection levels, and cross contamination is a concern. PFAS samples must be collected by experienced professional with at least 5 years of experience collecting samples for this extremely sensitive analysis. The resumes of the sampling technicians that collect these samples must be provided within the Imported Fill Management Plan will be reviewed in detail by the Navy.

Imported Fill Summary Report must be reviewed and approved by Installation Environmental through the contracting officer prior to any imported material onto the Installation. A minimum of 14 days is required to review and approve results. If imported fill results do not achieve the approved screening criteria provided within the Imported Fill Management Plan,

another borrow source must be identified, sampled, and submitted for review. This process will continue until a borrow source that meets the clean fill criteria is met.

The Imported Fill Summary Report must include, but not limited to, the following information:

- Fill source location/history (Phase I if available, current aerials, etc.)
- Field Sampling summary (including sample location plan, observations when in the field, COCs, etc)
- Analytical lab report
- Sample frequency for each analysis
- Confirmation of approved sampling team members
- A table screening fill results to approved screening criteria
- Schedule of delivery
- Estimated volume of fill material
- Management of material (including best management of practices to PREVENT cross contamination, on Installation laydown/stockpile area, etc)
- A PE/PG recommendation of import

NO MATERIAL is permitted to come onto Installation property without Installation Environmental approval through the Contracting officer.

1.5.1.1.4 Construction Site Stormwater

Construction site stormwater runoff must be treated using proper erosion control measures or stormwater management practices prior to release from the construction site. Pollutants, including but not limited to chemicals, fuels, lubricants, sewage, paints, sedimentation, and other harmful materials must not be discharged into or alongside any river, stream, or impoundment, or into any channels leading to them. Implement appropriate erosion and sediment control measures to all disturbed areas or bare soils to prevent unauthorized offsite sedimentation. Apply stabilization measures to denuded portions of a project that are at final grade or where work has temporarily ceased within 7 days.

1.5.1.1.5 Construction Dewatering

The dewatering requirements reflected in the project General Construction Permit do not apply to work within Sites 2A, 2B, and 3 as indicated on Drawings H-101 and H-102 due to the presence of contaminant impacts in shallow groundwater (including, but not limited to, petroleum, VOCs, metals, and PFAS). The contractor must implement all necessary means and methods to limit the inflow of groundwater and stormwater into the excavation cavity when working within Sites 2A, 2B, and 3. This includes physical or engineered controls such as well points, cutoff walls, sump management, perimeter sealing, and efficient sequencing, as well as secondary containments, dikes, curbs, and other barriers to prevent water from entering the excavation cavity.

The contractor must submit a Dewatering Plan for Sites 2A, 2B, and 3 specific to work in those areas that addresses the management of contaminated groundwater pursuant to the requirements in this section.

The contractor must profile the groundwater based on laboratory analysis, documented it within a waste characterization form, and manifest as part of the waste determination documentation. All analysis must be completed by a ELAP accredited laboratory for each analysis conducted by that lab

and all laboratory certifications and accreditations must be current and submitted to the government for review and approval. All laboratory analysis results must be submitted to the Government for review and approval. The only authorized department who may sign the waste manifest is a representative from the New London Environmental Department. The only allowable PFAS analytical method for sampling is EPA Method 1633 by a ELAP laboratory accredited for that method.

If the laboratory analysis results indicate the presence of PFAS in the groundwater sample, all groundwater removed through dewatering must be considered contaminated with PFAS and containerized for off-site disposal. All PFAS data must be collected per EPA standard operating procedures, analyzed by an ELAP certified lab for that method, and in accordance with the latest version of the DoD QSM. Only EPA Method 1633 is permitted for this type of sampling. Discussion and approval of appropriate sample methods, sampling staff, analytical laboratory, and distribution of data must be clearly documented within the Environmental Protection Plan and Dewatering Plans for approval by the Installation Environmental Staff and Environmental Design Specialist.

All containerized groundwater must be documented within a waste characterization form and manifest as part of the waste determination documentation. The waste characterization analysis is dependent on receiving facility requirements and must meet the minimal sampling required by SUBBASE New London; in accordance with the most recent version of the Department of Defense Quality Systems Manual and in accordance with SUBASENLONINST 5090.27A Hazardous Waste Management Plan
Transport and dispose of contaminant impacted groundwater at a licensed off-site PFAS-accepting treatment or disposal facility.

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 30 days prior to commencement of work activities. Typically, regulatory notifications must be provided for the

following (this listing is not all-inclusive): demolition, renovation, NPDES defined site work, construction, removal or use of a permitted air emissions source, and remediation of controlled substances (asbestos, hazardous waste, lead paint).

1.6.3 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) or equipment local requirement. 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. Submit these Assembled Employee Training Records to the Contracting Officer at the conclusion of the project, unless otherwise directed.

Train personnel to meet Connecticut requirements. Conduct environmental protection/pollution control meetings for personnel prior to commencing construction activities. Conduct additional meetings for new personnel and when site conditions change. Include in the training and meeting agenda: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring

purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, waters of the United States, and endangered species and their habitat that are known to be in the area. Provide copy of the Erosion and Sediment Control Inspector Certification as required by Connecticut.

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. FAR 52.242-14 Suspension of Work provides that a suspension, delay, or interruption of work due to the fault or negligence of the Contractor allows for no adjustments to the contract for time extensions or equitable adjustments. In addition to a suspension of work, the Contracting Officer may use additional authorities under the contract or law.

1.7 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 Installation Environmental Department, Environmental Design Specialist, Construction manager, engineering technician, and Contracting Officer or Contracting Officer Representative to discuss the EPP and develop a mutual understanding relative to the details for environmental protection including measures for protecting natural resources, required reports, and other measures to be taken. Submit the EPP within 15 days after Contractor award and not less than 10 days before the preconstruction meeting. Revise the EPP throughout the project to include any reporting requirements, changes in site conditions, or contract modifications that change the project scope of work in a way that could have an environmental impact. No requirement in this section will relieve the Contractor of any applicable federal, state, and local environmental protection laws and regulations. During Construction, identify, implement, and submit for review and 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 control plan, spill control plan, solid waste management plan, wastewater management plan, air pollution control plan, contaminant prevention plan, a historical, archaeological, cultural resources, biological resources, and wetlands plan, Hazardous, Toxic and Radioactive Waste (HTRW) Plan

Non-Hazardous Solid Waste Disposal Plan and borrowing material plan, Dewatering Plan, Imported Fill Management Plan, Imported Fill Summary Report, Waste management Plan, Dewatering Plan, and Eastern Ribbon Snake Construction Impact Protection 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, jurisdictional wetlands, material storage areas, structures, sanitary facilities, known areas of residual contamination and/or former spill locations, 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.

Show where any fuels, hazardous substances, solvents, or lubricants will be stored. Provide a spill plan to address any releases of those materials.

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

Submit Clearing Plan. The trees surrounding the main site of construction are protected habitat for federally listed endangered and threatened species. Protective measures to only take trees required to complete the project are permitted. As the trees are considered a beneficial habitat to these protected species, trees may NOT be felled, cut, and/or pruned between APRIL 1-OCTOBER 31 of any given year.

Submit Payment of Standing Timber Removal to Real Property plan.All timber removed from the project site shall become the property of the Contractor. The Contractor shall reimburse the Government for the value of the timber. The Contractor shall submit payment to the Contracting Officer by cashier's or certified check in the amount of $760.00 made payable to the U.S. Treasury. Payment shall be made no less than five (5) days prior to the start of land clearing operations.

c. Replacement of damaged landscape features

d. Temporary construction

e. Fish and wildlife resources

Endangered and threatened species are documented to be present within and in the vicinity of the project site. All requirements from the Endangered Species consultation listed within the NEPA Categorical Exclusion must be followed in addition to the Endangered Species/Critical Habitat - Habitat Protection Plan related to the Eastern Ribbon Snake developed with the Stormwater Permit Application.

f. Wetland areas

Perform all required construction activities within wetlands and upland areas in accordance with the wetland permit requirements.

The contractor must sign onto the wetland permit as a co-permitee and assumes all liability for the permit. All required reporting, fees, and any natural resource damage claims are the sole responsibility of the contractor.

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).

e. Stormwater Pollution Control Plan (SWPCP).

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 and nonhazardous waste.

This item consists of the management procedures for hazardous waste to be generated. The elements of those procedures will coincide with the Installation Hazardous Waste Management Plan when within an installation. The Contracting Officer will provide a copy of the Installation Hazardous Waste Management Plan as applicable.

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) and Hazardous Waste Treatment, Storage, Disposal, and Handling plan.

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 including Wastewater Collection System and Water Distribution System.

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 and Rock Crushing/Processing

Submit truck and material haul routes along with a Dirt and Dust Control Plan for controlling dirt, debris, and dust on Installation roadways and from on-site rock crushing and processing activities. 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, and for controlling and limiting dust and debris from on-site rock crushing and processing operations.

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 in coordination with the Installation Air Permit Manager 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). Ensure required permits are obtained prior to installing and operating applicable equipment/processes.

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 for review and approval prior to delivery of emission equipment to the Installation. Approval is expected to take a MINIMUM of 12 months to appropriately permit through CT DEEP. Maintain applicable records and log hours of operation and fuel use. Logs must include reasons for operation and delineate between maintenance/testing, 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, rock crushing and processing, 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 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 equipment that may require permits or special approvals that the Contractor plans to use on site. This paragraph supplements the Contractor's responsibility under FAR 52.236-7 Permits and Responsibilities.

a. The following permits have been obtained by the Government:

(1) **Plans approval for the** General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities

(2) **Plans approval for the** Post-Construction Stormwater Management General Permit

(3) Inland Wetlands and Watercourses Municipal Permit

(4) Authorization Application for Disposal of Special Waste (Including Asbestos

b. The following permits must be obtained by the Construction Contractor:

(1) General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities

(2) Post-Construction Stormwater Management General 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 SOLID WASTE MANAGEMENT PERMIT

Provide the Contracting Officer with written notification of the quantity of anticipated solid waste or debris that is anticipated or estimated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance from the receiving location or as applicable; submit one copy of the receiving location state and local Solid Waste Management Permit or license showing such agency's approval of the disposal plan before transporting wastes off Government property.

1.10.1 Monthly Solid Waste Disposal Report

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

1.11 FACILITY HAZARDOUS WASTE GENERATOR STATUS

Naval Submarine Base New London 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 as applicable, regarding rare species or sensitive habitats that need to be protected, and tree clearing and rock blasting restrictions that may be in effect. The protection of rare, threatened, and endangered animal and plant species identified, including their habitats, is the Contractor's responsibility. The following species are known and could be affected within the construction area: Eastern ribbon snake, tricolored bat, and northern long-eared bat.

The project lies in or adjacent to the CT DEEP Natural Diversity Data Base (NDDB) area. Section 3(b) of the General Permit requires that the "…activity must not threaten the continued existence of any species listed pursuant to section 26-306 of the Connecticut General Statutes as endangered or threatened and must not result in the destruction or adverse modification of habitat designated as essential to such species."

Appendix A of the General Permit addresses methods for achieving compliance with endangered species. Appendix A states "If the site is entirely or partially within a shaded area for a listed species a registrant can only achieve compliance with section 3(b)(2) of the General Permit by obtaining a limited two-year determination under Section 2, a safe harbor determination under Section 3, or an approved mitigation plan

under Section 5 of this Appendix from the Department's Wildlife Division".

A letter from the Connecticut Department of Energy & Environmental Protection dated January 16, 2026, outlines the requirements for protecting the habitat of the Eastern ribbon snake. Land disturbance activities must consider local habitat features and apply fencing and/or time of year restrictions as appropriate.

As part of the habitat protection, provide a protection plan detailing the application of methods described in the Eastern Ribbon Snake Construction Impact Protection Plan within the project area. The Eastern Ribbon Snake Construction Impact Protection Plan is included as an attachment to Section 01 14 00 WORK RESTRICTIONS. Following the completion of construction activities, provide Eastern Ribbon Snake Protection Plan Report documenting the monitoring and maintenance of exclusionary barriers and other aspects of the protection plan.

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work that is consistent with the requirements of the Installation Environmental Office or as otherwise specified. Confine construction activities to within the limits of the work indicated or specified.

3.1.1 Flow Ways

Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as specified and permitted.

3.1.2 Vegetation

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

Protect existing trees that are to remain to ensure they are not injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. Coordinate with the Contracting Officer and Installation Environmental Office to determine appropriate action for trees and other landscape features scarred or damaged by equipment operations.

3.2 STORMWATER

Do not discharge stormwater from construction sites to the sanitary sewer. Stormwater that has collected in excavation and comingled with groundwater in Site 2A, 2B, and 3 is considered to be contaminated and must be containerized and transported off-site for disposal as described in 1.5.1.1.5. If the water from areas other than OU 2 and 3 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 an updated Construction General Permit as required by 40 CFR 122.26 or the State of Connecticut General Permit. Under the terms and conditions of the permit, install, inspect, maintain BMPs, prepare stormwater erosion and sediment control inspection reports, and submit SWPCP 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 Control Plan

Submit an updated project-specific Stormwater Pollution Control Plan (SWPCP) to the Contracting Officer for approval, within 30 days of Contract Award and prior to the commencement of work. The SWPCP must meet the requirements of 40 CFR 122.26 and the Connecticut State General Permit for Stormwater Discharges from Construction Activities.

Include the following:

a. Comply with terms of the Connecticut State General Permit for Stormwater Discharges from Construction Activities. Prepare SWPCP in accordance with Connecticut requirements.

b. Select applicable BMPs from EPA Fact Sheets located at https://www.epa.gov/npdes/national-menu-best-management-practices-bmps-stormwater#constr or in accordance with applicable state or local requirements.

c. Include a completed copy of the Notice of Intent, BMP Inspection Report Template, and Stormwater Notice of Termination, except for the effective date.

3.2.1.2 Stormwater Notice of Intent for Construction Activities

Prepare and submit an **updated Notice of Intent for NPDES** coverage under the general permit for construction activities to the Contracting Officer for review. **Notify the Contracting Officer 30 days prior to submitting the Notice of Intent to the appropriate state agency to terminate the plans approval permit.**

Submit the updated 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 SWPCP at the onsite construction office, and continually update as regulations require, reflecting current site conditions.

Comply with additional state and local requirements.

3.2.1.3 Inspection Reports

Submit "Inspection Reports" to the Contracting Officer in accordance with the State of Connecticut Construction General Permit.

3.2.1.4 Stormwater Pollution Control 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, SWPCP and SWPCP

update amendments, inspection reports and related corrective action records, copies of correspondence with the Connecticut 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. Prepare as-built topographic survey information required by the permitting agency for certification of the stormwater management system and provide to the Contracting Officer.

3.2.2 Erosion and Sediment Control Measures

Provide erosion and sediment control measures in accordance with state and local laws and regulations. Preserve vegetation to the maximum extent practicable.

Erosion control inspection reports may be compiled as part of a stormwater pollution prevention plan inspection reports.

3.2.2.1 Erosion Control

Prevent erosion by mulching, erosion control blankets, Geotextiles, temporary slope drains, fiber rolls, and construction entrances as indicated on Drawings. Stabilize slopes by chemical stabilization, seeding, erosion control blankets, or such combination of these methods necessary for effective erosion control. 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, and check dams. 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, all markers must be visible in the dark. Personnel must be knowledgeable of the purpose for marking and protecting particular objects.

3.2.4 Contractor Facilities and Work Areas

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Contracting Officer. Move or relocate the Contractor facilities only when approved by the Government. Provide erosion and sediment controls for onsite borrow and spoil areas to prevent sediment from entering nearby waters. Control temporary excavation and embankments for plant or work areas to protect adjacent areas.

3.2.5 Municipal Separate Storm Sewer System (MS4) Management

Comply with the Installation's MS4 permit requirements. Comply with local and Connecticut requirements.

3.3 SURFACE AND GROUNDWATER

3.3.1 Cofferdams, Diversions, and Dewatering

Construction operations for dewatering 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 Connecticut water quality standards and anti-degradation provisions. Do not discharge excavation ground water to the sanitary sewer, storm drains, or to surface waters without prior specific authorization in writing from the Installation Environmental Office or Contracting Officer and CT DEEP. 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.

Construction dewatering in Operable Units 2 and 3 must be containerized for off-site disposal. See additional requirements listed within Section 1.5.1.1.5 of this Specification.

3.3.2 Waters of the United States

Do not enter, disturb, destroy, or allow discharge of contaminants into waters of the United States except as authorized herein. The protection of waters of the United States shown on the drawings in accordance with paragraph LICENSES AND PERMITS is the Contractor's responsibility. Authorization to enter specific waters of the United States identified does not relieve the Contractor from any obligation to protect other waters of the United States within, adjacent to, or in the vicinity of the construction site and associated boundaries.

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 Venting of Refrigerant

Accidental venting of a refrigerant is a release and must be reported immediately to the Contracting Officer. Intentional venting of refrigerants (including most Non-ODS substitute refrigerants) is prohibited per 40 CFR 82.

3.5.6 EPA Certification Requirements

Heating and air conditioning technicians must be certified through an EPA-approved program. Maintain copies of certifications at the employees' places of business; technicians must carry certification wallet cards, as provided by environmental law.

3.5.7 Dust Control

Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster. Since these products contain Crystalline Silica, comply with the applicable OSHA standard, 29 CFR 1910.1053 or 29 CFR 1926.1153 for controlling exposure to Crystalline Silica Dust.

3.5.7.1 Particulates

Dust particles, aerosols and gaseous by-products from construction activities, and processing and preparation of materials (such as from asphaltic batch plants) must be controlled at all times, including weekends, holidays, and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates that would exceed 40 CFR 50, state, and local air pollution standards or that would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators, or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp. Provide sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a particulate nuisance or hazard occurs. Comply with state and local visibility regulations.

3.5.7.2 Abrasive Blasting

Blasting operations cannot be performed without prior approval of the Installation Air Program Manager. The use of silica sand is prohibited in sandblasting.

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

3.5.8 Odors

Control odors from construction activities. The odors must be in compliance with state regulations and local ordinances and may not constitute a health hazard.

3.6 WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of waste. Include procedures for pollution prevention/ hazardous waste minimization in the Hazardous Waste Management Section of the EPP. Obtain a copy of the installation's Pollution Prevention/Hazardous Waste Minimization Plan for reference material when preparing this part of the EPP. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the anticipated types of the hazardous materials to be used in the construction when requesting information.

3.6.1 Salvage, Reuse and Recycle

Identify anticipated materials and waste for salvage, reuse, and recycling. Describe actions to promote material reuse, resale or recycling. To the extent practicable, all scrap metal must be sent for reuse or recycling and will not be disposed of in a landfill.

Include the name, physical address, and telephone number of the hauler, if transported by a franchised solid waste hauler. Include the destination and, unless exempted, provide a copy of the state or local permit (cover) or license for recycling.

3.6.2 Nonhazardous Solid Waste Diversion Report

Maintain an inventory of nonhazardous solid waste diversion and disposal of construction and demolition debris. Submit a report to the Installation Environmental HW Program Manager through the Contracting Officer on the first working day after each month, starting the first month that nonhazardous solid waste has been generated. Include the following in the report:

Construction and Demolition (C&D) Debris Disposed	Disposal location	cubic yards or tons as appropriate
C&D Debris Recycled	Disposal location	cubic yards or tons as appropriate
C&D Debris Composted	Disposal location	cubic yards or tons as appropriate
Total C&D Debris Generated		cubic yards or tons as appropriate
Surplus Soils used as daily cover at RCRA D Landfill	Disposal location	cubic yards or tons as appropriate
Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount)	Disposal location	cubic yards or tons as appropriate
Surplus Soil disposed within landfill liner	Disposal location	cubic yards or tons as appropriate

3.7 WASTE MANAGEMENT AND DISPOSAL

3.7.1 Waste Determination Documentation

Complete a Waste Determination form (provided at the pre-construction

conference) for Contractor-derived wastes to be generated. All potentially hazardous solid waste streams that are not subject to a specific exclusion or exemption from the hazardous waste regulations (e.g., scrap metal, domestic sewage) or subject to special rules, (lead-acid batteries and precious metals) must be characterized in accordance with the requirements of 40 CFR 262.11 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 (waste characterization form, analytical lab reports, detection summary table) 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, surplus soils, spent treatment media, and containers of the original materials.

3.7.2 Solid Waste Management

3.7.2.1 Project Solid Waste Disposal Documentation Report

Provide copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, a statement indicating the disposal location for the solid waste that is signed by an employee authorized to legally obligate or bind the firm may be submitted. The sales documentation 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 with an active landfill leachate and gas collection treatment system is the minimum acceptable offsite solid waste disposal option. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. Segregate and separate treated wood components disposed at a lined landfill approved to accept this waste in accordance with local and state regulations. Solid waste disposal offsite must comply with most stringent local, state, and federal requirements, including 40 CFR 241, 40 CFR 243, and 40 CFR 258.

Manage hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, in accordance with 49 CFR 173.

3.7.3 Control and Management of Hazardous Waste and Nonhazardous

Do not dispose of hazardous waste and nonhazardous waste on Government property. Do not discharge any waste to a sanitary sewer, storm drain, wetlands, vegetated surface, or to surface waters or conduct waste treatment or disposal on Government property without written approval of the Contracting Officer and Installation Hazardous Waste Program Manager.

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 and applicable state or local regulations. Individual waste streams will be limited to 55 gallons of accumulation (or one 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 or 180-day, as appropriate, 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 20 working days for processing this request. Additional compliance

requirements (e.g., training and contingency planning) 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 - 40 CFR 279, 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

During waste accumulation label all containers in accordance with 40 CFR 262. Prior to offering a waste for off-site transport, determine the Department of Transportation's (DOT's) proper shipping names for waste in accordance with 49 CFR 172 (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 and applicable state or local regulations.

3.7.3.4 Universal Waste Management

Manage the following categories of universal waste in accordance with federal, state, and local requirements and installation instructions:

a. Batteries as described in 40 CFR 273.2

b. Lamps as described in 40 CFR 273.5

c. Mercury-containing equipment as described in 40 CFR 273.4

d. Aerosol cans as described in 40 CFR 273.6

e. Installation specific

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 or designated representative for the facility RCRA identification number that is to be used on each manifest.

Submit a copy of the applicable EPA and or state permit(s), manifest(s), or license(s) for transportation, treatment, storage, and disposal of hazardous and regulated waste by permitted facilities. Hazardous or toxic waste manifests must be reviewed, signed, and approved by the Contracting Officer before the Contractor may ship waste. To obtain specific disposal instructions, coordinate with the Installation Environmental Office. Refer to location special requirements for the Installation Point of Contact information.

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

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 wastewater off-Government property in accordance with 40 CFR 403, state, regional, and local laws and regulations.

3.7.6.1.2 Surface Discharge

Surface discharge in accordance with the requirements of the NPDES or state STORMWATER DISCHARGES FROM CONSTRUCTION SITES permit.

3.7.6.1.3 Land Application

Water generated from the flushing of lines after disinfection or disinfection in conjunction with hydrostatic testing must be discharged into the sanitary sewer with prior approval and notification to the Wastewater Treatment Plant's Operator.

3.8 HAZARDOUS MATERIAL MANAGEMENT

Include hazardous material control procedures in the Safety Plan, in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Do not bring hazardous material onto Government property that does not directly relate to requirements for the performance of this contract. Submit an SDS and estimated quantities to be used for each hazardous material to the Contracting Officer prior to bringing the material on the installation. Typical materials requiring SDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. Use hazardous materials in a manner that minimizes the amount of hazardous waste generated. Containers of hazardous materials must have National Fire

Protection Association labels or their equivalent. Certify that hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste, in accordance with 40 CFR 261 and state and installation requirements.

3.8.1 Contractor Hazardous Material Inventory Log

Submit the "Contractor Hazardous Material Inventory Log"(found at: https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables), which provides information required by (EPCRA Sections 312 and 313) along with corresponding SDS, to the Contracting Officer at the start and at the end of construction (30 days from final acceptance), and update no later than January 31 of each calendar year during the life of the contract. Keep copies of the SDSs for hazardous materials onsite. At the end of the project, provide the Contracting Officer with copies of the SDSs, and the maximum quantity of each material that was present at the site at any one time, the dates the material was present, the amount of each material that was used during the project, and how the material was used.

The Contracting Officer may request documentation for any spills or releases, environmental reports, or off-site transfers.

3.9 PREVIOUSLY USED EQUIPMENT

Clean previously used construction equipment prior to bringing it onto the project site. Equipment must be free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. Consult with the U.S. Department of Agriculture jurisdictional office for additional cleaning requirements.

3.10 CONTROL AND MANAGEMENT OF ASBESTOS-CONTAINING MATERIAL (ACM)

Manage and dispose of asbestos- containing waste in accordance with all applicable federal, state, and local (or Host Nation) requirements. Refer to Section 02 82 00 ASBESTOS REMEDIATION. Manifest asbestos-containing waste and provide the manifest to the Contracting Officer. Notifications to the regulatory authorities and Installation Air Program Manager are required before starting any asbestos work.

3.11 CONTROL AND MANAGEMENT OF LEAD-BASED PAINT (LBP)

Manage and dispose of lead-contaminated waste in accordance with 40 CFR 745 and Section 02 83 00 LEAD REMEDIATION. Manifest any lead-contaminated waste and provide the manifest to the Contracting Officer.

3.12 CONTROL AND MANAGEMENT OF POLYCHLORINATED BIPHENYLS (PCBs)

Manage and dispose of PCB-contaminated waste in accordance with 40 CFR 761 and Section 02 84 33 REMOVAL AND DISPOSAL OF POLYCHLORINATED BIPHENYLS (PCBs).

3.13 CONTROL AND MANAGEMENT OF LIGHTING BALLAST AND LAMPS CONTAINING PCBs

Manage and dispose of contaminated waste in accordance with 40 CFR 761. Refer to Section 02 84 16 HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBs AND MERCURY.

3.14 MILITARY MUNITIONS

In the event military munitions, as defined in 40 CFR 260, are discovered, or uncovered, immediately stop work in that area and immediately inform the Contracting Officer.

3.15 PETROLEUM, OIL, LUBRICANT (POL) STORAGE AND FUELING

POL products include flammable or combustible liquids, such as gasoline, diesel, lubricating oil, used engine oil, hydraulic oil, mineral oil, and cooking oil. Store POL products and fuel equipment and motor vehicles in a manner that affords the maximum protection against spills into the environment. Manage and store POL products in accordance with EPA 40 CFR 112, and other federal, state, regional, and local laws and regulations. Use secondary containments, dikes, curbs, and other barriers, to prevent POL products from spilling and entering the ground, storm or sewer drains, stormwater ditches or canals, or navigable waters of the United States. Describe in the EPP (see paragraph ENVIRONMENTAL PROTECTION PLAN) how POL tanks and containers must be stored, managed, and inspected and what protections must be provided.

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 Spill Prevention Control and Countermeasure (SPCC) plan meeting the requirements of 40 CFR 112. No individual container may contain more than 660 gallons. 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 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.

3.18 SOUND INTRUSION

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

Keep construction activities under surveillance and control to minimize environment damage by noise. Comply with the provisions of the State of Connecticut rules.

Keep construction activities under surveillance and control to minimize environment damage by noise.

3.19 POST CONSTRUCTION CLEANUP

Clean up areas used for construction in accordance with Contract Clause: "Cleaning Up". Unless otherwise instructed in writing by the Contracting Officer, remove traces of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. Grade parking area and similar temporarily used areas to conform with surrounding contours.

-- End of Section --

SECTION 03 70 00

MASS CONCRETE
02/10, CHG 2: 08/20

PART 1 GENERAL

1.1 UNIT PRICES

1.1.1 Concrete for thicknesses 3 feet or more.

1.1.1.1 Payment

Payment will be made for costs associated with completing the concrete work for concrete placed in the Earth covered magazine foundations.. However, these costs will not include the cost of the cement, pozzolan, slag, reinforcement, water-reducing admixture, high range water reducer, and embedded parts that are specified to be paid for separately. No payment will be made for concrete, as such, that is placed in structures of which payment is made as a lump sum.

1.1.1.2 Measurement

Concrete will be measurement for payment based upon the actual volume of concrete within the pay lines of the structures as indicated on the drawings. Measure concrete placed against the sides of any excavation without the use of intervening forms only within the pay lines of the structure. Do not make deductions for rounded or beveled edges, space occupied by metal work, electrical conduits or reinforcing steel, nor for voids or embedded items that are either less than 5 cubic feet in volume or 1 square foot in cross section.

1.1.1.3 Unit of Measure

Unit of measure: cubic yards.

1.1.2 Portland Cement

1.1.2.1 Payment

Payment will be made for costs associated with Portland cement, which includes the cost of required unloading, hauling, handling, and storage at the site, of all portland cement used in the work.

1.1.2.2 Measurement

Portland cement will be measured for payment based upon the number of tons of portland cement used unless specifically excepted, wasted, or used for the convenience of the Contractor. The quantity to be paid for will be determined by multiplying the approved batch weight in pounds/cubic yard of portland cement in each type of concrete used by the number of cubic yards of concrete types placed within the pay lines of the structure, as determined in accordance with the concrete bid items, and dividing by 2,000.

1.1.2.3 Unit of Measure

Unit of measure: tons (2000 lb).

1.1.3 Pozzolan

1.1.3.1 Payment

Payment will be made for costs associated with pozzolan, which includes the cost of required unloading, hauling, handling, and storage at the site, of all pozzolan used in the concrete bid items.

1.1.3.2 Measurement

Pozzolan will be measured for payment based upon the number of cubic feet solid volume of pozzolan used unless specifically excepted, wasted, or used for the convenience of the Contractor. The quantity to be paid for will be determined by multiplying the approved batch weight in pounds/cubic yard of pozzolan in each type of concrete used by the number of cubic yards of concrete of the types placed within the pay lines of the structure, as determined in accordance with the concrete bid items, and dividing by the product of the average specific gravity of the pozzolan multiplied by 62.4 pounds/cubic foot. The average specific gravity is the average of the test results for all material accepted during the period covered by the payment.

1.1.3.3 Unit of Measure

Unit of measure: cubic feet solid volume.

1.1.4 Ground Granulated Blast-Furnace Slag

1.1.4.1 Payment

Payment will be made for costs associated with ground granulated blast-furnace slag, which includes the cost of required unloading, hauling, handling, and storage at the site, of all ground granulated blast-furnace slag used in the concrete bid items.

1.1.4.2 Measurement

Ground granulated blast-furnace slag will be measured for payment based upon the number of tons of ground granulated blast-furnace slag used excluding the amount specifically excepted, wasted, or used for the convenience of the Contractor. The quantity to be paid for will be determined by multiplying the approved batch weight in pounds/cubic yard of ground granulated blast-furnace slag in each type of concrete used by the number of cubic yards of concrete types placed within the pay lines of the structure, as determined in accordance with the concrete bid items, and dividing by 2,000.

1.1.4.3 Unit of Measure

Unit of measure: tons (2000 lb).

1.1.5 Water-Reducing Admixture (WRA)

1.1.5.1 Payment

Payment will be made for costs associated with water-reducing admixture (WRA) at the applicable contract unit price per cubic yard of concrete containing water-reducing admixture.

1.1.5.2 Measurement

Water-reducing admixture (WRA) will be measured for payment based upon the actual volume of concrete containing the admixture and within the pay lines of the structures, as determined in accordance with the concrete bid items.

1.1.5.3 Unit of Measure

Unit of measure: cubic yards.

1.1.6 High-Range Water-Reducing Admixture (HRWR)

1.1.6.1 Payment

Payment will be made for costs associated with high-range water-reducing admixture (HRWR) at the applicable contract unit price per cubic yard of concrete containing water-reducing admixture.

1.1.6.2 Measurement

High-Range water-reducing admixture (HRWR) will be measured for payment based upon the actual volume of concrete containing the admixture and within the pay lines of the structures, as determined in accordance with the concrete bid items.

1.1.6.3 Unit of Measure

Unit of measure: cubic yards.

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 ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(2005; R 2017) Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 214R	(2011) Evaluation of Strength Test Results of Concrete
ACI 306R	(2016) Guide to Cold Weather Concreting

ASTM INTERNATIONAL (ASTM)

ASTM C31/C31M	(2022) 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 C40/C40M	(2020) Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
ASTM C94/C94M	(2021b) Standard Specification for Ready-Mixed Concrete
ASTM C117	(2017) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C123/C123M	(2023) Standard Test Method for Lightweight Particles in Aggregate
ASTM C127	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C128	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C142/C142M	(2017) Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2021) Standard Specification for Portland Cement
ASTM C171	(2020) Standard Specification for Sheet Materials for Curing Concrete
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
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 C295/C295M	(2019) Standard Guide for Petrographic Examination of Aggregates for Concrete
ASTM C309	(2019) Standard Specification for Liquid

	Membrane-Forming Compounds for Curing Concrete
ASTM C494/C494M	(2019) Standard Specification for Chemical Admixtures for Concrete
ASTM C535	(2016) Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C566	(2013) Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM C618	(2019) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C666/C666M	(2015) Resistance of Concrete to Rapid Freezing and Thawing
ASTM C881/C881M	(2020a) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C928/C928M	(2020a) Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs
ASTM C989/C989M	(2018a) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1059/C1059M	(2021) Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C1064/C1064M	(2023) 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 C1107/C1107M	(2020) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D4791	(2019) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(2018) Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices

NATIONAL READY MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(2000; R 2006) Concrete Plant Standards

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 55	(1992) Test Method for Within-Batch Uniformity of Freshly Mixed Concrete
COE CRD-C 94	(1995) Corps of Engineers Specification for Surface Retarders
COE CRD-C 100	(1975) Method of Sampling Concrete Aggregate and Aggregate Sources, and Selection of Material for Testing
COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 130	(2001) Standard Recommended Practice for Estimating Scratch Hardness of Coarse Aggregate Particles
COE CRD-C 143	(1962) Specifications for Meters for Automatic Indication of Moisture in Fine Aggregate
COE CRD-C 144	(1992) Standard Test Method for Resistance of Rock to Freezing and Thawing
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Concrete Lifts; G

Equipment; G

SD-03 Product Data

Batch Plant; G

Mixers

Construction Joint Treatment; G

Curing and Protection; G

Cold-Weather Protection; G

Hot-weather Placing; G

SD-07 Certificates

Sheet Curing

Nonshrink Grout; G

Bonding Agents

1.4 QUALITY ASSURANCE

1.4.1 Government Preconstruction Testing

1.4.1.1 Aggregate Sources

The aggregate sources listed in paragraph COMMERCIAL CONCRETE AGGREGATE SOURCES, have been tested, and at the time testing was performed, these sources were capable of producing materials of the quality and quantity required for this project provided suitable processing is performed. Deliver samples from any source selected, taken under the supervision of the Contracting Officer in accordance with COE CRD-C 100, within 15 days after notice to proceed. Sampling and shipment of samples is the Contractor's expense. 14 days will be required to complete evaluation of the aggregates. Testing will be performed by the Government in accordance with the applicable COE CRD-C or ASTM test methods. Tests to which aggregate may be subjected are listed in paragraph AGGREGATES. The material from the proposed source must meet the quality requirements of this paragraph to be used for the project. The Government test data and other information on aggregate quality of those sources listed in paragraph COMMERCIAL CONCRETE AGGREGATE SOURCES and are available for review in the District Office. Quality assurance testing of aggregates by the Government does not relieve the Contractor of quality control requirements.

1.4.1.2 Cementitious Materials, Admixtures, and Curing Materials

Notify the Contracting Officer of the source, brand name, type, and quantity of all materials (other than aggregates) to be used in the manufacture and curing of the concrete at least 60 days in advance of submitting samples for mixture proportioning studies. Assist the Contracting Officer in obtaining samples of each material. Sampling and testing as determined appropriate will be performed by and at the expense of the Government. If cement or pozzolan are to be obtained from more than one source, state the estimated amount of cement or pozzolan to be obtained from each source and the proposed schedule of shipments in the notification. When pozzolan other than fly ash is used, it must be from one source.

1.4.1.3 Materials for Mixture-Proportioning Studies

At least 30 days in advance of the time when placing of concrete is expected to begin, deliver samples of representative materials proposed for this project and meeting all the requirements of this specification by the Contractor at its expense. Take samples of aggregates under the supervision of the Contracting Officer in accordance with COE CRD-C 100, accompanied by test reports indicating conformance with grading and

quality requirements hereinafter specified. Provide samples of materials other than aggregates that are representative of those proposed for the project and submit accompanied by manufacturer's test reports indicating compliance with applicable specified requirements. Quantities of the following materials must be submitted:

MATERIAL	QUANTITY
6 inch nominal maximum-size coarse aggregate	
3 inch nominal maximum-size coarse aggregate	
1-1/2 inch nominal maximum-size coarse aggregate	
3/4 inch nominal maximum-size coarse aggregate	
Fine aggregate	
Cement	
Pozzolans	
Air-entraining admixture	
Other admixtures (each)	

Mixture-proportioning studies will be made by the Government.

1.4.2 Construction Testing by the Government

1.4.2.1 General

The Government will sample and test cementitious materials, admixtures, aggregates, and concrete during construction as considered appropriate to determine compliance with the specifications. 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 COE CRD-C 100. Slump and air content will be determined in accordance with ASTM C143/C143M and ASTM C231/C231M, respectively, except the point of sampling will be as directed. Compression test specimens will be made and laboratory cured in accordance with ASTM C31/C31M and will be tested in accordance with ASTM C39/C39M.

1.4.2.2 Testing Aggregates

Testing performed by the Government will not relieve the Contractor of its responsibility for testing as appropriate for quality control. During construction, aggregates will be sampled for acceptance testing as delivered to the mixer to determine compliance with specification provisions. Provide necessary facilities and labor for the ready procurement of representative samples under Contracting Officer supervision. The Government will test such samples at its expense using appropriate COE CRD-C and ASTM methods.

1.4.2.3 Cementitious Materials

Furnish cement or pozzolan or both from a prequalified source or, if not, it (they) will be sampled at the mill, shipping point, or site of the work by the Contracting Office. A list of prequalified cement sources and prequalified pozzolan sources is available from the Director, U.S. Army Corps of Engineers, Engineer Research and Development Center - Structures Laboratory, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199, ATTN: CEERD-SC. If tests prove that a material which has been delivered is unsatisfactory, promptly remove it from the site of the work. Cementitious materials that have not been used within 6 months after being tested will be retested by the Government at the expense of the Contractor when directed.

1.4.2.4 Cement from Prequalified Sources

Deliver and use cement directly from a mill of a producer designated as a prequalified source for the type of cement being used. Samples of cement for quality-assurance testing will be taken at the project site or cement-producing plant by the Contracting Officer for testing at the expense of the Government. Furnish a copy of the mill tests from the cement manufacturer to the Contracting Officer for each lot.

1.4.2.5 Pozzolan from Prequalified Sources

Deliver and use pozzolan directly from a producer designated as a prequalified source. Samples of pozzolan for check testing will be taken at the project site by the Contracting Officer for testing at the expense of the Government. Furnish a copy of the test results from the pozzolan manufacturer to the Contracting Officer for each lot.

1.4.2.6 Cement from Nonprequalified Sources

Cement, if not from a prequalified source, will be sampled and tested by or under the supervision of the Contracting Officer and at Government expense. Do not use cement until notice has been given by the Contracting Officer that test results are satisfactory. In the event of failure, the cement may be resampled and tested at the request of the Contractor and at the Contractor's expense. When the point of sampling is other than at the site of the work, the fill gate or gates of the sampled bin will be sealed and kept sealed until shipment from the bin has been completed. The fill gate or gates of conveyances used in shipment will be sealed by or under the supervision of the Contracting Officer. Conveyances will not be accepted at the site of the work unless received with all seals intact. If tested cement is rehandled at transfer points, the extra cost of inspection will be at the Contractor's expense. The cost of testing cement excess to project requirements will also be at the Contractor's expense and will be deducted from payments due the Contractor.

1.4.2.7 Pozzolan from Nonprequalified Sources

Pozzolan, if not from a prequalified source, will be sampled at the source or at the site of the work and will be stored in sealed bins pending completion of acceptance tests. Pozzolan may be resampled at the site when determined necessary. All sampling and testing will be performed by and at the expense of the Government. Release for shipment and approval for use will be based on compliance with seven day lime-pozzolan strength requirements and other physical, chemical, and uniformity requirements for which tests can be completed by the time the seven day lime-pozzolan

strength test is completed. Release for shipment and approval for use on this basis will be contingent on continuing compliance with the other requirements of the specifications. If test results of a bin fail, the contents may be resampled and tested at the Contractor's expense. The Government will supervise or perform the unsealing and resealing of bins and shipping conveyances. If tested pozzolan is rehandled at transfer points, the extra cost of inspection will be at the Contractor's expense. The cost of testing excess pozzolan in excess of project requirements will be at the Contractor's expense. The amount will be deducted from payment to the Contractor.

1.4.2.8 Ground Granulated Blast-Furnace Slag

Ground granulated blast-furnace slag will be sampled and tests at the mill or shipping point by and at the expense of the Government to determine that the material meets the requirements of the specification under which it is furnished. Do not use ground granulated blast-furnace slag until notice of acceptance has been given by the Contracting Officer. Ground granulated blast-furnace slag will be subject to check testing from samples obtained at the project site, as scheduled, and such sampling will be by or under the supervision of the Contracting Officer and at Government expense. Remove material not meeting specifications promptly from the site of work.

1.4.2.9 Chemical Admixtures

Provide satisfactory facilities for ready procurement of test samples. All sampling and testing of a chemical admixture will be by and at the expense of the Government. Tests will be conducted using samples of materials proposed for the project.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Cementitious Materials

1.5.1.1 Transportation

When bulk cement, pozzolan, or ground granulated blast-furnace slag is not unloaded from primary carriers directly into weather-tight hoppers at the batching plant, accomplish transportation from the railhead, mill, or intermediate storage to the batching plant in weather-tight trucks, conveyors, or other means that will protect the material from exposure to moisture. Transportation facilities for dry bulk silica fume must be approved in advance.

1.5.1.2 Storage

Furnish cementitious materials in bulk except that cement used for finishing and patching may be packaged, and silica fume may be packaged or in slurry form. Immediately upon receipt at the site of the work, store all cementitious materials in separate dry, weather-tight, and properly ventilated structures. All storage facilities must permit easy access for inspection and identification. Maintain sufficient materials in storage to complete any lift of concrete started. In order that cement may not become unduly aged after delivery, use any cement that has been stored at the site for 60 days or more before using cement of lesser age. Do not use silica fume in slurry form that has been in storage at the project site for longer than recommended by the manufacturer or that has been subjected to freezing in the work and remove from the site.

1.5.1.3 Separation of Materials

Provide separate facilities for unloading, transporting, and handling each cementitious material. Provide separate appropriate storage facilities for each type of cement and each source of pozzolan, or slag. Plainly mark the contents of each storage facility marked with a large permanent sign posted near the loading port.

1.5.2 Aggregates Storage

Store fine aggregate and each size of coarse aggregate in separate size groups adjacent to the batch plant and in such a manner as to prevent the intermingling of size groups or the inclusion of foreign materials in the concrete. Maintain sufficient fine and coarse aggregate at the site at all times to permit continuous placement and completion of any lift of concrete started.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide concrete composed of cementitious materials, water, fine and coarse aggregates, and admixtures. Use cementitious materials that are portland cement, portland cement in combination with pozzolan, portland blast-furnace slag cement, portland cement in combination with ground granulated blast-furnace slag, or portland-pozzolan cement. Use a retarding admixture, a WRA, a HRWRA, or an accelerating admixture. A retarding admixture may be used at the request of the Contractor when approved. Do not use chemical admixtures other than those listed above.

2.1.1 Design Requirements

The proportions of all material entering into each concrete mixture will be furnished to the Contractor. The proportions will be changed by the Contracting Officer as necessary. Make adjustments to the batch weights of aggregates and water as necessary to compensate for free moisture in the aggregates. Adjust the quantity of air-entrainment admixture to maintain the specified air content.

2.1.2 Air Content

Determine the air content by volume by ASTM C231/C231M. When the nominal maximum size of coarse aggregate is 1-1/2 inches or larger, the air content of the sample measured in accordance with ASTM C231/C231M must be 5-1/2 ± 1-1/2 percent. When the nominal maximum-size coarse aggregate is 3/4 inch, the air content must be 6 ± 1 percent. The specified air content must be present in the concrete when the concrete has been placed in the forms.

2.1.3 Slump

Determine slump in accordance with ASTM C143/C143M of 2 inches ± 1 inch for massive features and between 1 and 4 inches for all others except where placement by pump is approved, in which case the slump must be 4-1/2 ± 1-1/2 inches. In addition, the range of each set of two consecutive tests for each mixture must be no more than 2 inches. The above specified slump is that required at the forms.

2.1.4 Construction Tolerances

Make level and grade tolerance measurements of slabs as soon as possible after finishing. When forms or shoring are used, make the measurements prior to removal. Tolerances are not cumulative. The most restrictive tolerance controls. Do not allow tolerances to extend the structure beyond legal boundaries. Except as specified otherwise, plus tolerance increases the amount or dimension to which it applies, or raises a level alignment and minus tolerance decreases the amount or dimension to which it applied, or lowers a level alignment. A tolerance without sign means plus or minus. Where only one signed tolerance is specified, there is no limit in the other direction. Finish unformed finished surfaces subject to high-velocity flow (40 fps) to meet the tolerances for A-HV surfaces specified in Table, "TOLERANCES FOR FINISHED FORMED CONCRETE SURFACES".

2.1.5 Tabulations and Definitions

The definitions of the terms used in the following tabulations are used as defined and used in ACI 117. Make level and grade tolerance measurements of slabs as soon as possible after finishing.

TOLERANCES FOR FOUNDATIONS		
(1)	Lateral alignment	
	As cast to the center of gravity as specified; 0.02 times width of footing in direction of misplacement but not more than	2 inches
	Supporting masonry construction	1/2 inch
(2)	Level alignment	
	Top of footings supporting masonry	1/2 inch
	Top of other footings	+1/2 inch, -2 inch
(3)	Cross-sectional dimensions	
	Horizontal dimensions of formed members	+2 in.,-1/2 in.
	Horizontal dimensions of unformed members cast against soil	
	2 feet or less	+3 in., -1/2 in.
	Greater than 2 feet but less than 6 feet	+6 in., -1/2 in.
	Over 6 feet	+12 in., -1/2 in.
	Vertical dimension (thickness)	-5 percent

TOLERANCES FOR FOUNDATIONS			
(4)	Relative alignment		
	Slope of footing side and top surfaces with respect to the specified plan		1 in./10 ft

TOLERANCES FOR CAST-IN-PLACE REINFORCED CONCRETE FOR BUILDINGS			
(1)	Vertical alignment		
	For heights 100 feet		
		Lines, surfaces, and arrises	1 inch
		Outside corner of exposed corner columns and control joint grooves in concrete exposed to view	1/2 inch
	For heights greater than 100 ft		
		Lines, surfaces, and arrises, 1/1,000 times the height at any point but not more than	6 inches
		Outside corner of exposed corner columns and control joint grooves in concrete, 1/2,000 times the height at any point but not more than	3 inches
(2)	Lateral alignment		
	Members		1 inch
	In slabs, centerline location of openings 12 in. or smaller and edge location of larger openings		1/2 inch
	Sawcuts, joints, and weakened plane embedment in slabs		3/4 inch
(3)	Level alignment		
	Top of slabs		
		Elevation of slabs-on-grade	3/4 inch
		Elevation of top surfaces of formed slabs before removal of supporting shores	3/4 inch
	Elevation of formed surfaces before removal of shores		3/4 inch
	Lintels, sills, parapets, horizontal grooves, and other lines exposed to view		1/2 inch

TOLERANCES FOR CAST-IN-PLACE REINFORCED CONCRETE FOR BUILDINGS			
(4)	Cross-sectional dimensions		
	Members, such as columns, beams, piers, walls (thickness only) and slabs (thickness only)		
		12 inches dimension or less	+3/8, -1/4 inch
		More than 12 inches but not over 3 feet dimension	+1/2, -3/8 inch
		Over 3 feet dimension	+1, -3/4 inch
(5)	Relative alignment		
	Stairs		
		Different in height between adjacent risers	1/8 inch
		Different in width between adjacent treads	1/4 inch
	Grooves		
		Specified width 2 inches or less	1/8 inch
		Specified width more than 2 inches but not more than 12 inches	1/4 inch
	Sawcuts, joints, and weakened plane on slab		
		Lateral, gradual	3/4 inch in 10 feet
		Lateral, abrupt	0 inch
(6)	Openings through members		
	Cross-sectional size of opening		+1, -1/4 inch
	Location of centerline of opening		1/2 inch

TOLERANCE FOR FINISHED FORMED CONCRETE SURFACES		
(1)	Vertical alignment: Formed surfaces slope with respect to the specified plane	
	Vertical alignment of outside corner of exposed corner columns and control joint grooves in concrete exposed to view	1/4 in. in 10 ft
	All other conditions	3/8 in. in 10 ft

TOLERANCE FOR FINISHED FORMED CONCRETE SURFACES		
(2)	Abrupt variation: The offset between concrete surfaces under adjacent pieces of formwork for the following classes of surface: (For Class A-HV, positive means raise of elevation in the direction of waterflow, negative means drop of elevation in the direction of waterflow)	
	Class A-HV, in the direction of waterflow	+0, -1/8 inch
	*Class A-HV, perpendicular to the direction of waterflow	1/8 inch
	Class A	1/8 inch
	Class B	1/4 inch
	Class C	1/4 inch
	Class D	1 inch
(3)	Gradual variation: Surface finish tolerances as measured by placing a freestanding (unleveled), 5 foot straightedge for plane surface or curved template for curved surface anywhere on the surface and allowing it to rest upon two high spots within 72 hr after concrete placement. The gap at any point between the straightedge or template and the surface must not exceed:	
	*Class A (including Class A-HV)	1/8 inch
	Class B	1/4 inch
	Class C	1/2 inch
	Class D	1 inch
*Includes any high-velocity flow surface.		

TOLERANCES FOR CAST-IN-PLACE, VERTICALLY SLIPFORMED BUILDING ELEMENTS		
(1)	Translation and rotation from a fixed point at the base of the structure:	
	For heights 100 feet or less	2 inches
	For heights greater than 100 feet, 1/600 times the height but not more than	8 inches
(2)	Lateral alignment	
	Between adjacent elements	2 inches
(3)	Cross-sectional dimensions	
	Wall thickness	+3/4 inch, -3/8 inch

TOLERANCES FOR CAST-IN-PLACE, VERTICALLY SLIPFORMED BUILDING ELEMENTS		
(4)	Relative alignment	
	Formed surface slope with respect to the specified plane	3/4 in. in 10 ft

TOLERANCES FOR MASS CONCRETE STRUCTURES OTHER THAN BUILDINGS			
(1)	Vertical alignment		
	Visible surfaces		1-1/4 inch
	Concealed surfaces		2-1/2 inches
	Side walls for radial gates and similar watertight joints		3/16 inch
(2)	Lateral alignment		
	Visible surfaces		1-1/4 inch
	Concealed surfaces		2-1/2 inches
(3)	Level alignment		
	Visible flatwork and formed surfaces		1/2 inch
	Concealed flatwork and formed surfaces		1 inch
	Sills for radial gates and similar watertight joints		3/16 inch
(4)	Relative alignment: Formed surface slope with respect to the specified plane		
	Slopes in lateral and level alignments		
		Visible surfaces	1/4 in. in 10 ft
		Concealed surfaces	1/2 in. in 10 ft
	Slopes in vertical alignment		
		Visible surfaces	1/2 in. in 10 ft
		Concealed surfaces	1 in. in 10 ft

TOLERANCES FOR CANAL LINING		
(1)	Lateral alignment	
	Alignment of tangents	2 inches
	Alignment of curves	4 inches
	Width of section at any height	0.0025W + 1 inch
(2)	Level alignment	
	Profile grade	1 inch
	Surface of invert	1/4 inch
	Surface of side slope	1/2 inch
	Height of lining	0.005H + 1 inch
(3)	Cross-sectional dimensions	
	Thickness of lining cross section: percent of specified thickness provided average thickness is maintained as determined by daily batch volumes	10

TOLERANCES FOR TUNNEL LININGS, CONDUITS, AND FILLING AND EMPTYING CULVERTS			
(1)	Lateral alignment		
	Centerline alignment		
		Water conveying tunnels, conduits, and culverts	1/2 inch
		Other	1 inch
	Inside dimensions		0.005 times inside dimension
(2)	Level alignment		
	Profile grade		
		Water conveying tunnels, conduits, and culverts	1/2 inch
		Other	1 inch
	Surface of invert		1/4 inch
	Surface of side slope		1/2 inch

(3)	Cross-sectional dimension		
	Thickness at any point		
		Tunnel and culvert lining	-0 inch
		Conduits	+5 percent thickness but not less than1/2 inch
			-2.5 percent thickness but not less than 1/4 inch

2.2 MATERIALS

2.2.1 Cementitious Materials

2.2.1.1 Portland Cement

Provide portland cement conforming to ASTM C150/C150M, Type I or II, including the heat of hydration requirement at 7 days .

2.2.1.2 Pozzolan Other

Provide pozzolan conforming to ASTM C618, Class C or F, including low alkali. Uniformity Requirements (for entrained air) must apply to all fly ash.

2.2.1.3 Ground Granulated Blast-Furnace Slag

Provide ground granulated blast-furnace slag conforming to ASTM C989/C989M, Grade 100.

2.2.1.4 Temperature of Cementitious Materials

The temperature of the cementitious materials as delivered to the site must not exceed 150 degrees F.

2.2.2 Admixtures

All chemical admixtures furnished as liquids must be in a solution of suitable viscosity for field use as determined by the Contracting Officer.

2.2.2.1 Air-Entraining Admixtures

Provide air-entraining admixture conforming to ASTM C260/C260M and consistently entrain air in the specified ranges under field conditions.

2.2.2.2 Accelerating Admixture

Do not use calcium chloride. Use accelerators that meet the requirements of ASTM C494/C494M, Type C.

2.2.2.3 Retarding Admixture

Provide retarding admixture meeting the requirements of ASTM C494/C494M,

Type B, or D, except that the 6-month and 1-year compressive strength tests are waived. The admixture may be added to the concrete mixture only when approved. Do not use Type D as the reason to reduce the cementitious material content unless used in mixture proportioning studies.

2.2.2.4 Water-Reducing Admixture

Provide a water-reducing admixture meeting the requirements of ASTM C494/C494M, Type A , except that the 6-month and 1-year compressive strength tests are waived. The admixture may be added to the concrete mixture only when its use is approved or directed and after mixture proportioning studies.

2.2.2.5 High-Range Water-Reducing Admixture (HRWRA)

Use high-range water-reducing admixture that meets the requirements of ASTM C494/C494M, Type F , except the 6-month and 1-year strength requirements are waived.

2.2.3 Curing Materials

2.2.3.1 Sheet Materials

Provide sheet curing materials conforming to ASTM C171, type optional, except do not use polyethylene sheet. Submit a manufacturer's certificate certifying that the materials comply with the requirements of ASTM C171, if sheet curing is used.

2.2.3.2 Membrane-Forming Curing Compound

Provide membrane-forming curing compound conforming to ASTM C309, Type 1D or 2, except a styrene acrylate or chlorinated rubber compound meeting ASTM C309, Class B, requirements may be used for surfaces that are to be painted or are to receive subsequent coatings, or floors that are to receive adhesive applications of resilient flooring. Select curing compound selected that is compatible with any subsequent paint, roofing, coating, or flooring specified.

2.2.3.3 Burlap

Provide burlap for curing purposes conforming to AASHTO M 182.

2.2.4 Water

Use water for washing aggregates and for mixing and curing concrete that is free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances and in compliance with COE CRD-C 400.

2.2.5 Aggregates

2.2.5.1 Aggregate Composition

Provide fine aggregate consisting of natural sand, manufactured sand, or a combination of natural and manufactured sands. Provide coarse aggregate consisting of gravel, crushed gravel, crushed stone, air-cooled blast-furnace slag, or a combination thereof. ""

2.2.5.2 Grading

2.2.5.2.1 Fine Aggregate

Deliver fine aggregate to the mixers with a grading such that the individual percent retained on any sieve does not vary more than 3 percent from the percent retained on that sieve in a fixed grading selected by the Contractor with the approval of the Contracting Officer. The fixed grading may be selected at the start of concrete placement and based upon 30 days fine aggregate production or selected after the first 30 days of concrete placement. The minimum individual percent retained on the 2.36 mm (No. 8) sieve must be 5 percent and on all smaller sieves, except the 75 µm (No. 200), must be 10 percent. In addition to the grading limits, the fine aggregate, as delivered to the mixer, must have a fineness modulus of no less than 2.25 nor more than 2.85. Also control the grading of the fine aggregate so that the fineness moduli groups (average of the current test and the previous two tests) of the fine aggregate as delivered to the mixer do not vary more than 0.10 from the target fineness modulus of the fixed grading selected by the Contractor and approved by the Contracting Officer. The range of each group must not exceed 0.20. Determine the fineness modulus in accordance with COE CRD-C 104. At the option of the Contractor, fine aggregate may be separated into two or more sizes or classifications, but control the uniformity of grading of the separate sizes so that they may be combined throughout the job in fixed proportions established during the first 30 days of concrete placement. The selected fixed grading must be within the following limits, except any individual test result may be outside these limits if within the allowable 3 percent variation from the selected grading.

SIEVE DESIGNATION U.S. STANDARD SQUARE MESH	PERMISSIBLE LIMITS PERCENT BY MASS, PASSING
3/8 inch	100
No. 4	95 - 100
No. 8	80 - 95
No. 16	60 - 80
No. 30	35 - 60
No. 50	15 - 30
No. 100	5 - 10
No. 200	0 - 5

2.2.5.2.2 Coarse Aggregate

Rescreen coarse aggregate just prior to delivery to the concrete batch plant bins. The grading of the coarse aggregate within the separate size groups must conform to the following requirements as delivered to the mixer.

PERCENT BY MASS PASSING INDIVIDUAL SIEVES				
U.S. STANDARD SIEVE SIZE	No. 4 to 3/4 inch	3/4 inch to 1-1/2 inch	1-1/2 inch to 3 inch	3 inch to 6 inch
7 inch				100
6 inch				90 - 100
4 inch			100	20 - 55
3 inch			90 - 100	0 - 15
2 inch		100	20 - 55	0 - 5
1-1/2 inch		90 - 100	0 - 10	
1 inch	100	20 - 45	0 - 5	
3/4 inch	90 - 100	0 - 10		
3/8 inch	20 - 55	0 - 5		
No. 4	0 - 10			
No. 8	0 - 5			

2.2.5.3 Particle Shape

The quantity of flat and elongated particles in the separate size groups of coarse aggregate, as determined by ASTM D4791, using a value of 3 for width-thickness ratio and length-width ratio must not exceed 25 percent in any size group.

2.2.5.4 Nominal Maximum-Size of Aggregate

Use nominal maximum-size of coarse aggregate in the various parts of the work in accordance with the following tabulation except as directed. The NMSA may be changed for sections requiring a special quality of concrete as directed.

FEATURES	NOMINAL MAXIMUM-SIZE AGGREGATE
Sections 7-1/2 inches or less in width or slabs 4 inches or less in thickness or any section with a clear distance between reinforcement less than 2-1/4 inches	3/4 inch
Sections over 7-1/2 inches or slabs at least 4 inch in thickness. However, do not use this size in any section in which the clear distance between reinforcement is less than 2-1/4 inch	1-1/2 inch

FEATURES	NOMINAL MAXIMUM-SIZE AGGREGATE
Unreinforced sections over 12 inches in width and reinforced sections over 18 inches in width or slabs 10 inches or greater in thickness. However, do not use this size in any section in which the clear distance between reinforcing bars is less than 4-1/2 inches	3 inches
Massive sections exceeding 6 feet in width and slabs 24 inches in thickness, in which the clear distance between reinforcing bars is at least 9 inches	6 inches

2.2.5.5 Moisture Content

Do not place fine aggregate in bins at the batch plant until it is in a stable state of moisture content. Reach a stable moisture content when the variation in the percent of total moisture tested in accordance with ASTM C566 and when sampled at the same location will not be more than 0.5 percent during 1 hour of the 2 hours prior to placing the material in the batch plant bins and the variation in moisture content when sampled at the same location must not be more than 2.0 percent during the last 8 hour period that the aggregate remains in the stockpile. Deliver coarse aggregate to the mixers with the least amount of free moisture and the least variation in free moisture practicable under the job conditions. Under no conditions deliver coarse aggregate to the mixer "dripping wet".

2.2.5.6 Commercial Concrete Aggregate Sources

Concrete aggregates may be furnished from any source capable of meeting the quality requirements stated in paragraph AGGREGATES above.

a. Selection of Source - After the award of the contract, designate in writing only one source or combination of sources from which the Contractor proposes to furnish aggregates. Regardless of the source selected, provide samples for quality-assurance testing as required by paragraphs GOVERNMENT PRECONSTRUCTION TESTING and MATERIALS FOR MIXTURE-PROPORTIONING STUDIES IN part 1. If a source for coarse or fine aggregate so designated by the Contractor does not meet the quality requirements stated above, do not submit for approval other sources but furnish the coarse or fine aggregate, as the case may be, from one or a combination of the sources listed at no additional cost to the Government.

2.2.6 Nonshrink Grout

Use nonshrink grout for use in setting base plates and machinery conforming to ASTM C1107/C1107M, and is a commercial formulation suitable for the application proposed. Submit descriptive literature of the grout proposed for use containing certified laboratory test results showing that it meets ASTM C1107/C1107M 60 days prior to its use together with a

certificate from the manufacturer stating that the grout is suitable for the application or exposure for which it is being considered. In addition, a detailed plan for review, showing equipment and procedures for use in mixing and placing the grout.

2.2.7 Packaged Dry Repair Materials

Provide packaged dry rapid-hardening cementitious materials for concrete repairs that is a commercial formulation conforming to ASTM C928/C928M requiring only the addition of water.

2.2.8 Bonding Agents

Submit descriptive literature and certification in advance of their use. Bonding agents must meet the following requirements:

2.2.8.1 Latex Bonding Agent

Provide latex agents for bonding fresh to hardened concrete conforming to ASTM C1059/C1059M, Type II.

2.2.8.2 Epoxy Resin

Provide epoxy resins for use in repairs conforming to ASTM C881/C881M, Type V, Grade I or II.

2.2.9 Surface Retarder

Provide surface retarder conforming to COE CRD-C 94.

2.3 PLANT AND EQUIPMENT

Submit the methods and description of the equipment proposed for transporting, handling, and depositing the concrete for review, 60 days before concrete placement begins. Include site drawings or sketches with locations of equipment and placement site.

2.3.1 Batch Plant

Submit details and data on the concrete plant, within 60 days prior to assembly, to the Contracting Officer for conformance review with the requirements of paragraph PLANT AND EQUIPMENT. Batch plant must meet the following requirements:

2.3.2 Location

The concrete plant may be located at the site of the work in the general area indicated on the drawings, or may be located offsite.

2.3.3 Bins and Silos

Provide separate bins, compartments, or silos for each size or classification of aggregate and for each of the cementitious materials. Provide compartments of ample size and constructed so that the various materials will be maintained separately under all working conditions. Separate all compartments containing bulk cement, pozzolan, ground granulated blast-furnace slag, or silica fume from each other by a free-draining air space. Clearly mark all filling ports with a permanent sign stating the contents.

2.3.4 Batching Equipment

2.3.4.1 Batchers

Weigh aggregate in separate weigh batchers with individual scales. Weigh each bulk cement and/or other cementitious materials on a separate scale in a separate weigh batcher. Measure water by weight or by volume. If measured by weight, do not weigh cumulatively with another ingredient. Measure ice separately by weight. Batch admixtures separately and batch by weight or by volume in accordance with the manufacturer's recommendations.

2.3.4.2 Water Batcher

Provide a suitable water-measuring and batching device that will be capable of measuring and batching the mixing water within the specified tolerances for each batch. Use mechanism for delivering water to the mixers that is free from leakage when the valves are closed. Interlock the filling and discharge valves for the water batcher so that the discharge valve cannot be opened before the filling valve is fully closed. When a water meter is used, provide a suitable strainer ahead of the metering device.

2.3.4.3 Admixture Dispensers

Provide a separate batcher or dispenser for each admixture. Equip each plant with the necessary calibration devices that will permit convenient checking of the accuracy of the dispensed volume of the particular admixture. Use batching or dispensing devices capable of repetitively controlling the batching of the admixtures to the accuracy specified. Use piping for liquid admixtures that are free from leaks and properly valved to prevent backflow or siphoning. Include a device or devices that will detect and indicate the presence or absence of the admixture or provide a means of visually observing the admixture in the process of being batched or discharged in the dispensing system. Ensure each system is capable of ready adjustment to permit varying the quantity of admixture to be batched. Interlock each dispenser with the batching and discharge operations so that each admixture is added separately to the batch in solution in a separate portion of the mixing water or in fine aggregate in a manner to ensure uniform distribution of the admixtures throughout the batch during the required mixing period. Store and handle admixtures in accordance with the manufacturers recommendations.

2.3.4.4 Moisture Control

Provide plant which is capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the weights of the materials being batched. Provide a moisture meter complying with the provisions of COE CRD-C 143 for measurement of moisture in the fine aggregate. Arrange the sensing element so that the measurement is made near the batcher charging gate of the fine aggregate bin or in the fine aggregate batcher.

2.3.4.5 Scales

Provide facilities for the accurate measurement and control of each of the materials entering each batch of concrete. Use weighing equipment and controls conforming to the applicable requirements of NIST HB 44, except

that the accuracy must be within 0.2 percent of the scale capacity. Provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring device. Make tests at the frequency required in paragraph TESTS AND INSPECTIONS in PART 3, and in the presence of a Government quality assurance representative. Include a visible indicator for each weighing unit that indicates the scale load at all stages of the weighing operation and shows the scale in balance at zero load. Arrange weighing equipment so that the concrete plant operator can observe the indicators.

2.3.4.6 Operation and Accuracy

Start weighing operation of each material automatically when actuated by a single starter switch and end automatically when the designated amount of each material has been reached. These requirements can be met by providing an automatic batching system as defined in NRMCA CPMB 100. Provide equipment to permit the selection of preset mixes each by the movement of not more than two switches or other control devices. Cumulative weighing will not be permitted. Construct and arrange weigh batchers so that the sequence and timing of batcher discharge gates can be controlled to produce a ribboning and mixing of the aggregates, water, admixtures, and cementitious materials as the materials pass through the charging hopper into the mixer. Include provisions to facilitate the inspection of all operations at all times. Deliver materials from the batching equipment within the following limits of accuracy:

MATERIAL	PERCENT
Cementitious materials	± 1
Water	± 1
Aggregate smaller than 1-1/2 inch size	± 2
Aggregate larger than 1-1/2 inch size	± 3
Chemical admixtures	± 3

2.3.4.7 Interlocks

Interlock batchers and mixers so that:

a. The charging device of each batcher cannot be actuated until all scales have returned to zero balance within ± 0.2 percent of the scale capacity and each volumetric device has reset to start or has signaled empty.

b. The charging device of each batcher cannot be actuated if the discharge device is open.

c. The discharge device of each batcher cannot be actuated if the charging device is open.

d. The discharge device of each batcher cannot be actuated until the indicated material is within the allowable tolerances.

e. One admixture is batched automatically with the water.

f. Each additional admixture is batched automatically with a separate portion of the water or with the fine aggregate.

g. The mixers cannot be discharged until the required mixing time has elapsed.

2.3.4.8 Recorder

Provide an accurate recorder or recorders conforming to the following detailed requirements:

a. Produce a graphical or digital record on a single visible chart or tape of the weight or volume of each material in the batchers at the conclusion of the batching cycle. Produce record prior to delivery of the materials to the mixer. After the batchers have been discharged, show the return to empty condition.

b. House graphical recording or digital printout unit completely in a single cabinet that is capable of being locked.

c. Mark the chart or tape so that each batch may be permanently identified and so that variations in batch weights of each type of batch can be readily observed. Provide chart or tape which is easily interpreted in increments not exceeding 0.5 percent of each batch weight.

d. Show time of day at intervals of no more than 15 minutes.

e. The recorder chart or tape will become the property of the Government.

f. Place recorder in a position convenient for observation by the concrete plant operator and the Government inspector.

g. The recorded weights or volumes when compared to the weights or volumes actually batched must be accurate within ± 2 percent.

2.3.4.9 Batch Counters

Include devices for automatically counting the total number of batches of all concrete batched and the number of batches of each preset mixture.

2.3.4.10 Rescreening Plant

Locate, arrange, and operate rescreening plant in a manner that all coarse aggregate will be routed through the plant and that its operation will ensure delivery to the mixers of graded coarse aggregate free from excessive variation and conforming to the size groups and grading of paragraph AGGREGATES above and with moisture content conforming to the provisions of paragraph MOISTURE CONTENT above. Coarse aggregate may be rescreened and delivered to the batch plant bins one size group at a time or two or more adjacent size groups at a time. Simultaneous rescreening of nonadjacent size groups is not permitted. Waste all material passing the bottom screen of the smallest size of coarse aggregate being screened.

2.3.4.11 Washing Plant

Wash all coarse aggregates immediately prior to entering the rescreening

plant. Provide rewashing plant containing water nozzles and vibrating screens to remove foreign materials and coatings from aggregate particles. Use water for washing meeting the requirements of paragraph WATER above.

2.3.4.12 Trial Operation

Not less than 7 days prior to commencement of concrete placing, make a test of the batching and mixing plant in the presence of the Contracting Officer to check operational adequacy. Produce the number of full-scale concrete batches required in trial runs as directed, do not exceed 20, and proportion as directed. Waste or use all concrete produced in these tests for purposes other than inclusion in structures covered by this specification. Correct all deficiencies found in plant operation prior to the start of concrete placing operations. No separate payment will be made to the Contractor for labor or materials required by provisions of this paragraph. Notify the Contracting Officer of the trial operation not less than 7 days prior to the start of the trial operation.

2.3.4.13 Protection

Protect weighing, indicating, recording, and control equipment against exposure to dust, moisture, and vibration so that there is no interference with proper operation of the equipment.

2.3.5 Laboratory Areas

Provide a room in the plant to house the moisture and grading testing equipment for aggregate and to provide working space. Provide another room for testing fresh concrete and for fabricating and initial curing of concrete test specimens in accordance with ASTM C31/C31M. The size, arrangement, and location of these rooms will be subject to approval. Provide electricity, air conditioning, heat, and water as required for use in these laboratory areas.

2.3.6 Mixers

Provide stationary mixers or truck mixers. Each mixer must combine the materials into a uniform mixture and discharge this mixture without segregation. Do not charge mixers in excess of the capacity recommended by the manufacturer on the nameplate. Excessive over-mixing requiring introduction of additional water will not be permitted. Maintain mixers in satisfactory operating condition, and keep mixer drums free of hardened concrete. Replace mixer blades or paddles when worn down more than 10 percent of their depth when compared with the manufacturer's dimension for new blades. Should any mixer at any time produce unsatisfactory results, discontinue its use promptly ntil it is repaired or replaced. Submit the make, type, capacity, and number of the concrete mixers proposed for use, 60 days prior to installation for review by the Contracting Officer for conformance with the requirements of paragraph PLANT AND EQUIPMENT.

2.3.6.1 Stationary Mixer Uniformity Requirements

Adjust the size of the batch, the mixing time, the charging sequence, and other factors to provide concrete that meets the uniformity limits specified herein and in paragraph MIXER UNIFORMITY IN PART 3. Perform all testing in accordance with COE CRD-C 55. When regular testing is performed, the concrete must meet the limits of any five of the six uniformity requirements. When abbreviated testing is performed, the

concrete must meet only those requirements listed for abbreviated testing. The initial mixer evaluation test is a regular test and perform prior to the start of concrete placement. Use concrete proportions for the evaluation that contains the largest size aggregate on the project and as directed. Regular testing consists of performing all six tests on three batches of concrete. The range for regular testing is the average of the ranges of the three batches. Abbreviated testing consists of performing the three required tests on a single batch of concrete. The range for abbreviated testing is the range for one batch. If more than one mixer is used and all are identical in terms of make, type, capacity, condition, speed of rotation, etc., the results of tests on one of the mixers applies to the others, subject to approval. Perform mixer evaluations as specified herein.

	ABBREVIATED	
PARAMETER	REGULAR TESTS ALLOWABLE MAXIMUM RANGE FOR AVERAGE OF 3 BATCHES	TESTS ALLOWABLE MAXIMUM RANGE FOR 1 BATCH
Unit weight of air-free mortar, lb/cu ft	2.0	2.0
Air content, percent	1.0	---
Slump, inches	1.0	---
Coarse aggregate, percent	6.0	6.0
Compressive strength at 7 days, percent	10.0	10.0
Water content, percent	1.5	---

2.3.6.2 Truck Mixers

Provide truck mixers and the mixing of concrete therein conforming to the requirements of ASTM C94/C94M. A truck mixer may be used 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. Do not use truck mixers to mix or agitate concrete with greater than 1-1/2 inch nominal maximum-size aggregate or concrete with a slump of 2 inches or less. Determine the acceptability of truck mixers by uniformity tests in accordance with ASTM C94/C94M.

2.3.7 Sampling Facilities

Provide suitable facilities and labor for obtaining representative samples of concrete in accordance with ASTM C172/C172M for Contractor quality control (QC) and Government quality control (QA) testing.

2.3.8 Coarse Aggregate

Provide suitable facilities for readily obtaining representative samples of coarse aggregate for test purposes immediately prior to the material entering the mixer.

2.3.9 Transporting Equipment

Design, operate, and maintain transporting equipment so that it does not cause or permit segregation or loss of material. Do not drop concrete vertically more than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized.

2.3.9.1 Buckets

Use bottom-dump buckets conforming to the following requirements: the interior hopper slope must be no less than 70 degrees from the horizontal; the minimum dimension of the clear gate opening must be at least five times the nominal maximum size of the aggregate, and the area of the gate opening must not be less than 2 square feet; the bucket gates must be grout-tight when closed, the double clamshell type, and manually, pneumatically, or hydraulically operated; and design the gate-opening mechanism to close the gates automatically when the control is released or when the air or hydraulic line is broken. If gate actuation is dependent on integral air or hydraulic reservoirs, the capacity of the reservoirs must be sufficient to open and close the gates three times without recharging the reservoir.

2.3.9.2 Trucks

Use truck mixers or agitators for transporting central-mixed concrete conforming to the applicable requirements of ASTM C94/C94M. Do not use truck mixers to transport concrete with larger than 1-1/2 inch nominal maximum-size aggregate or 2 inch or lower slump. Nonagitating trucks may be used for transporting central-mixed concrete over a smooth road when the hauling time is less than 15 minutes and the slump is less than 3 inches. Bodies of nonagitating trucks must be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

2.3.9.3 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating truck, the chutes supplied by the truck manufacturer as standard equipment may be used. Use a discharge deflector when required by the Contracting Officer. Separate chutes and other similar equipment are not permitted for conveying concrete except when specifically approved and do not increase slump to accommodate their use.

2.3.9.4 Belt Conveyors

Design and operate belt conveyors to assure a uniform flow of concrete from mixer or delivery truck to final place of deposit without segregation of ingredients or loss of mortar and provide with positive means for preventing segregation of the concrete or loss of mortar at the transfer point(s) and the point of placing. Do not exceed idler spacing of 36 inches. Use a minimum belt speed of 300 feet per minute and a maximum of 750 feet per minute. Belt width must be a minimum of 24 inches if the NMSA is 6 inches and must be a minimum of 16 inches if the NMSA is 3 inches or less. The NMSA required in mixture proportions furnished by the Government will not be changed to accommodate the belt width.

2.3.9.5 Pump Placement

Concrete may be conveyed by positive-displacement pump when approved. Pump placement will be approved only for areas where placement by bucket or conveyor is difficult or impractical. Provide piston or squeeze-pressure type pumping equipment. Provide rigid-steel pipe or heavy-duty flexible hose pipeline. Do not use aluminum pipe. Use pipe with an inside diameter at least 3 times the nominal maximum size of the coarse aggregate in the concrete to be pumped but no less than 4 inches.

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

3.1.1 Vibrators

Keep an adequate number of vibrators on hand to meet placing requirements, and spare vibrators available to maintain production in the event of breakdown. Make adequate air pressure available for air vibrators and adequate voltage for electric vibrators. Use vibrators of the proper size, frequency, and amplitude for the type of work being performed in conformance with the following requirements:

APPLICATION	HEAD DIAMETER (inch)	FREQUENCY VPM	AMPLITUDE (inch)
Thin walls, beams, etc.	1-1/4 - 2-1/2	9,000 - 13,500	0.020 - 0.04
General construction	2 - 3-1/2	8,000 - 12,000	0.025 - 0.05
Heavy sections	3 - 6	7,000 - 10,500	0.030 - 0.06
Mass concrete	5 - 7	5,500 - 8,500	0.04 - 0.08

Use frequency and amplitude within the range indicated in the tabulation as determined in accordance with paragraph TESTS AND INSPECTIONS below.

3.1.2 Embedded Items

Before placing concrete, take care to determine that all embedded items are securely fastened in place as indicated in the drawings or required. Provide embedded items that are free of oil and other foreign matter such as loose coatings of rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Provide any air or water lines or other materials embedded in structures, as authorized construction expedients, conforming to the above requirements and upon completion of their use backfill with concrete or mortar as directed. Welding will not be permitted on embedded or otherwise exposed metals which are in contact with concrete surfaces. Tack welding of or to embedded items will not be permitted.

3.1.3 Concrete on Earth Foundations

Place concrete on earth foundations that are clean, damp, and free from frost, ice, and standing or running water. Prior to placement of concrete, compact the earth foundation satisfactorily in accordance with the provisions of Section 31 00 00 EARTHWORK.

3.1.4 Concrete on Rock Foundations

Place concrete on rock surfaces that are clean and free from oil, standing or running water, ice, mud, drummy rock, coatings, debris, and loose, semidetached, overhanging, or unsound fragments. Clean faults or joints to a satisfactory depth and to firm rock on the sides as directed by the Contracting Officer. Immediately before concrete is placed, clean all rock surfaces thoroughly by the use of air-water jet, high-pressure water jet, or sandblasting as described in the paragraph below. Keep all rock surfaces continuously wet for at least 24 hours immediately prior to placing concrete thereon. Cover all approximately horizontal surfaces immediately before the concrete is placed with a 1/2 inch layer of mortar composed of the same sand and cementitious materials used in the concrete. The sand-cementitious materials ratio and the water-cementitious material ratio of the mortar must be approximately the same as those used in the concrete mixture. Cover mortar with concrete before the mortar has reached its initial time of setting.

3.1.5 Construction Joint Treatment

Submit the method and equipment proposed for joint cleanup and waste disposal, for review 30 days before concrete placement begins.

3.1.5.1 Joint Preparation

Prepare concrete surfaces to which other concrete is to be bonded for receiving the next lift or adjacent concrete by cleaning by sandblasting, high-pressure water jet, or air-water cutting. Surface cutting by air-water jets will not be permitted for concrete surfaces congested with reinforcing steel or if they are relatively inaccessible. If, for any other reason, it is considered undesirable to disturb the surface of a lift before it has hardened, the use of sandblasting or high-pressure water jet after hardening will be required. Regardless of the method used, the resulting surface must be free from all laitance and inferior concrete so that clean, well-bonded coarse aggregate particles are exposed uniformly over the lift surface. Apply joint treatment method such that the edges of the larger particles of aggregate are not undercut. Where joint preparation occurs more than 2 days prior to placing the next lift or where the work in the area subsequent to the joint preparation causes dirt or debris to be deposited on the surface, clean the surface as the last operation prior to placing the next lift. Keep the surface of the construction joint continuously wet for the first 12 hours of the 24 hours prior to placing concrete, except that the surface must be damp with no free water at the time of placement.

3.1.5.2 Air-Water Cutting

Perform air-water cutting of a construction joint at the proper time, generally between 4 and 12 hours after placement and only on horizontal construction joints. This period may be modified if a retarder is used to prolong the setting of the cement at surface of the concrete. Use an air pressure of 90 to 110 psi in the jet, and use sufficient water pressure to bring the water into effective influence of the air pressure. When approved a surface retarder complying with the requirements of COE CRD-C 94 may be applied to the surface of the lift to prolong the period of time during which air-water cutting is effective. Prior to receiving approval, furnish samples of the material to be used and demonstrate the method to be used in its application. After cutting, wash and rinse the surface until the wash water is no longer cloudy. If air-water cutting does not

produce acceptable results, prepare the surface by high-pressure water jet or sandblasting.

3.1.5.3 High-Pressure Water Jet

A stream of water under a pressure of not less than 3,000 psi may be used for 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 high-pressure water jet is incapable of a satisfactory cleaning, clean the surface by sandblasting.

3.1.5.4 Wet Sandblasting

This method of joint preparation may be used when the concrete has reached sufficient strength to prevent undercutting of coarse aggregate particles. Continue the operation until all accumulated laitance, coatings, stains, debris, and foreign materials are removed. Then wash the surface of the concrete thoroughly to remove all loose material. This method may be used on both horizontal and vertical surfaces.

3.1.5.5 Waste Water Disposal

Use a method in disposing of waste water employed in cutting, washing, and rinsing of concrete surfaces such 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 must meet all requirements of Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

3.2 TRANSPORTING AND PLACING

3.2.1 Transporting

Methods and equipment for conveying and depositing the concrete into the form are subject to approval. Provide transporting system with sufficient capacity to supply concrete at a rate to prevent cold joints forming during placement. A properly designed and sized elephant trunk and rigid drop chute bottom section which will prevent free-fall within the elephant trunk and rigid drop chute will be used if concrete is to drop more than 5 feet. If concrete is to be placed through installed horizontal or sloping reinforcing bars, discharge the concrete into a pipe or elephant trunk that is long enough to extend through the reinforcing bars to within 5 feet of the placing surface. In no case will concrete be discharged to free fall through the reinforcing bars.

3.2.1.1 Transporting by Bucket

Provide indicating and signaling devices to control the identification of types or classes of concrete as they are mixed and discharged into buckets for transfer to the forms. Identify each type or class of concrete visually by placing a colored tag or marker on a bucket as it leaves the mixing plant so that the concrete may be positively identified in the forms and placed in the structure in the desired position.

3.2.1.2 Transporting by Pump

The nominal maximum-size coarse aggregate will not be reduced or mixture proportions changed to accommodate a pump except as specifically determined appropriate. The distance and height to be pumped must not

exceed limits recommended by the pump manufacturer. Supply concrete to the pump continuously. When pumping is completed, eject concrete remaining in the pipeline without contamination of concrete in place. After each operation clean the equipment thoroughly and waste flushing water outside the forms.

3.2.1.3 Transporting by Belt Conveyor

Methods and equipment for transporting the concrete by belt conveyor into the form are subject to approval.

3.2.2 Placing

Provide placing system with sufficient capacity to supply concrete at a rate which will prevent cold joints in any placement. Work concrete into the corners and angles of the forms and around all reinforcement and embedded items without permitting the material to segregate. Deposit concrete as close as possible to its final position in the forms, and in so depositing, there must be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Regulate depositing of concrete so that it will be effectively placed and consolidated in horizontal layers not exceeding 5 feet in thickness with a minimum of lateral movement. Deposit amount of concrete such that it can be readily and thoroughly consolidated and do not exceed 4 cubic yards in one pile. All concrete-placing equipment and methods are be subject to approval. Concrete placement will not be permitted when, in the opinion of the Contracting Officer, weather conditions prevent proper placement and consolidation.

3.2.2.1 Time Interval Between Mixing and Placing

Place concrete mixed in stationary mixers and transported by nonagitating equipment within 30 minutes after it has been mixed, unless otherwise authorized. When concrete is truck mixed or when a truck mixer or agitator is used for transporting concrete mixed by stationary mixers, deliver the concrete to the site of the work, and complete discharge within 1 hour after introduction of the cement to either the water or aggregate.

3.2.2.2 Hot-Weather Placing

The temperature of the concrete when deposited in the forms during hot weather must not exceed 90 degrees F at humidity greater than 60%, 85 degrees F at humidity between 40%-60%, and 80 degrees F at humidity less than 40 percent except as further required above. An approved retarding admixture may be used in accordance with paragraph RETARDING ADMIXTURE to facilitate placing and finishing. Cool steel forms and reinforcement and conveying and placing equipment if necessary to assist in maintaining specified concrete-placing temperature. Measure the temperature of the fresh concrete in accordance with ASTM C1064/C1064M. Submit a description of the materials and methods proposed for protection of the concrete 60 days in advance of anticipated need date for review, when concrete is to be placed under hot-weather conditions.

3.2.2.3 Cold Weather Placing

The temperature of the concrete when deposited in the forms must not be less than 40 degrees F. The ambient temperature of the placement area and all surfaces to receive concrete must be above 32 degrees F. Materials

entering the mixer must be free from ice, snow, and frozen lumps. Closely regulate heating of mixing water or aggregates necessary to keep the concrete temperature above 40 degrees F so that the concrete temperature does not exceed 60 degrees F. An accelerator may be used when approved in advance.

3.2.2.4 **Concrete Lifts**

Deposit all concrete in approximately horizontal layers about 1-1/2 feet in thickness in stepped progression at such a rate that the formation of cold joints will be prevented. Place slabs in one lift, unless 2.5 foot or more deep. Where 7.5 foot or greater lift depths are permitted, furnish approved cantilever forms that are jointed or hinged approximately midheight to facilitate placement against surfaces sloping more than 10 degrees from vertical. At the beginning of the placing of a lift, retract the top half of a hinged or jointed form to such a position that it does not interfere with the operation of buckets placing concrete adjacent to the form. Use a minimum of five successive horizontal layers in stepped progression for 7.5 foot lifts. Where 5 foot lifts are required, use a minimum of three successive horizontal layers in stepped progression. Place each new layer of concrete on the oldest exposed layer. Do not exceed 40 feet maximum exposed bulkhead face of concrete between adjacent monoliths except as otherwise approved. Submit a lift drawing and bill of materials for each lift of concrete. (Show only one lift on a drawing). These drawings must be to scale and show all embedded items in sufficient detail for the proper installation and prosecution of the work. Identify all embedded electrical and/or mechanical items. The drawings must not be less than 22 by 34 inches in size and use a sufficiently large scale to clearly show all details of the structure covered by these drawings. Include a note on each lift drawing indicating all contract drawings from which the lift drawing was prepared. Submit 2 copies of each drawing for review at least 60 days prior to scheduling the lift for placement.

3.2.2.5 Consolidation

Immediately after placing, consolidate each layer of concrete by internal vibrating equipment. Do not use vibrators to cause concrete to flow for significant distances within the forms. Hand spading may be used if necessary together with internal vibration along formed surfaces permanently exposed to view. Do not use form vibrators unless forms are specifically designed for this use and unless specifically approved. Insert vibrator vertically at uniform spacing over the entire area of placement. Use distance between insertions that is approximately 1.5 times the radius of action of the vibrator. The vibrator must penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding unhardened layer if such exists. Hold it stationary until the concrete is consolidated and then withdraw slowly. Consolidate slabs 8 inches or less in depth by approved methods.

3.3 FINISHING

Finish concrete in accordance with Specification Section 03 30 00 CAST-IN-PLACE CONCRETE

3.4 CURING AND PROTECTION

Submit the curing media and methods to be used for review 30 days before concrete placement begins.

3.4.1 Curing Time

Cure all concrete by one of the following methods or combination of methods for the period of time given below corresponding to the cementing materials used in the concrete:

Type III portland cement	3 days
Type I portland cement	7 days
Portland cement in combination with silica fume	7 days
Type II portland cement	14 days
Portland cement blended with 25 percent or less fly-ash or GGBF slag	14 days
Portland cement blended with more than 25 percent fly-ash or GGBF slag	21 days

Begin curing immediately after placing. Provide all equipment needed for curing and protection of the concrete on hand and ready to install before actual concrete placement begins. Use curing medium and method, or the combination of media and methods, as approved in accordance with paragraph SUBMITTALS, SD-03 Product Data, submittal item "Curing".

3.4.2 Moist Curing

Moist cure horizontal and nearly horizontal surfaces by ponding, by covering with a minimum uniform thickness of 2 inches of continuously saturated sand, or by covering with saturated nonstaining burlap or cotton mats. Rinse burlap and cotton mats to remove soluble substances before using. Moist cure other surfaces when approved or directed. Maintain concrete that is moist cured continuously, not periodically, wet for the duration of the entire curing period. Use water for curing complying with the requirements of the paragraph WATER in PART 2. If the water, sand, mats, etc. cause staining or discoloration of permanently exposed concrete surfaces, clean the surfaces by an approved method. When wood forms are left in place during curing, keep the forms continuously wet except for sealed insulation curing in cold weather. When steel forms are left in place on vertical surfaces during curing of concrete, carefully break loose the forms from the hardened concrete and continuously introduce curing water into the void. The temperature of the water should be tepid. Allow horizontal construction joints to dry sufficiently to remove free water immediately prior to placing the next lift.

3.4.3 Membrane Curing

Membrane curing may be used on surfaces that are not specified or directed to receive moist curing and that are not to receive a grout-cleaned finish. Do not use membrane-forming curing compound on surfaces that contain protruding steel reinforcing, that are heated by free steam, that will have additional concrete bonded to them, or that are to be grout-cleaned.

3.4.3.1 Nonpigmented Curing Compound

Nonpigmented compound conforming to ASTM C309, Type ID, containing a fugitive dye may be used on surfaces that will be exposed to view when the project is completed. The reflective requirements of ASTM C309 are waived. Shield surfaces cured with nonpigmented compound from direct rays of the sun for 3 days.

3.4.3.2 Application

Apply curing compound to formed surfaces immediately after the forms are removed. Moisten surfaces thoroughly with water, and apply the curing compound as soon as free water disappears. Apply curing compound to unformed surfaces as soon as free water has disappeared provided steps have been taken when necessary to prevent premature loss of free water due to excessive evaporation as described in paragraph UNFORMED SURFACES above. Apply curing compound in a two-coat continuous operation by motorized power-spraying equipment or pressure-tank equipment operating at a minimum pressure of 75 psi with provisions for continuous agitation. The application equipment must be approved in advance. Do not use hand-operated pressure applicators ("garden sprayers") except in small, isolated areas as approved. Apply compound at a uniform coverage of no more than 400 square feet/gallon for each coat. Apply the second coat perpendicular to the first coat. Respray concrete surfaces that have been subjected to rainfall within 3 hours after the curing compound has been applied by the method and at the coverage specified. Protect all concrete surfaces on which the curing compound has been applied for the duration of the entire curing period from pedestrian and vehicular traffic and from any other influence that will disrupt the continuity of the curing membrane.

3.4.4 Sheet Curing

Use sheets only on horizontal or near horizontal surfaces. Use sheets complying with the requirements of ASTM C171, except do not use polyethylene sheet. Wet all surfaces thoroughly and completely cover with waterproof paper, or polyethylene-coated burlap. Lay covering with light-colored side up. Lap covering no less than 4 inches and tape to form a continuous cover with completely closed joints. Use weighted sheet to prevent displacement so that it remains in contact with the concrete during the specified length of curing. Fold coverings down over exposed edges of slabs and secure by approved means. Repair sheets immediately or replace if tears or holes appear during the curing period.

3.4.5 Sealed Insulation Curing

Between dates listed in paragraph COLD WEATHER PROTECTION below where cold weather protection is provided entirely by insulation, seal all joints in the insulation to retard moisture loss and maintain a seal throughout the curing period.

3.4.6 Protection

No fire or excessive heat is permitted near or in direct contact with concrete at any time. Do not operate vibratory earth compaction equipment or pile-driving equipment within 100 feet horizontally of concrete less than 5 days old. Blasting is not permitted within 100 feet horizontally of concrete less than 90 days old. Blasting plans must be approved by the Contracting Officer. Keep all galleries, conduits, and other openings

through the concrete closed or sealed during the entire construction period. Protect the surface of the concrete from rain or snow during placing.

3.4.7 Cold Weather-Protection

During cold weather, as defined by ACI 306R, cover all concrete less than 30 days old . Submit a description of the materials and methods proposed for protection of the concrete, 60 days in advance of anticipated need date for review, when concrete is to be placed under cold-weather conditions.

a. Maintain insulation in such a condition that the R value does not diminish during the period of protection. Protect edges and corners of the placement with a double layer of the insulation specified above for a minimum distance of 2 feet in all directions.

b. Insulate concrete placed prior to the starting date from the starting date until it reaches an age of 5 days. Insulate concrete placed after the starting date continuously during and subsequent to placement.

c. Insulate forms in such a manner that the combined form-insulation system has a thermal resistance (R value) no less than that specified. Keep insulation and the combined form-insulation system in place for at least 5 days after placement of the concrete. After 5 days, forms and insulation on vertical surfaces may be removed for periods not to exceed 4 hours in a 24 hour period to allow forms to be moved, and insulation on horizontal surfaces may be removed for periods not to exceed 8 hours in a 24 hour period to allow reinforcement to be installed, insulation to be installed, lift joints to be prepared, etc. provided that suitable precautions are taken to prevent the concrete from being subjected at any time to ambient temperatures of 20 degrees F or below.

d. Insulate the first 6 feet of all steel protruding from insulated concrete with material having an R value as stated. Insulate all form bolts and metal ribs on the forms in a like manner. During the period of protection there must be no holes or openings in the insulation or between the insulation and concrete which permit ambient air to penetrate the insulation except as noted for construction purposes. Give special attention to seams, corners, and edges to prevent holes or openings in the insulation.

3.5 BASE PLATES AND BEARING PLATES

3.5.1 Setting of Plates

After being plumbed and properly positioned, provide full bearing column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates using nonshrink grout. The space between the top of the concrete bearing surface and the bottom of the plate must not be less than 1/24 of the width of the plate or 1/2 inch, whichever is greater. Concrete surfaces must be clean, free of oil, grease, and laitance, and damp. Metal surfaces must be clean and free of oil, grease, and rust.

3.5.2 Nonshrink Grout

Use nonshrink grout conforming to the requirement of paragraph NONSHRINK GROUT. 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.

3.5.2.1 Mixing and Placing

Perform mixing and placing in conformance with the material manufacturer's instructions and as specified. Dry-mix ingredients thoroughly 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 masonry bearing surface and the plate with the grout. Use forms consisting of wood or other suitable material for retaining the grout and remove after the grout has hardened. If Grade "A" grout is used, form all surfaces, including top surfaces, to provide restraint. Work placed grout to eliminate voids; however, avoid overworking and breakdown of the initial set. Do not retemper or subject grout to vibration from any source. Where clearances are unusually small, make placement under pressure with a grout pump. Maintain temperature of the grout, and of surfaces receiving the grout, at 65 to 85 degrees F until after setting.

3.5.2.2 Treatment of Exposed Surfaces

Those types of grout containing metallic aggregate, Grade B or C grout, must, after setting, have exposed surfaces under cut back 1 inch from the edge of the base plate and immediately cover with a thick coat of mortar proportioned by weight of one part portland cement, two parts sand, and sufficient water to make the mixture placeable. The parge coat must have a smooth, dense finish. The exposed surface of other types of nonshrink grout must have a smooth, dense finish.

3.5.2.3 Curing

Cure grout and parge coats in conformance with paragraph CURING AND PROTECTION above.

3.6 TESTS AND INSPECTIONS

3.6.1 General

Perform the following inspection and tests as described, and, based upon the results of these inspections and tests, take the action required and submit reports as required. When, in the opinion of the Contracting Officer, the concreting operation is out of control, cease concrete placement. The laboratory performing the tests must be onsite and conform with the requirements given in ASTM C1077. The individuals who sample and test concrete or the constituents of concrete as required in this specification will have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per year thereafter for conformance with ASTM C1077. The individual who performs the inspection will have demonstrated a knowledge and ability equivalent to the ACI minimum guidelines for certification of Concrete Transportation

Construction Inspector (CTCI) .

3.6.2 Testing and Inspection Requirements

3.6.2.1 Fine Aggregate

3.6.2.1.1 Grading

At least once during each shift when the concrete plant is operating, there make 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. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. Recoed the results on a sheet on which are also shown the specification limits applicable to the project.

3.6.2.1.2 Fineness Modulus Control Chart

Group results for fineness modulus in sets of three consecutive tests, and plot the average and range of each group on a control chart. Draw the upper and lower control limits for average 0.10 units above and below the target fineness modulus, and the upper control limit for range 0.20 units above the target fineness modulus.

3.6.2.1.3 Corrective Action for Fine Aggregate Grading

When the amount passing any sieve is outside the specification limits, resample and retest the fine aggregate immediately. If there is another failure for any sieve, report the fact immediately. Whenever a point on the fineness modulus control chart, either for average or range, is beyond one of the control limits, double the frequency of testing. If two consecutive points are beyond the control limits, consider the process out of control and stop concreting. Notify the Contracting Officer, and take immediate steps to rectify the situation. After two consecutive points have fallen within the control limits, testing at the normal frequency may be resumed.

3.6.2.1.4 Moisture Content Testing

When in the opinion of the Contracting Officer the electric moisture meter is not operating satisfactorily, perform at least four tests for moisture content in accordance with ASTM C566 during each 8-hour period of mixing plant operation. Select times for the tests randomly within the 8-hour period. Make an additional test whenever the slump is shown to be out of control or excessive variation in workability is reported by the placing foreman. When an electric moisture meter is operating satisfactorily, make at least two direct measurements of moisture content per week to check the calibration of the meter. Use results of tests for moisture content to adjust the added water in the control of the batch plant.

3.6.2.1.5 Moisture Content Corrective Action

Whenever the moisture content of the fine aggregate changes by 0.5 percent or more, adjust the scale settings for the fine-aggregate batcher and water batcher (directly or by means of a moisture compensation device).

3.6.2.2 Coarse Aggregate

3.6.2.2.1 Grading

At least once during each shift in which the concrete plant is operating, perform a sieve analysis in accordance with ASTM C136/C136M for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production 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. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When facilities are available to test samples five times as large as those required in ASTM C136/C136M, averaging is not permitted.

3.6.2.2.2 Corrective Action for Grading

When the amount passing any sieve is outside the specification limits, resample and retest the coarse aggregate immediately. If the second sample fails on any sieve, report that fact. Where two consecutive averages of five tests (or two consecutive tests where large samples are used) are outside specification limits, consider the operation out of control, and report that fact, stop concreting, and take immediate steps to correct the grading.

3.6.2.2.3 Coarse Aggregate Moisture Content

Make a test for moisture content of each size group of coarse aggregate at least once a shift. When two consecutive readings for smallest size coarse aggregate differ by more than 1.0 percent, increase frequency of testing to that specified previously for fine aggregate.

3.6.2.2.4 Coarse Aggregate Moisture Corrective Action

Whenever the moisture content of any size of coarse aggregate changes by 0.5 percent or more, adjust the scale setting for the coarse aggregate batcher and the water batcher to compensate for this.

3.6.2.2.5 Particle Shape Testing

When directed, a problem exists in connection with aggregate particle shape, make tests in accordance with ASTM D4791. Testing frequency must not be ess than one per day, when directed.

3.6.2.2.6 Particle Shape Corrective Action

When testing for particle shape is required, report two consecutive failures in the same sieve size immediately, and determine what corrective action is needed.

3.6.2.2.7 Material Finer than the No. 200 Sieve

When in the opinion of the Contracting Officer, a problem exists in connection with the cleanliness of aggregate, make tests in accordance with ASTM C117. Testing frequency must be as directed.

3.6.2.2.8 Corrective Action for Material Finer than the No. 200 Sieve

When material finer than the No. 200 sieve exceeds 1.0 percent of the weight of the aggregate finer than 1-1/2 inches or 0.5 percent of the weight of the aggregate coarser than 1-1/2 inches, notify the Contracting Officer and initiate steps, such as washing or other corrective action, immediately.

3.6.2.3 Quality of Aggregates

3.6.2.3.1 Frequency of Quality Tests

Prior to submitting samples for mixture proportioning studies and 30 days prior to the start of concrete placement, perform the tests for aggregate quality in the following list. In addition, after the start of concrete placement, perform tests for aggregate quality in accordance with the following frequency schedule. Take samples tested after the start of concrete placement immediately prior to entering the concrete mixer.

PROPERTY	FINE AGGREGATE	FREQUENCY COARSE AGGREGATE	TEST
Specific Gravity	Every 3 months	Every 3 months	ASTM C127 ASTM C128
Absorption	Every 3 months	Every 3 months	ASTM C127 ASTM C128
Durability (Procedure A)	Factor using Every 12 months	Every 12 months	COE CRD-C 144 ASTM C666/C666M
Clay Lumps and Friable Particles	Every 3 months	Every 3 months	ASTM C142/C142M
Material Finer than the 75-µm (No. 200) Sieve	Every 3 months	Every 3 months	ASTM C117
Organic Impurities	Every 3 months	Not applicable	ASTM C40/C40M
L.A. Abrasion	Not applicable	Every 6 months	ASTM C131/C131M ASTM C535
Soft and Friable (Scratch Hardness)	Not applicable	Every 6 months	COE CRD-C 130
Petrographic Examination	Every 6 months	Every 6 months	ASTM C295/C295M
Chert, less than 2.40 specific gravity	Every 6 months	Every 6 months	ASTM C123/C123M

PROPERTY	FINE AGGREGATE	FREQUENCY COARSE AGGREGATE	TEST
Coal and lignite, less than 2.00 specific gravity	Every 6 months	Every 6 months	ASTM C123/C123M

3.6.2.3.2 Corrective Action for Aggregate Quality

If the result of a quality test fails to meet the requirements for quality during submittal of samples for mixture-proportioning studies or immediately prior to start of concrete placement, change production procedures or materials and perform additional tests until the material meets the quality requirements prior to proceeding with either mixture-proportioning studies or starting concrete placement. After concrete placement commences, whenever the result of a test for quality fails the requirements, rerun the test immediately. If the second test fails the quality requirement, report the fact and take immediate steps to rectify the situation.

3.6.2.4 Scales

3.6.2.4.1 Weighing Accuracy

Check accuracy of the scales by test weights at least once a month for conformance with the applicable requirements of paragraph PLANT AND EQUIPMENT. Also make such tests as directed whenever there are variations in properties of the fresh concrete that could result from batching errors.

3.6.2.4.2 Batching and Recording Accuracy

Check the accuracy of each batching and recording device once a week during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. Confirm that the calibration devices described in paragraph PLANT AND EQUIPMENT in PART 2, for checking the accuracy of dispensed admixtures, are operating properly.

3.6.2.4.3 Scales Corrective Action

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. Correct discrepancies in recording accuracies immediately.

3.6.2.5 Batch-Plant Control

Control the measurement of all constituent materials including cementitious materials, each size of aggregate, water, and admixtures continuously. Adjust 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 plant operation.

3.6.2.6 Concrete

3.6.2.6.1 Air Content

Make at least two tests for air content on randomly selected batches of each concrete mixture produced during each 8 hour period of concrete production. Make additional tests when excessive variation in workability is reported. Make tests in accordance with ASTM C231/C231M. Plot the average of each set of two tests for each mixture on control charts on which the average percent and upper and lower limits are set in accordance with paragraph MATERIALS FOR MIXTURE PROPORTIONING STUDIES, in PART 1, for each NMSA. Plot the range between two consecutive tests for each mixture on a control chart on which the upper control limit is 3.0 percent. Normally take samples for air content at the mixer, however the Contractor is responsible for delivering the concrete to the forms at the proper air content. Take samples at the placement site as often as required, depending on the Contractor's delivery method, to determine any air loss.

3.6.2.6.2 Air Content Corrective Action

Whenever points on the control chart approach the upper or lower control limits, an adjustment should be made in the amount of air-entraining admixture batched. If a single test result is outside the specification limit, immediate adjustment is mandatory. As soon as practical after each adjustment, make another test to verify the correction of the adjustment. Whenever a point falls above the upper control for range, calibrate the dispenser to ensure that it is operating correctly and with good reproducibility. Whenever two consecutive points either for average or range are outside the control limits, notify the Contracting Officer.

3.6.2.6.3 Slump Testing

Make at least two slump tests in accordance with ASTM C143/C143M on each concrete mixture produced during each 8-hour period or less of concrete production each day. Make additional tests when excessive variation in workability is reported. Plot the result of each test for each mixture on a control chart on which the upper and lower limits are set as specified in paragraph SLUMP. Plot the range on a control chart on which the upper control limit is 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 Contractor's materials or transportation methods cause slump loss between the mixer and the placement, take samples at the placement site as often as required by the Contracting Officer.

3.6.2.6.4 Slump Corrective Action

Whenever points on the control chart approach the upper or lower control limits, make an adjustment 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 specified in the mixture proportions provided based on the free water available with the aggregates and that amount of water batched. If the adjustments to the batch weights of water and aggregates do not satisfactorily produce the required slump, the Contracting Officer may adjust the mixture proportions if the fine-aggregate moisture content is stable and within the required limits. When a single slump is outside the control limits, such adjustment is mandatory. As soon as practical 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 above the upper control limits, consider the slump to be out of control, halt the concreting operation, and undertake additional testing for aggregate moisture content required, and take action immediately to correct the problem.

3.6.2.6.5 Compression Test Cylinders

Make at least one set of test cylinders each shift on each different concrete mixture placed during the shift. Make additional sets of test cylinders, as directed, when the mixture proportions are changed or when low strengths have been detected. Develop a random sampling plan for approval by the Contracting Officer prior to start of construction. Assure that sampling is done in a completely random and unbiased, not just haphazard, manner. Provide a set of test cylinders for structural concrete containing Type I or Type II portland cement only consisting of four cylinders, two to be tested at 7 days and two at 28 days. Provide a set of test cylinders for all other concrete consisting of six cylinders, two to be tested at 7 days, two at 28 days, and two at 90 days. In addition, for all concrete except that containing Type I or Type II portland cement only, every 2 months make four additional cylinders and test two at 6 months of age and test two at 12 months of age. Mold and cure all test specimens in accordance with ASTM C31/C31M and test in accordance with ASTM C39/C39M. Report all compressive strength tests immediately. Keep quality control charts for individual strength tests, moving average for strength and moving average for range for each mixture. The charts must be similar to those found in ACI 214R.

3.6.2.7 Inspection Before Placing

Inspect foundation or construction joints, forms, and embedded items in sufficient time prior to each concrete placement in order to certify that they are ready to receive concrete. Report results of each inspection in writing.

3.6.2.8 Concrete Placement

3.6.2.8.1 Placing Inspection

The placing foreman must supervise all placing operations, must determine that the correct quality of concrete or grout is placed in each location as directed, and is responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, yardage placed, and method of placement.

3.6.2.8.2 Placing Corrective Action

Do not permit placing to begin until an adequate number of vibrators in working order with competent operators are available is verified. 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.

3.6.2.9 Vibrators

3.6.2.9.1 Vibrator Testing and Use

Determine frequency and amplitude of each vibrator in accordance with COE CRD-C 521prior to initial use and at least once a month when concrete is being placed. Make additional tests as directed when a vibrator does not appear to be adequately consolidating the concrete. Determine the frequency while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. Determine the amplitude with the head vibrating in air. Take two measurements, one near the tip and another near the upper end of the vibrator head, and average these results. Report make, model, type, and size of the vibrator and frequency and amplitude results in writing.

3.6.2.9.2 Vibrator Corrective Action

Remove any vibrator not meeting the requirements of paragraph PREPARATION FOR PLACING above immediately from service and repair or replace.

3.6.2.10 Curing

3.6.2.10.1 Moist Curing Inspections

At least twice each shift, and twice per day on nonwork days, inspect all areas subject to moist curing. Note and record the surface moisture condition.

3.6.2.10.2 Moist Curing Corrective Action

When a daily inspection report lists an area of inadequate moistness, take immediate corrective action, and extend the required curing period for those areas by one (1) day.

3.6.2.10.3 Membrane Curing Inspection

Do not apply curing compound until the Contractor's authorized representative 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 and compute the rate of coverage in square feet per gallon. Note whether or not coverage is uniform.

3.6.2.10.4 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.

3.6.2.10.5 Sheet Curing Inspection

At least once each shift and once per day on nonwork days, inspect all areas being cured using sheets. Note and record the condition of the covering and the tightness of the laps and tapes.

3.6.2.10.6 Sheet Curing Corrective Action

When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, repair the tears and holes promptly or

replace the sheets, close the joints, and extend the required curing period for those areas by one day.

3.6.2.11 Cold Weather Protection and Sealed Insulation Curing

At least once each shift and once per day on nonwork days inspect all areas subject to cold weather protection. Inspect the protection system for holes, tears, unsealed joints, or other incongruities which could result in damage to the concrete. Take special attention at edges, corners, and thin sections. Note, correct, and report any deficiencies.

3.6.2.12 Cold Weather Protection Corrective Action

When a daily inspection report lists any holes, tears, unsealed joints, or other incongruities, correct the deficiency immediately and extend the period of protection for one (1) day.

3.6.2.13 Mixer Uniformity

3.6.2.13.1 Stationary Mixers

Prior to the start of concrete placing and once every 3 months when concrete is being placed, or once for every 75,000 cubic yards of concrete placed, whichever results in the longest time, determine interval uniformity of concrete mixing in accordance with paragraph PLANT AND EQUIPMENT in PART 2. The initial and every fourth set of tests must be regular tests performed on three batches of concrete. Intermediate uniformity tests must be abbreviated tests performed on a single batch of concrete. If the mixer fails the abbreviated test, perform a regular test immediately. Whenever adjustments in a mixer or increased mixing time are required because of failure of a uniformity test, reevaluate the mixer by a regular test after the adjustments have been completed. If the Contractor proposes to reduce a mixing time, perform a regular test to evaluate the proposed time. Perform additional testing when directed when there is visible evidence of possible improper mixer performance. Report results of all uniformity tests in writing.

3.6.2.13.2 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 in accordance with ASTM C94/C94M. Select 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. Report results of tests in writing.

3.6.2.14 Mixer Uniformity Corrective Action

When a mixer fails to meet mixer uniformity requirements, either increase the mixing time, change batching sequence, reduce batch size, or make adjustments to the mixer until compliance is achieved.

3.6.3 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, make 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.

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TOTAL BUILDING COMMISSIONING
03/23

PART 1 GENERAL

1.1 SUMMARY

The Government has hired an independent Commissioning Firm.

This Section specifies the scope of work for the entire Commissioning Team which includes the scope of work for the Lead Commissioning Specialist, Commissioning Specialists, Designers of Record, Installing Contractors, and Equipment Suppliers. Refer to paragraph COMMISSIONING TEAM for descriptions of Commissioning Team members and assigned responsibilities.

1.2 COMMISSIONING LIMITATIONS

Commissioning Requirements specified in this Section are prohibited from fulfilling requirements specified in other Sections. Requirements specified in other Sections are prohibited from fulfilling requirements specified in this Section.

1.3 SYSTEMS TO BE COMMISSIONED

Commissioning must be performed for equipment, systems, and assemblies listed under each systems category in the following paragraphs whether or not listed equipment, system, or assembly is required to be commissioned by any reference related to Sustainability TPC.

Specified equipment, system, and assembly counts are totals that include all commissioned buildings and all construction phases in this project. Refer to items entitled "Sample Strategy" throughout this Section that must be applied to these counts.

1.3.1 Heating, Ventilation, and Air-Conditioning (HVAC) Systems Category

a. Primary Systems.

(1) Up to one Energy Management and Control system.

b. Air Handling Systems.

(1) One dedicated outside air systems (DOAS)featuring a variable-air-volume supply air fan, a variable-air-volume exhaust air fan, air-to-air heat transfer, hot gas reheat coil, air-side energy recovery, and packaged controls.

(2) Up to 7 heatpumps each featuring an indoor section with a variable-air-volume supply air fan and auxiliary electric heat strip, air-to-air heat transfer outdoor section, and packaged controls.

(3) Up to two split system air-conditioning units each featuring packaged controls.

c. Terminal Devices.

(1) Up to two unit heaters.

(2) One exhaust air fan.

1.3.2 Plumbing Systems Category

a. One domestic heating hot water system featuring up to two electric water heaters each with packaged controls, up to one recirculating pump, and up to one temperature mixing valve.

1.3.3 Utility Systems Category

a. Up to one set of whole-building energy utility metering systems.

b. Up to one whole-building water utility metering system.

1.3.4 Electrical Type I Systems Category

a. Power - all generator paralleling and loading systems.

b. Power - all generator transfer switches.

c. Power - all grounding systems.

d. Power - all industrial control systems.

e. Power - all main distribution panels.

f. Power - all main transformers.

g. Power - all panelboards.

h. Power - all stationary generator sets.

i. Power - all step-down transformers.

j. Power - all switchgear.

k. Power - all transient voltage surge protective devices.

1.3.5 Electrical Type II Systems Category

a. Lighting - all emergency egress systems, control devices, and control systems.

b. Lighting - all exit systems, control devices, and control systems.

c. Lighting - all exterior systems, control devices, and control systems.

d. Lighting - all interior systems, control devices, and control systems.

1.3.6 Building Envelope Systems, Components, and Assemblies Category

a. All building envelope systems including curtain walls, exterior penetrations, exterior air barrier assemblies, exterior windows, exterior doors, and skylights.

b. All roofing including low sloped roofs and steep sloped roofs.

1.4 COMPLEX SYSTEMS

Complex systems are defined as the following systems categories as listed under paragraph SYSTEMS TO BE COMMISSIONED with appropriate qualifiers and are subject to more stringent requirements as specified in this Section.

a. All equipment, systems, and assemblies listed under item entitled "Heating, Ventilation, and Air-Conditioning (HVAC) Systems Category."

b. All equipment, systems, and assemblies listed under item entitled "Plumbing Systems Category" featuring on-board factory packaged controls such as domestic heating hot water systems, domestic solar heating hot water systems, and service water pressure-booster pump systems. Refer to the following paragraph for definition of equipment featuring on-board factory packaged controls.

c. All equipment, systems, and assemblies listed under item entitled "Utility Systems Category."

Equipment featuring on-board factory packaged controls is defined as equipment that is a complex system as defined in paragraph COMPLEX SYSTEMS which features a controller issuing sophisticated logic-based commands to its internal components to accomplish the intent of Plans and Specifications. This equipment may function as either a stand-alone piece of commissioned equipment or may function as part of a commissioned system. This controller may be equipment mounted or may be remote mounted and may or may not interface with a building control system. Examples of equipment meeting and not meeting this definition are provided in the following paragraphs.

a. Equipment meeting this definition includes chillers, boilers provided with or without master controllers, packaged pumping systems, dedicated outside air systems, packaged rooftop units, computer room air conditioners, and air terminal units.

b. Equipment not meeting this definition includes unitary air-conditioners, packaged terminal air-conditioners, and heat pumps.

c. Equipment not meeting this definition, but requiring demonstration of minimum safe motor speed either prior to or during Functional Performance Testing includes variable frequency drives.

1.5 REFERENCES

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

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

ASHRAE 202	(2018) Commissioning Process for Buildings and Systems

GREEN BUILDING INITIATIVE (GBI)

GBI DOD GP Compliance	(2017) GBI Department of Defense Guiding Principles Compliance Program for New

Construction

INTERNATIONAL CODE COUNCIL, INC.

ICC IgCC	(2018) International Green Construction Code

1.6 SUBMITTALS

Commissioning Submittals are not required to be submitted by the Installing Contractor. Exchange of information between the Commissioning Team specified in this Section must still occur.

1.7 COMMISSIONING TEAM

The Commissioning Team is defined as the entity that must perform all Commissioning Activities specified in this Section for systems listed under paragraph SYSTEMS TO BE COMMISSIONED. The Commissioning Team is composed of the Lead Commissioning Specialist, Commissioning Specialists, Designers of Record, Installing Contractors, Equipment Suppliers, and the Contracting Officer's Technical Representative.

1.7.1 Lead Commissioning Specialist

The Lead Commissioning Specialist (CxC) is defined as the entity that must perform all Commissioning Responsibilities assigned in this Section that includes, but is not limited to, coordinating all aspects of the Commissioning Process; managing all Commissioning Specialists; and submitting all Commissioning Plans, schedules, reports, and documentation directly to the Contracting Officer's Technical Representative as modified in this Section.

1.7.2 Commissioning Specialists

Commissioning Specialists are defined as entities that must perform all Commissioning Responsibilities assigned in this Section that includes, but is not limited to, performing reviews, witnessing that all system components have been installed, that each control device operates, that each equipment piece operates, that complete systems operate, and that interactive systems operate in accordance with Plans and Specifications.

Commissioning Specialists must perform assigned responsibilities for equipment, systems, and assemblies listed under systems categories assigned to them in this Section. Commissioning Specialists are prohibited from performing responsibilities for equipment, systems, and assemblies listed under systems categories assigned to other Commissioning Specialists.

1.7.3 Designers of Record

Designers of Record are defined as entities that must act as design professionals responsible for design of their respective system that is subject to Commissioning. Designers of Record must perform all Commissioning Responsibilities assigned in this Section.

1.7.4 Installing Contractors

Installing Contractors are defined as the General Contractor's Superintendent or Project Manager; Quality Control Representative; and

Mechanical, Controls, Plumbing, Electrical, Test and Balance, Fire Protection, and Building Envelope Sub-Contractors who provide, install, or construct systems in whole or in part for this contract. The General Contractor must provide a Lead Commissioning Representative to manage all Sub-Contractor Commissioning Representatives and Equipment Suppliers to accomplish all Commissioning Responsibilities assigned in this Section. Each Sub-Contractor must provide a Commissioning Representative to coordinate and perform all Commissioning Responsibilities for commissioned equipment, systems, and assemblies provided as part of their respective contract as directed by the General Contractor. Submission of Commissioning related certifications or qualifications for the Lead Commissioning Representative and Installing Contractor Representatives is not required.

Installing Contractors must perform all Commissioning Responsibilities assigned in this Section that includes, but is not limited to, demonstrating performance of all commissioned equipment, systems, and assemblies provided as part of their respective contract and must provide all necessary materials, services, and labor required for successful demonstration as modified in this Section.

1.7.5 Equipment Suppliers

Equipment Suppliers (ES) are defined as factory authorized start-up technicians or factory representatives knowledgeable with start-up, demonstration, and testing of commissioned equipment featuring on-board factory packaged controls provided as part of their respective contract. Each Equipment Supplier must coordinate and perform all Commissioning Responsibilities assigned in this Section as directed by the General Contractor. Submission of Commissioning related certifications or qualifications for Equipment Suppliers is not required. Refer to paragraph COMPLEX SYSTEMS for definition of equipment featuring on-board factory packaged controls's.

Equipment Suppliers must perform all Commissioning Responsibilities assigned in this Section that includes, but is not limited to, demonstrating performance of all commissioned equipment provided as part of their respective contract and must provide all necessary materials, services, and labor required for successful demonstration of all commissioned equipment provided as part of their respective contract as modified in this Section.

1.7.6 Installing Contractors and Equipment Suppliers Coordination

Installing Contractors and Equipment Suppliers must coordinate and share demonstration and testing responsibilities specified in this Section for commissioned equipment featuring on-board factory packaged controls. Installing Contractors and Equipment Suppliers must simultaneously perform all aspects of demonstration and testing for these types of systems. Refer to paragraph COMPLEX SYSTEMS for definition of equipment featuring on-board factory packaged controls.

1.7.7 Contracting Officer's Technical Representative

The Contracting Officer's Technical Representative (COTR) represents the Government for all elements of the Commissioning Process. The COTR will serve as the single point of contact with the Lead Commissioning Specialist, will receive all Commissioning Submittals, may attend meetings, and may, but is not required to, witness field inspections and

testing specified in this Section.

1.8 COMMUNICATIONS

1.8.1 Communications with the Contracting Officer's Technical Representative

Communication with the Contracting Officer's Technical Representative must be through the Lead Commissioning Specialist who acts as the single direct point of contact for all aspects of the Commissioning Process.

1.8.2 Communications between the Commissioning Team

Communications between the Commissioning Team including, but not limited to, verbal communications, schedule information, and exchange of information specified in this Section, must occur directly between the Commissioning Team without requiring interaction of the Contracting Officer's Technical Representative.

1.9 NUMBER OF BUILDINGS AND CONSTRUCTION PHASING

1.9.1 Number Of Buildings

This project includes one commissioned building.

a. Commissioning Design Reviews specified in this section must be performed as a single review for each submission inclusive of all commissioned buildings in this project. Refer to item entitled "Commissioning Design Reviews" for additional requirements.

b. Construction Phase Site Observations specified in this Section are inclusive of all commissioned buildings in this project. Refer to item entitled "Construction Phase Site Observations" for additional requirements.

c. Construction Phase Functional Performance Testing must be performed during a single continuous occurrence inclusive of all commissioned buildings for each systems category until completion of testing of all systems listed under respective systems category. Refer to item entitled "Construction Phase Functional Performance Testing" for additional requirements.

d. Post-Construction Phase Site Observations specified are inclusive of all commissioned buildings in this project. Refer to item entitled "Post-Construction Phase Site Observations" for additional requirements.

1.9.2 Construction Phasing

This project's construction is phased.

1.10 INTERNATIONAL GREEN CONSTRUCTION CODE COMMISSIONING COMPLIANCE

International Green Construction Code (IgCC) Commissioning compliance is required for this project.

1.10.1 General Requirements

All Commissioning Activities listed in ICC IgCC paragraphs 1001.1 through

1001.3.1.3.6, ICC IgCC Informative Appendix I, and ASHRAE 202 as modified in this Section, Commissioning Activities listed in references contained in ICC IgCC's paragraphs and ASHRAE 202 as modified in this Section, and Commissioning Activities specified in this Section must be performed. All Commissioning Activities that are referred to as "optional activities," "guidance," "should activities," "recommendations," "suggested practices," "informative information," or listed as similar designations are mandatory regardless of any qualifiers.

1.10.2 Commissioning Team Responsibilities

The Commissioning Team must, at a minimum, perform all Commissioning Activities specified in the preceding item entitled "General Requirements" and must perform all Commissioning Activities specified in this Section. This Section takes precedence should there be a conflict between requirements listed in this Section and requirements listed in the ICC IgCC, listed in ASHRAE 202, or listed in any of their references.

1.11 SUSTAINABILITY THIRD PARTY CERTIFICATION (TPC) COMMISSIONING COMPLIANCE

Sustainability Third Party Certification (TPC) is required for this project.

1.11.1 General Requirements

All Commissioning Activities listed in all references for pursuing Sustainability TPC as modified in this Section and Commissioning Activities specified in this Section must be performed. All Commissioning Activities that are referred to as "optional activities," "guidance," "should activities," "recommendations," "suggested practices," "informative information," or listed as similar designations are mandatory regardless of any qualifiers and whether or not activity is included as total points toward Sustainability TPC.

1.11.2 Commissioning Team Responsibilities

The Commissioning Team must, at a minimum, perform all Commissioning Activities specified in the preceding item entitled "General Requirements," perform Commissioning Activities listed in the reference for pursuing Sustainability TPC, GBI DOD GP Compliance, as modified in this Section, perform Commissioning Activities listed in all of its references as modified in this Section, and perform Commissioning Activities specified in this Section. This Section takes precedence should there be a conflict between requirements listed in this Section and requirements listed in the reference for pursuing Sustainability TPC or listed in any of its references.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Subpart title "DESIGN PHASE" (Deleted)

3.1 CONSTRUCTION PHASE

3.1.1 Construction Phase International Green Construction Code Commissioning Compliance

3.1.1.1 General Requirements

Activities must include, but not be limited to, Construction Phase Commissioning Activities listed in ICC IgCC paragraphs 1001.1 through 1001.3.1.3.6, ICC IgCC Informative Appendix I, and ASHRAE 202 as modified in this Section, Construction Phase Commissioning Activities listed in references contained in ICC IgCC's paragraphs and ASHRAE 202 as modified in this Section, and Construction Phase Commissioning Activities specified in this Section.

3.1.1.2 Lead Commissioning Specialist and Commissioning Specialists Responsibilities

The Lead Commissioning Specialist and Commissioning Specialists must, at a minimum, perform all activities specified under item entitled "Construction Phase International Green Construction Code Commissioning Compliance."

3.1.2 Construction Phase Sustainability Third Party Certification (TPC) Commissioning Compliance

3.1.2.1 General Requirements

Activities must include, but not be limited to, Commissioning Activities listed in the reference for pursuing Sustainability TPC, GBI DOD GP Compliance, as modified in this Section, Commissioning Activities listed in all of its references as modified in this Section, and Commissioning Activities specified in this Section.

3.1.2.2 Lead Commissioning Specialist and Commissioning Specialists Responsibilities

The Lead Commissioning Specialist and Commissioning Specialists must, at a minimum, perform activities specified in the following paragraphs.

a. The Lead Commissioning Specialist must submit all Construction Phase documentation of Commissioning Activities directly to the Suitability TPC organization as modified in this Section.

b. The Lead Commissioning Specialist and Commissioning Specialists must perform all activities specified under item entitled "Construction Phase Sustainability Third Party Certification (TPC)."

3.1.3 Construction Phase Sequencing

3.1.3.1 Heating, Ventilation, and Air-Conditioning (HVAC) Systems

Heating, ventilation, and air-conditioning (HVAC) systems activities specified in the following paragraphs must be performed as applicable prior to performing Functional Performance Testing of systems listed under item entitled "Heating, Ventilation, and Air-Conditioning (HVAC) Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED.

a. All equipment, systems, and assemblies have been completed, cleaned,

flushed, disinfected, calibrated, tested, and operate in accordance with Plans and Specifications.

b. All Ductwork Air Leakage Testing (DALT) field work, Test and Balance (TAB) field work, Pre-Final TAB Reports, and related prerequisites have been completed, submitted, and approved in accordance with Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR MECHANICAL SYSTEMS.

c. All inspections, measurements, and testing of building envelope and roofing systems specified in Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM have been completed, submitted, and approved.

d. All pressure testing, infrared thermography testing, and fog testing of building envelope and roofing systems specified in Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS have been completed, submitted, and approved.

e. All Pre-Functional Checks have been completed, submitted, and approved.

g. Certified TAB Report specified in Section 23 05 93.00 22 TESTING, ADJUSTING, AND BALANCING FOR MECHANICAL SYSTEMS has been prepared, submitted, and approved.

h. Certified Certificate of Readiness has been completed, submitted, and approved.

All completed Final Functional Performance Test Checklists for commissioned equipment, systems, and assemblies listed under item entitled "Heating, Ventilation, and Air-Conditioning (HVAC) Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED must be submitted and approved prior to the Government performing any Performance Verification Testing specified in
Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

3.1.3.2 Electrical Systems

Electrical systems activities specified in the following paragraphs must be performed as applicable prior to performing Functional Performance Testing of systems listed under item entitled "Electrical Type II Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED.

a. All electrical, power generation, and lighting equipment, systems, and assemblies have been completed, calibrated, tested, and operate in accordance with Plans and Specifications.

b. Building Envelope has been enclosed according to contract documents and final construction has been completed.

c. All ceiling tiles, floor coverings, and window coverings have been put in place.

d. All lamps have completed a minimum 100-hour burn-in period.

e. All furniture has been put in place.

f. Certified Certificate of Readiness has been completed, submitted, and approved.

3.1.4 Construction Phase Scheduling

3.1.4.1 General Requirements

Commissioning Activities and other related activities for inclusion into the Project Construction Schedule must include, but not be limited to, activities specified in the following paragraphs.

a. Perform Construction Phase Commissioning Coordination meeting.

d. Submit and approve completed Pre-Functional Checklists.

e. Submit and approve proposed Functional Performance Test Checklists.

f. Submit and approve final Functional Performance Test Checklists.

i. Perform Construction Phase Site Observations.

j. Perform inspections, measurements, and testing of building envelope and roofing systems specified in Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM.

k. Perform pressure testing, infrared thermography testing, and fog testing of building envelope and roofing systems specified in Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS.

m. Submit and approve Certified TAB Report specified in Section 23 05 93.00 22 TESTING, ADJUSTING, AND BALANCING FOR MECHANICAL SYSTEMS.

n. Submit and approve Certified Certificate of Readiness.

o. Witness Construction Phase Functional Performance Testing.

p. Correct deficiencies discovered during Construction Phase Functional Performance Testing.

q. Re-witness Construction Phase Functional Performance Testing.

u. Government Witness of Performance Verification Testing.

v. Correct deficiencies discovered during Performance Verification Testing.

w. Government Re-witness of Performance Verification Testing.

x. Provide all Systems Manuals contents.

y. Submit and approve completed Systems Manuals.

z. Perform training.

aa. Submit and approve Final Commissioning Report.

bb. Perform Post-Construction Phase Site Observations.

dd. Witness Post-Construction Phase Functional Performance Testing if all requirements and activities for respective system could not be fully or successfully completed during the Construction Phase.

ee. Correct deficiencies discovered during Post-Construction Phase Functional Performance Testing.

ff. Re-witness Post-Construction Phase Functional Performance Testing.

3.1.4.2 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must request a current Project Construction Schedule from Installing Contractors no later than at the Construction Phase Commissioning Coordination Meeting and must prepare and provide to Installing Contractors a list of Commissioning Activities for inclusion into the Project Construction Schedule. The Lead Commissioning Specialist must associate each Commissioning Activity to a single construction activity such that if the date of the construction activity changes, the associated Commissioning Activity changes accordingly. List of Commissioning Activities for inclusion into the Project Construction Schedule is not required to be submitted to the Government.

3.1.4.3 Installing Contractors Responsibilities

Installing Contractors must provide a current Project Construction Schedule to the Lead Commissioning Specialist upon receiving request. Installing Contractors must incorporate the list of Commissioning Activities into the Project Construction Schedule and must link each Commissioning Activity to the associated construction activity identified by the Lead Commissioning Specialist such that if the date of the construction activity changes, the associated Commissioning Activity changes accordingly.

Installing Contractors must provide updated Project Construction Schedules to the Lead Commissioning Specialist at least on a monthly basis.

3.1.5 Construction Phase Commissioning Coordination Meeting

3.1.5.1 General Requirements

A Construction Phase Commissioning Coordination meeting must be conducted no later than 90 calendar days after award of construction contract to discuss topics that include, but not be limited to, the Commissioning Process, contract requirements, lines of communication, roles and responsibilities, Commissioning Activities for inclusion into the Project Construction Schedule, documentation requirements, Inspections and Testing, and logistics specified in this Section. Meeting must be conducted by conference call.

3.1.5.2 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must, at a minimum, conduct meeting and prepare meeting minutes complete with Attendance Roster.

3.1.5.3 Installing Contractors and Others Responsibilities

Installing Contractors must attend this meeting. The Contracting Officer's Technical Representative, a User Representative, and a Public Works Department Representative may attend this meeting.

3.1.6 Construction Phase Commissioning Progress Meetings

3.1.6.1 General Requirements

Construction Phase Commissioning Progress meetings must be conducted to discuss topics that include, but not be limited to, unresolved Commissioning Issues, status of items specified to be provided to the Lead Commissioning Specialist, and upcoming Commissioning Activities. Number of Construction Phase Commissioning Progress meetings must be conducted for each systems category as specified in the following paragraphs. Meetings must be conducted by conference call.

a. Heating, Ventilation, and Air-Conditioning (HVAC) Systems Category: Six meetings.

b. Plumbing Systems Category: Two meetings.

c. Utility Systems Category: No meetings.

d. Electrical Type I Systems Category: No meetings.

e. Electrical Type II Systems Category: Two meetings.

h. Building Envelope Systems, Components, and Assemblies Category: No meetings.

Construction Phase Commissioning Progress meetings are prohibited from being combined with conducting Construction Phase Commissioning Coordination meeting, conducting Site Observations, or witnessing Functional Performance Testing.

3.1.6.2 Commissioning Specialists Responsibilities

Each Commissioning Specialist must, at a minimum, conduct meetings and prepare meeting minutes complete with Attendance Roster for systems categories assigned to them in this Section. Commissioning Specialists are prohibited from performing these responsibilities for systems categories assigned to other Commissioning Specialists.

3.1.6.3 Installing Contractors and Others Responsibilities

Installing Contractors must attend these meetings. The Contracting Officer's Technical Representative, a User Representative, and a Public Works Department Representative may attend these meetings.

3.1.7 Construction Phase Interim Commissioning Plan

3.1.7.1 General Requirements

The Construction Phase Interim Commissioning Plan must be prepared and must be an update to the Design Phase Commissioning Plan and contents must include, but not be limited to, contents specified in the following paragraphs.

a. All contents specified for the Design Phase Commissioning Plan.

b. Basis of Design.

c. Contact information for the entire Commissioning Team.

3.1.7.2 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must, at a minimum, prepare and submit the Construction Phase Interim Commissioning Plan no later than 30 calendar days after the Construction Phase Commissioning Coordination meeting and no later than 14 calendar days prior to performing construction of the building envelope.

3.1.8 Construction Phase Final Commissioning Plan

3.1.8.1 General Requirements

The Construction Phase Final Commissioning Plan must be prepared and must be an update to the Construction Phase Interim Commissioning Plan and contents must include, but not be limited to, contents specified in the following paragraphs.

a. All contents specified for the Construction Phase Interim Commissioning Plan.

b. All Pre-Functional Checklists.

c. All approved final Functional Performance Test Checklists.

3.1.8.2 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must, at a minimum, perform activities specified in the following paragraphs.

a. Prepare and submit the Construction Phase Final Commissioning Plan no later than 30 calendar days prior to performing any Functional Performance Testing.

b. File one copy of Approved Construction Phase Final Commissioning Plan in the Sustainability eNotebook no later than 14 calendar days after receiving approval of the Construction Phase Final Commissioning Plan.

3.1.9 Construction Phase Issues And Resolution Log

3.1.9.1 General Requirements

The Construction Phase Issues and Resolution Log must be prepared and maintained to track all Commissioning Issues identified by any member of the Commissioning Team. The Construction Phase Issues and Resolution Log must be prepared in an electronic format that can be used throughout the Construction Phase such that it can be provided to the Government upon request. Construction Phase Issues and Resolution Log contents must include, but not be limited to, contents specified in the following paragraphs.

a. Project title and location.

b. Lead Commissioning Specialist's contact information.

c. Issue number.

d. Date issue was discovered.

e. Name of Commissioning Team member identifying the issue.

f. Commissioning Team member responsible for resolving the issue.

g. Current status.

h. Issue description.

i. Pictures of item if available and appropriate.

j. Effects of issue on project or building operation.

k. Possible cause of issue.

l. Proposed resolution.

m. Final resolution and final resolution date.

n. Approvals of issue resolution, including approver's name.

3.1.9.2 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must prepare and maintain the Construction Phase Issues And Resolution Log and must submit one electronic copy no later than seven calendar days after the addition of an issue or a change in status of an issue.

3.1.10 Pre-Functional Checklists

3.1.10.1 General Requirements

Pre-Functional Checklists must be prepared for all commissioned equipment, systems, and assemblies that are subject to functional performance testing. Pre-Functional Checklist contents must include, but not be limited to, contents for physical inspections that demonstrate construction, installation and start-up of equipment, systems, and assemblies is complete. Refer to item entitled "Pre-Functional Checklists" in item entitled "Inspections and Testing" for more information.

Download example Pre-Functional Checklists for Section 01 91 00.15 TOTAL BUILDING COMMISSIONING at the following location: http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables. Checklists must contain the same level of detail shown in examples, but are not required to match the format of examples.

3.1.10.2 Lead Commissioning Specialist Responsibilities

Lead Commissioning Specialist must provide blank Pre-Functional Checklists to Installing Contractors. Blank Pre-Functional Checklists are not required to be submitted to the Government.

3.1.10.3 Commissioning Specialists Responsibilities

Commissioning Specialists must prepare Pre-Functional Checklists for all equipment, systems, and assemblies listed under systems categories assigned to them in this Section that are subject to functional performance testing. Commissioning Specialists are prohibited from

performing these responsibilities for equipment, systems, and assemblies listed under systems categories assigned to other Commissioning Specialists.

3.1.11 Functional Performance Test (FPT) Checklists

Functional Performance Test (FPT) Checklists must be prepared for all commissioned equipment, systems, and assemblies demonstrating performance is in accordance with Plans and Specifications as specified in the following paragraphs. A single final FPT Checklist must be prepared for each equipment piece, system, and assembly except that a single final FPT Checklist may be prepared for use with those that have identical features as modified in the following paragraphs. FPT Checklist contents must include, but not be limited to, step-by-step actions and expected results, as modified in the following paragraphs. Refer to item entitled "Construction Phase Functional Performance Testing" for more information.

3.1.11.1 Complex Systems Requirements

FPT Checklists must be prepared for all complex systems as defined in paragraph COMPLEX SYSTEMS. A single FPT Checklist must be prepared for each system except that a single FPT Checklist may be prepared for use with multiple systems that have identical control sequences such as unitary air-conditioners, packaged terminal air-conditioners, and heat pumps.

Contents must include, but not be limited to, contents specified in the following paragraphs and shown in example FPT Checklists for Section 01 91 00.15 TOTAL BUILDING COMMISSIONING available for download at the following location: http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables. FPT Checklists must contain the same level of detail specified below and as shown in examples, but are not required to match the format of examples.

a. Notable system features including information about such attributes as system sizing and controls to facilitate understanding of system operation.

b. Conclusions and recommendations based on control system feature, point-to-point, actuator, and system operation observations. Conclusions must clearly indicate if system does or does not perform in accordance with requirements of Plans and Specifications. Recommendation must clearly indicate that the system should or should not be accepted by the Government.

c. Test conditions including date, beginning and ending time, and beginning and ending outdoor air conditions.

d. Identification of the equipment involved in the test.

e. Attendees present throughout the entire system test.

f. Control system feature identification including control point description, embedded/visible type, adjustable/monitoring type, actual value, and setpoint value/alarm range.

g. Point-to-point observations including demonstrating system flow meters and sensors have been calibrated and are correctly displayed on the Operator workstation.

h. Actuator operation observations demonstrating actuator responses to commands from the control system.

i. Variable frequency drive observations demonstrating minimum safe motor speed.

j. System operation observations for system-based testing demonstrating each control sequence, operation mode, and alarm condition resulting from control setpoint manipulation. System operation observations must include, but not be limited to, observations specified in the following paragraphs.

(1) Introduction identifying testing methodology.

(2) As-found conditions prior to system manipulation.

(3) Clear list of test items (step numbers).

(4) Design control sequences or interlocks segmented by unique functions.

(5) Intended test procedures following each segmented sequence or interlock identifying the system manipulation required to initiate system response.

(6) Expected system responses.

(7) Space for comments for each test item.

(8) Pass or fail indication for each test.

Performance Verification Tests prepared by the Controls Contractor are prohibited from fulfilling requirements of this Section.

3.1.11.2 Plumbing Systems Requirements

FPT Checklists must be prepared for all equipment, systems, and assemblies listed under item entitled "Plumbing Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED.

3.1.11.3 Electrical Type I Systems Requirements

FPT Checklists must not be prepared for equipment, systems, and assemblies listed under item entitled "Electrical Type I Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED.

3.1.11.4 Electrical Type II Systems Requirements

FPT Checklists must be prepared for all equipment, systems, and assemblies listed under item entitled "Electrical Type II Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED. FPT Checklists must be system-based and demonstrate end-objective performance in accordance with Plans and Specifications. FPT Checklists must not repeat fundamental performance testing such as resistance measurements required in other Sections.

3.1.11.5 Building Envelope Systems, Components, and Assemblies Requirements

FPT Checklists must not be prepared for equipment, systems, and assemblies listed under item entitled "Building Envelope Systems, Components, and Assemblies Category" in paragraph SYSTEMS TO BE COMMISSIONED.

3.1.11.6 Proposed FPT Checklist Meeting and Draft FPT Checklist Meeting

For all complex systems as defined in paragraph COMPLEX SYSTEMS, a Proposed FPT Checklist Meeting and a Draft FPT Checklist Meeting must be conducted for detailed discussions of procedures intended to demonstrate performance is in accordance with Plans and Specifications. Meetings must be conducted by conference call.

3.1.11.7 Lead Commissioning Specialist and Commissioning Specialists Responsibilities

For all equipment, systems, and assemblies other than complex systems as defined in paragraph COMPLEX SYSTEMS, the Lead and Commissioning Specialist must perform respective responsibilities specified in the following paragraphs.

a. The Lead Commissioning Specialist must submit Final Functional Performance Test Checklists for each systems category listed under paragraph SYSTEMS TO BE COMMISSIONED for which FPT checklists are required to be prepared. FPT checklists must be submitted as a single submittal for each systems category no later than 30 calendar days prior to testing of any system in the respective systems category.

b. Commissioning Specialists must prepare Final Functional Performance Test Checklists for equipment, systems, and assemblies listed under systems categories assigned to them in this Section for which FPT checklists are required to be prepared. Commissioning Specialists are prohibited from performing these responsibilities for equipment, systems, and assemblies listed under systems categories assigned to other Commissioning Specialists.

For all complex systems as defined in paragraph COMPLEX SYSTEMS, the Lead Commissioning Specialist and Commissioning Specialists must prepare and submit Final Functional Performance Test Checklists in the sequence specified in the following paragraphs. Commissioning Specialists must perform respective responsibilities for equipment, systems, and assemblies listed under systems categories assigned to them in this Section. Commissioning Specialists are prohibited from performing respective responsibilities for equipment, systems, and assemblies listed under systems categories assigned to other Commissioning Specialists.

a. Commissioning Specialists must prepare Proposed Functional Performance Test Checklists.

b. The Lead Commissioning Specialist must submit Proposed Functional Performance Test Checklists for all complex systems as a single submittal no later than 60 calendar days prior to testing of any complex system.

c. Commissioning Specialists must conduct the Proposed Functional Performance Test Checklist Meeting attended by the Contracting Officer's Technical Representative.

d. Commissioning Specialists must prepare Draft Functional Performance Test Checklists to incorporate input from the Contracting Officer's Technical Representative.

e. The Lead Commissioning Specialist must provide Draft Functional Performance Test Checklists to Installing Contractors and Equipment Suppliers no later than seven calendar days prior to the Draft Functional Performance Test Checklist Meeting.

f. Commissioning Specialists must conduct the Draft Functional Performance Test Checklist Meeting attended by Installing Contractors and Equipment Suppliers. The Contracting Officer's Technical Representative may attend this meeting.

g. Commissioning Specialists must prepare Final Functional Performance Test Checklists to incorporate input from Installing Contractors.

h. The Lead Commissioning Specialist must submit Final Functional Performance Test Checklists for all complex systems as a single submittal no later than seven calendar days after meeting to discuss Draft Functional Performance Test Checklists and no later than 30 calendar days prior to testing of any complex system.

3.1.11.8 Installing Contractors and Equipment Suppliers Responsibilities

Installing Contractors and Equipment Suppliers must attend Draft Functional Performance Test Checklist Meeting.

3.1.12 Construction Submittals

3.1.12.1 General Requirements

Construction Submittals must be reviewed for all commissioned equipment, systems, and assemblies to the extent necessary to verify that equipment, systems, and assemblies are in compliance with Commissioning Aspects of Owner's Project Requirements (OPR), Basis of Design (BOD), and Plans and Specifications as modified in this Section. One review for each commissioned equipment, system, and assembly must be performed coincident with Designers of Record and review must include, but not be limited to, review of shop drawings and equipment performance data. Review of resubmittals is prohibited.

The OPR and BOD are for reference only and do not constitute part of this contract.

3.1.12.2 Construction Submittal Review Reports

A Construction Submittal Review Report must be prepared for all commissioned equipment, systems, and assemblies and contents must include, but not be limited to, contents specified in the following paragraphs.

a. Project title, project number, and date of review.

b. Overview complete goals of the Commissioning-focused submittal review process.

c. Summary of deficiencies.

d. Ongoing record of all Construction Submittals received and reviewed,

list of unresolved deficiencies, and record of communications made to resolve deficiencies.

e. Descriptive outline of reviewed construction submittals complete with the Installing Contractor's submittal designation.

f. Clear description of deficiencies complete with supporting documentation.

3.1.12.3 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist activities must include, but not be limited to, activities specified in the following paragraphs.

a. Provide list of shop drawings and equipment performance data that must be reviewed to Installing Contractors.

b. Prepare and provide Construction Submittal review comments to Designers of Record.

c. Prepare and submit Construction Submittal Review Reports no later than seven calendar days after completion of each Construction Submittal review.

3.1.12.4 Commissioning Specialists Responsibilities

Commissioning Specialists must perform reviews of Construction Submittals for equipment, systems, and assemblies listed under systems categories assigned to them in this Section. Commissioning Specialists are prohibited from performing these responsibilities for equipment, systems, and assemblies listed under systems categories assigned to other Commissioning Specialists.

3.1.12.5 Designers of Record Responsibilities

Designers of Record activities must include, but not be limited to, receiving and considering for incorporation comments listed in Construction Submittal Review Reports provided by the Lead Commissioning Specialist.

3.1.12.6 Installing Contractors Responsibilities

Installing Contractors must provide all requested Construction Submittals and requested supplemental information to the Lead Commissioning Specialist.

3.1.13 Construction Phase Site Observations

3.1.13.1 General Requirements

Construction Phase Site Observations must be performed as specified in the following paragraphs to verify and document Commissioning Aspects of equipment, systems, and assemblies as specified in this Section. Two eight-hour Construction Phase Site Observations must be conducted for each systems category that is not specified in the following paragraphs. Specified number of observations are totals that include all commissioned buildings and all construction phases in this project.

Construction Phase Site Observations are prohibited from being combined

with witnessing Functional Performance Testing, but may be combined with Pre-Functional Checklist Verification unless indicated otherwise. Purposes of Site Observations specified in the following paragraphs for each systems category may be combined into a single Site Observation.

3.1.13.2 Heating, Ventilation, and Air-Conditioning (HVAC) Systems Category

Site Observations must be performed for the purposes specified in the following paragraphs.

a. Two eight-hour Site Observations to identify issues that may result in unsuccessful functional performance testing and to verify and document Commissioning Aspects of commissioned equipment, systems, and assemblies listed under this systems category.

b. One eight-hour Site Observation to verify and document HVAC pipe pressure testing.

c. One eight-hour Site Observation to verify and document HVAC pump installation.

3.1.13.3 Plumbing Systems Category

Site Observations must be performed for the purposes specified in the following paragraphs.

a. One eight-hour Site Observation to identify issues that may result in unsuccessful functional performance testing and to verify and document Commissioning Aspects of commissioned equipment, systems, and assemblies listed under this systems category.

b. One eight-hour Site Observation to verify and document Plumbing pipe pressure testing.

c. One eight-hour Site Observation to verify and document Plumbing pump installation.

3.1.13.4 Utility Systems Category

Site Observations must be performed for the purposes specified in the following paragraphs.

a. No Site Observation dedicated to this systems category. Verification and documentation of Commissioning Aspects of commissioned equipment, systems, and assemblies listed under this systems category may be combined with Site Observations for other systems categories.

3.1.13.5 Electrical Type I Systems Category

Site Observations must be performed for the purposes specified in the following paragraphs.

a. Two eight-hour Site Observations to verify and document Commissioning Aspects and to witness testing performed by independent testing organizations of commissioned equipment, systems, and assemblies listed under this systems category and listed by the Lead Commissioning Specialist to require on-site verification and documentation by Commissioning Specialists. Independent testing organizations typically use tests readily available from testing

associations such as the InterNational Electrical Testing Association (NETA).

3.1.13.6 Electrical Type II Systems Category

Site Observations must be performed for the purposes specified in the following paragraphs.

a. Two eight-hour Site Observations to identify issues that may result in unsuccessful functional performance testing and to verify and document Commissioning Aspects of commissioned equipment, systems, and assemblies listed under this systems category.

3.1.13.7 Building Envelope Systems, Components, and Assemblies Category

Site Observations must be performed for the purposes specified in the following paragraphs.

c. bne eight-hour Site Observation to verify, document, and witness inspections, measurements, and testing of building envelope and roofing systems performed by independent testing agencies and specified in Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM.

c. One eight-hour Site Observation to verify, document, and witness pressure testing, infrared thermography testing, and fog testing of building envelope and roofing systems performed by independent testing agencies and specified in Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS.

3.1.13.8 Summary Meetings

A Summary Meeting must be conducted at the conclusion of each Site Observation for the purpose of discussing issues discovered during each Site Observation. Meeting must be conducted on-site with all attendees present.

3.1.13.9 Site Observation Reports

A Site Observation Report must be prepared for each Site Observation for the purpose of documenting issues discovered during each Site Observation.

Site Observation Reports for all equipment, systems, and assemblies listed under item entitled "Electrical Type I Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED must include results of testing performed by independent testing organizations that were witnessed by Commissioning Specialists and test results that were not witnessed by Commissioning Specialists.

3.1.13.10 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must provide list of equipment, systems, and assemblies listed under item entitled "Electrical Type I Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED that require on-site verification and documentation by Commissioning Specialists to Installing Contractors.

The Lead Commissioning Specialist must submit Construction Phase Site Observation Reports complete with Summary Meeting Attendance Roster no later than seven calendar days after Site Observation.

3.1.13.11 Commissioning Specialists Responsibilities

Commissioning Specialist must perform responsibilities specified in the following paragraphs.

a. Each Commissioning Specialist must be responsible to perform Site Observations, conduct Summary Meetings, and prepare Construction Phase Site Observation Reports for equipment, systems, and assemblies listed under systems categories assigned to them in this Section. Commissioning Specialists are prohibited from performing these responsibilities for equipment, systems, and assemblies listed under systems categories assigned to other Commissioning Specialists.

3.1.13.12 Installing Contractors Responsibilities

Installing Contractors must provide Commissioning Specialists access to construction and systems for Site Observations and must attend Summary Meetings.

Installing Contractors must schedule testing to occur in the presence of Commissioning Specialists as specified in the following paragraphs.

a. All equipment, systems, and assemblies listed under item entitled "Electrical Type I Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED and listed by the Lead Commissioning Specialist to require on-site verification and documentation by Commissioning Specialists. Results of testing of equipment, systems, and assemblies listed under item entitled "Electrical Type I Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED must be provided to the Lead Commissioning Specialist that were witnessed by Commissioning Specialists and that were not witnessed by Commissioning Specialists.

c. Pressure testing, infrared thermography testing, and fog testing specified in Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS and inspections, measurements, and testing specified in Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM for equipment, systems, and assemblies listed under item entitled "Building Envelope Systems, Components, and Assemblies Category" in paragraph SYSTEMS TO BE COMMISSIONED. Results of all tests, inspections, and measurements must be provided to the Lead Commissioning Specialist that were witnessed by Commissioning Specialists and that were not witnessed by Commissioning Specialists.

3.1.14 Pre-Functional Checks

Pre-Functional Checks must be performed prior to performing Functional Performance Testing of respective system and activities must include, but not be limited to, activities specified in the following paragraphs.

c. Perform Pre-Functional Checklist Verification.

3.1.14.1 Pre-Functional Checklist Verification

3.1.14.1.1 General Requirements

Pre-Functional Checklist Verification must be performed using Pre-Functional Checklists from the approved Construction Phase Final Commissioning Plan by conducting on-site spot-checks to verify accuracy

after receipt of completed Pre-Functional Checklists from Installing Contractors. Verification may be combined with Construction Phase Site Observations.

3.1.14.1.2 Number of Trips

The number of trips to the site for the purpose of Pre-Functional Checklist Verification for each systems category must be up to that specified in the following paragraphs. It is encouraged that these trips be combined with Construction Phase Site Observations.

a. Heating, Ventilation, and Air-Conditioning (HVAC) Systems Category: One eight-hour trip.

b. Plumbing Systems Category: One eight-hour trip.

d. Utility Systems Category: No trip dedicated to this systems category. Verification of commissioned equipment, systems, and assemblies listed under this systems category may be combined with trips for other systems categories.

e. Electrical Type I Systems Category: No Trips.

f. Electrical Type II Systems Category: One eight-hour trip.

i. Building Envelope Systems, Components, and Assemblies Category: No Trips.

3.1.14.1.3 Sample Strategy

20-Percent sample spot-check for all equipment, systems, and assemblies for which Pre-Functional Checklists have been completed. Sample spot-check must include at least one complete item such as one complete unitary air-conditioner.

3.1.14.1.4 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must provide blank Pre-Functional Checklists to Installing Contractors.

The Lead Commissioning Specialist must submit all completed Pre-Functional Checklists and all associated equipment start-up reports for each systems category listed under paragraph SYSTEMS TO BE COMMISSIONED as a single submittal no later than seven calendar days after receipt of all completed checklists for equipment, systems, and assemblies listed under the respective systems category from Installing Contractors.

3.1.14.1.5 Commissioning Specialists Responsibilities

Commissioning Specialists must perform Pre-Functional Checklist Verifications and then must indicate acceptance of all Pre-Functional Checklist items for equipment, systems, and assemblies listed under systems categories assigned to them in this Section. Commissioning Specialists are prohibited from performing these responsibilities for equipment, systems, and assemblies listed under systems categories assigned to other Commissioning Specialists.

3.1.14.1.6 Installing Contractors Responsibilities

Installing Contractors must complete one Pre-Functional Checklist for each piece of equipment and system. Initial each Pre-Functional Checklist item for their area of responsibility indicating the item's construction, installation, and start-up as applicable has been verified to be complete and is ready for testing.

Installing Contractors must provide completed and initialed Pre-Functional Checklists and all associated equipment start-up reports to the Lead Commissioning Specialist as a single package for each systems category no later than seven calendar days after completion of inspection of all checklist items for each piece of equipment and system.

3.1.15 Certified Certificates of Readiness and Certificates of Readiness

3.1.15.1 General Requirements

A single Certified Certificate of Readiness must be prepared for each equipment, system, and assembly subject to Functional Performance Testing by reviewing, signing, and dating Certificates of Readiness to indicate each equipment, system, and assembly is complete and ready for testing. Testing of any equipment, system, or assembly is prohibited until after its Certified Certificate of Readiness has been submitted and approved. Government approval of Certified Certificates of Readiness does not constitute the Government's responsibility for equipment, systems, or assemblies being complete and ready for testing.

A single Certificate of Readiness must be prepared for each equipment, system, and assembly subject to Functional Performance Testing. Certificate of Readiness contents must include, but not be limited to, contents specified in the following paragraphs to the extent applicable to the specific system being tested.

a. Cover sheet with spaces for signatures and dates by the Lead Commissioning Specialist and by Installing Contractors to indicate each system is complete and ready for testing.

c. Equipment and system start-up reports.

d. Control system start-up reports.

e. Diagnostic test reports.

g. Completed Pre-Functional Checklists.

3.1.15.2 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must sign, date, and submit Certified Certificates of Readiness for all equipment, systems, and assemblies listed under each systems category listed under paragraph SYSTEMS TO BE COMMISSIONED as a single submittal no later than 14 calendar days prior to testing of any equipment, system, or assembly listed under respective systems category.

3.1.15.3 Commissioning Specialists Responsibilities

Commissioning Specialists must perform reviews of Certificates of Readiness for accuracy to ensure equipment, systems, and assemblies are

complete and ready for testing for equipment, systems, and assemblies listed under systems categories assigned to them in this Section. Commissioning Specialists are prohibited from performing these responsibilities for equipment, systems, and assemblies listed under systems categories assigned to other Commissioning Specialists.

3.1.15.4 Installing Contractors Responsibilities

Installing Contractors must prepare, sign, and date Certificates of Readiness indicating equipment, systems, and assemblies are complete and ready for testing. Certificates of Readiness for all equipment, systems, and assemblies listed under each systems category listed under paragraph SYSTEMS TO BE COMMISSIONED must be provided to the Lead Commissioning Specialist as a single package for each systems category.

3.1.16 Construction Phase Functional Performance Testing

3.1.16.1 General Requirements

Construction Phase Functional Performance Testing must be performed for all equipment, systems, and assemblies for which a Functional Performance Test (FPT) Checklist has been prepared. Testing must be performed using approved checklists and all required Commissioning Team participants must be present prior to start of testing. Testing must be aborted and rescheduled to occur at a later date if any Commissioning Team participant is not present or if deficiencies discovered during testing prevent successful completion. Testing of any equipment, system, and assembly is prohibited until after its Certified Certificate of Readiness has been submitted and approved.

All necessary materials and system modifications to simulate actual conditions as close as is practically possible must be provided. Complete all testing by returning affected equipment, systems, and assemblies to pre-test conditions.

3.1.16.2 Complex Systems Requirements

Testing of complex systems as defined in paragraph COMPLEX SYSTEMS in paragraph SYSTEMS TO BE COMMISSIONED must be performed as specified in the following paragraphs.

3.1.16.2.1 Equipment Featuring On-Board Factory Packaged Controls

Testing of equipment featuring on-board factory packaged controls must include, but not be limited to, testing specified in the following paragraphs.

a. Equipment enabling and disabling.

b. Equipment standard and optional control points necessary to accomplish functionality whether or not control points are specified in Plans and Specifications.

c. Equipment standard and optional alarms critical to safe operation whether or not optional alarms are specified in Plans and Specifications.

d. All control points added by Controls Contractor in addition to on-board factory packaged controls whether or not control points are

specified in Plans and Specifications.

3.1.16.2.2 Test Setup and Condition Simulation

Test setup must include all necessary materials and system modifications to simulate flows, pressures, temperatures, and other conditions necessary to perform testing according to specified conditions must be provided.

Condition simulation must be accomplished by temporarily changing control system setpoints. Condition simulation by over-writing control system inputs (actual) values is prohibited unless approved in advance of test by the Contracting Officer's Technical Representative.

3.1.16.2.3 Condition Simulation Methods

Condition simulation methods for equipment, systems, and assemblies listed under item entitled "Heating, Ventilation, and Air-Conditioning (HVAC) Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED that are acceptable are specified in the following paragraphs.

a. When varying static pressures inside ductwork cannot be simulated within the duct, and where a sensor signals the controls system to initiate sequences at various duct static pressures, it is acceptable to simulate the various pressures with a Pneumatic Squeeze-Bulb Type Signaling Device with gauge temporarily attached to the sensing tube leading to the transmitter. It is not acceptable to reset the various setpoints, nor to simulate an electric analog signal unless approved as specified in the preceding paragraphs.

b. Dirty filter pressure drops can be simulated using sheets of cardboard at filter face.

c. Freeze-stat safeties can be simulated by packing portion of sensor with ice.

d. High outside air temperatures can be simulated with a hair blower.

e. High entering cooling coil temperatures can be used to simulate entering cooling coil conditions.

f. Do not use signal generators to simulate sensor signals unless approved by the Contracting Officer's Technical Representative, as noted above, for special cases.

g. Control setpoints can be altered. For example, to see the air conditioning compressor lockout work at an outside air temperature below lockout setpoint, when the outside air temperature is above lockout setpoint, temporarily change the lockout setpoint to be minus 0 degrees above the current outside air temperature. Caution: Setpoints are not to be raised or lowered to a point such that damage to the components, systems, or the building structure and/or contents will occur.

h. Test duct mounted smoke detectors in accordance with the manufacturer's recommendations. Perform testing with air system at minimum airflow condition in ductwork.

i. Test current sensing relays used for fan and pump status signals to control system to indicate unit failure and run status by resetting

the setpoint on the relay to simulate a lost belt or unit failure while the unit is running. Confirm that the failure alarm was generated and received at the control system. After the test is performed, return the setpoint to its original setpoint or a setpoint as indicated by the Contracting Officer's Technical Representative.

3.1.16.3 Sample Strategy

3.1.16.3.1 General Requirements

100-Percent testing of all equipment, systems, and assemblies as modified in the following paragraphs. Sample strategy for testing less than 100-percent testing must be equally applied to each commissioned building in this project.

Sample strategy testing must be applied to total equipment and system counts specified for system categories under paragraph SYSTEMS TO BE COMMISSIONED.

3.1.16.3.2 Complex Systems

Sample strategy for all complex systems as defined in paragraph COMPLEX SYSTEMS must be as specified in the following paragraphs.

a. 100-Percent testing for equipment, systems, and assemblies such as chilled water systems, HVAC heating hot water systems, renewable energy systems, building automation systems, energy management and control systems, aircraft pre-conditioned air systems, air handling unit systems including all associated fans except for remote exhaust air fans, dedicated outside air systems including all associated fans except for remote exhaust air fans, computer room air-conditioning units, whole-building energy monitoring, and whole-building water utility monitoring.

b. 20-Percent sample testing for equipment, systems, and assemblies with identical control sequences such as heat pumps, split system air-conditioning units, and packaged terminal air-conditioner units. Sample must include at least one complete item such as one complete heat pump.

3.1.16.3.3 Plumbing Systems

Sample strategy for all equipment, systems, and assemblies listed under item entitled "Plumbing Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED except plumbing systems defined as complex systems in paragraph COMPLEX SYSTEMS must be as specified in the following paragraphs.

a. 100-Percent testing for equipment, systems, and assemblies such as domestic heating hot water systems, domestic solar heating hot water systems, service water pressure-booster pump systems, process water systems, natural gas systems, and irrigation systems.

b. 20-Percent sample testing for equipment, systems, and assemblies with identical features such as fixtures, semi-instantaneous water heaters, emergency eyewash stations, and vacuum systems. Sample must include at least one complete item such as one complete fixture.

3.1.16.3.4 Electrical Type II Systems

Sample strategy for all equipment, systems, and assemblies listed under item entitled "Electrical Type II Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED except electrical systems defined as complex systems in paragraph COMPLEX SYSTEMS must be as specified in the following paragraphs.

a. 100-Percent testing for equipment, systems, and assemblies such as frequency converters, emergency power off control systems, emergency response systems, electrical utility metering systems, and photovoltaic systems.

b. 20-Percent sample testing for equipment, systems, and assemblies with identical features such as audiovisual systems, automatic receptacles controls, communications systems, energy monitoring, lighting systems, lighting control devices, lighting control systems, and security systems. Sample must include at least one complete item such as lighting in one space.

3.1.16.4 Unsuccessful Testing and Re-Testing

3.1.16.4.1 Unsuccessful Testing of 100-Percent Sample

Testing must be failed for equipment or systems for which 100-percent sample size are tested if one or more of the test procedures results in discovery of a deficiency that cannot be resolved within five minutes during testing.

Re-testing must be witnessed to the extent necessary to confirm that deficiencies have been corrected without negatively impacting the performance of the rest of the system.

3.1.16.4.2 Unsuccessful Testing of Less than 100-Percent Sample

Testing must be failed for equipment or systems for which less than 100-percent sample size are tested if one or more of the test procedures results in discovery of a deficiency, regardless of whether the deficiency is corrected during the sample test.

a. Re-testing must be witnessed of only items which experienced initial failures if the failure rate is 5-percent or less, meaning that 5-percent or less of the equipment or systems had at least one deficiency.

b. Re-testing must be witnessed of items which experienced initial failures to the extent necessary to confirm that the deficiencies have been corrected if the failure rate is higher than 5-percent, meaning that more than 5-percent of equipment or systems tested had at least one deficiency. In addition, testing of another random sample must be witnessed for the same size as the initial sample for the first time. If the second random sample set has any failures, those failed items must be retested and all remaining equipment, systems, and assemblies must be tested to complete 100-percent testing of that system type.

3.1.16.5 Re-Testing Costs

Re-testing costs may be withheld by the Contracting Officer from payments to Installing Contractors. These costs may include salary, travel costs, and per diem associated with re-testing for the Lead Commissioning

Specialist, Commissioning Specialists, and Government personnel.

3.1.16.6 Commissioning Team Participants

Participants of Functional Performance Testing must include, but not be limited to, participants specified in the following paragraphs. The Contracting Officer's Technical Representative, Public Works Department Division (PWD) Representatives, and Using Agent's Representatives (Users) may, but are not required to, participate in any testing.

3.1.16.6.1 Heating, Ventilation, and Air-Conditioning (HVAC) Systems

Commissioning Team members participating in Functional Performance Testing of equipment, systems, and assemblies listed under item entitled "Heating, Ventilation, and Air-Conditioning (HVAC) Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED must include, but not be limited to, participants specified in the following paragraphs.

a. Mechanical Commissioning Specialist (CxM).

b. Installing Contractors’ Quality Control Personnel (CQC).

c. Installing Contractors’ Controls Commissioning Representative (CC).

d. Installing Contractors’ TAB Commissioning Representative (TAB).

e. Installing Contractors’ Mechanical Commissioning Representative (MC).

f. Equipment Supplier (ES).

3.1.16.6.2 Plumbing Systems

Commissioning Team members participating in Functional Performance Testing of equipment, systems, and assemblies listed under item entitled "Plumbing Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED must include, but not be limited to, participants specified in the following paragraphs.

a. Mechanical Commissioning Specialist (CxM).

b. Installing Contractors’ Quality Control Personnel (CQC).

c. Installing Contractors’ Controls Commissioning Representative (CC).

d. Installing Contractors’ Plumbing Commissioning Representative (PC).

e. Equipment Supplier (ES).

3.1.16.6.3 Utility Systems

Commissioning Team members participating in Functional Performance Testing of equipment, systems, and assemblies listed under item entitled "Utility Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED must include, but not be limited to, participants specified in the following paragraphs.

a. Mechanical Commissioning Specialist (CxM).

b. Installing Contractors’ Quality Control Personnel (CQC).

c. Installing Contractors’ Controls Commissioning Representative (CC).

d. Installing Contractors’ TAB Commissioning Representative (TAB).

e. Installing Contractors’ Mechanical Commissioning Representative (MC).

f. Installing Contractors’ Plumbing Commissioning Representative (PC).

g. Installing Contractors’ Electrical Commissioning Representative (EC).

h. Equipment Supplier (ES).

3.1.16.6.4 Electrical Type II Systems

Commissioning Team members participating in Functional Performance Testing of equipment, systems, and assemblies listed under item entitled "Electrical Type II Systems Category" in paragraph SYSTEMS TO BE COMMISSIONED must include, but not be limited to, participants specified in the following paragraphs.

a. Electrical Commissioning Specialist (CxE).

b. Installing Contractors’ Quality Control Personnel (CQC).

c. Installing Contractors’ Electrical Commissioning Representative (EC).

d. Equipment Supplier (ES).

3.1.16.7 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must, at a minimum, perform activities specified in the following paragraphs.

a. Contact Contracting Officer's Technical Representative no later than 30 calendar days prior to performing Testing to select which systems must be tested for samples of less than 100-percent.

b. Coordinate logistics with Installing Contractors.

c. Provide summary of Functional Performance Testing results to the Contracting Officer's Technical Representative for concurrence or acceptance at intervals no later than seven calendar days after the start of each occurrence of testing.

d. Submit completed Final Functional Performance Test Checklists for each systems category listed under paragraph SYSTEMS TO BE COMMISSIONED as a single submittal no later than 14 calendar days after successful testing of all systems listed under the respective systems category.

3.1.16.8 Commissioning Specialists Responsibilities

Commissioning Specialists must witness, re-witness, and document all testing for equipment, systems, and assemblies listed under systems categories assigned to them in this Section. Commissioning Specialists are prohibited from performing these responsibilities for equipment, systems, and assemblies listed under systems categories assigned to other Commissioning Specialists.

3.1.16.9 Installing Contractors Responsibilities

Installing Contractors must provide all necessary materials and perform all aspects of testing including modifications to simulate actual conditions for all equipment, systems, and assemblies related to their contract.

3.1.16.10 Equipment Suppliers Responsibilities

Equipment Suppliers must perform all aspects of testing of equipment featuring on-board factory packaged controls provided as part of their contract. Refer to paragraph COMPLEX SYSTEMS for definition of equipment featuring on-board factory packaged controls.

3.1.16.11 Installing Contractors and Equipment Supplier Coordination

Installing Contractors and Equipment Suppliers must simultaneously perform all aspects of testing of equipment featuring on-board factory packaged controls provided as part of their contract.

3.1.17 Systems Manuals

3.1.17.1 General Requirements

Systems Manuals must be prepared for all commissioned equipment, systems, and assemblies and contents must include, but not be limited to, contents specified in the following paragraphs.

a. Executive summary containing overview of design, construction, and operation requirements.

b. Certificate of Occupancy.

c. Approved Construction Phase Commissioning Plan.

d. Approved Construction Phase Issues and Resolution Log.

e. Identification of unresolved deficiencies complete with resolution plan if not included in approved Final Commissioning Report.

f. Final Owner's Project Requirements.

g. Final Basis of Design.

h. Record documents including as-built Plans and Specifications and approved Construction Submittals.

i. Operation and Maintenance Manuals.

j. Maintenance procedures, checklists, and records.

k. Recommended maintenance schedules when schedules are not provided in Operation and Maintenance manuals.

l. Ongoing Commissioning operational and maintenance record keeping procedures to monitor equipment, systems, and assemblies performance.

m. Building and equipment operation schedules.

n. Equipment and system limitations.

o. Emergency procedures.

p. Recommended schedule for sensor and actuator calibration.

q. Recommended re-testing schedule.

r. Blank copy of all approved final Functional Performance Test Checklists.

s. Completed Functional Performance Test Checklists if not included in approved Final Commissioning Report.

v. Equipment warranty information.

w. Installing Contractors and Equipment Suppliers contact information.

x. Training Plans if not included in approved Final Commissioning Report, training materials, and completed Training Attendance Rosters if not included in approved Final Commissioning Report.

y. Commissioning Design Review Reports if not included in approved Final Commissioning Report.

z. Construction Submittal Review Reports.

aa. Approved Final Commissioning Report.

bb. All Commissioning reports that are not specified in the preceding paragraphs and are not specified to be included in the approved Final Commissioning Report.

Systems Manual contents for all complex systems as defined in paragraph COMPLEX SYSTEMS, in addition to contents specified in the preceding paragraphs, must include, but not be limited to, contents specified in the following paragraphs.

a. As-built system single line diagrams.

b. As-built sequences of operation and controls drawings.

c. As-built control system setpoints and operating ranges.

3.1.17.2 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must, at a minimum, provide all review comments to the Installing Contractors for all equipment, systems, and assemblies listed under each systems category as a single package no later than 45 calendar days prior to first training event for any equipment, system, or assembly in respective systems category. Review comments are not required to be submitted to the Government.

3.1.17.3 Commissioning Specialist Responsibilities

Commissioning Specialists must, at a minimum, review and prepare review comments for all Systems Manuals. Commissioning Specialists are prohibited from performing these responsibilities for equipment, systems, and assemblies listed under systems categories assigned to other Commissioning

Specialists.

3.1.17.4 Installing Contractors Responsibilities

Installing Contractors must, at a minimum, perform activities specified in the following paragraphs.

a. Prepare and provide all Systems Manuals to the Lead Commissioning Specialist for all equipment, systems, and assemblies listed under each systems category as a single package no later than 60 calendar days prior to first training event for any equipment, system, or assembly in respective systems category.

b. Incorporate all review comments.

3.1.18 Training

3.1.18.1 Training Plans

Training Plans must be prepared for all commissioned equipment, systems, and assemblies and contents must include, but not be limited to, contents specified in the following paragraphs.

a. List of those who should receive training by position or name.

b. List of systems that require training organized by Specification Section.

c. Outline of training topics that addresses design, construction, operation, and maintenance.

d. Learning objectives and training delivery methods.

e. Planned location of the training sessions (classroom, on-site, and off-site).

f. Minimum duration of each training session.

g. Training materials requirements to be used during the instructional process.

h. Training report, records, and recording requirements.

i. Instructor qualifications.

j. Instructor name and contact information.

k. Criteria for determining whether provided training is acceptable.

l. Blank Training Attendance Rosters.

3.1.18.2 Training

Training must be performed in accordance with Training Plans and in accordance with requirements specified in other Sections.

3.1.18.3 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must, at a minimum, provide all review

comments to the Installing Contractors for all equipment, systems, and assemblies listed under each systems category as a single package no later than 45 calendar days prior to first training event for any equipment, system, or assembly in respective systems category. Review comments are not required to be submitted to the Government.

3.1.18.4 Commissioning Specialist Responsibilities

Commissioning Specialists must, at a minimum, review and prepare review comments for all Training Plans. Commissioning Specialists are prohibited from performing these responsibilities for equipment, systems, and assemblies listed under systems categories assigned to other Commissioning Specialists.

3.1.18.5 Installing Contractors Responsibilities

Installing Contractors must, at a minimum, perform activities specified in the following paragraphs.

a. Prepare and provide all Training Plans to the Lead Commissioning Specialist for all equipment, systems, and assemblies listed under each systems category as a single package no later than 60 calendar days prior to first training event for any equipment, system, or assembly in respective systems category.

b. Incorporate all review comments.

c. Perform training as specified in the preceding paragraphs.

d. Require all training attendees to sign Training Attendance Rosters.

e. Provide all Approved Training Plans and Completed Training Attendance Rosters to the Lead Commissioning Specialist for all equipment, systems, and assemblies listed under each systems category as a single package no later than 30 calendar days after the last training event for all equipment, systems, and assemblies in respective systems category.

3.1.19 Final Commissioning Report

3.1.19.1 General Requirements

The Final Commissioning Report must be prepared and contents must include, but not be limited to, contents specified in the following paragraphs.

a. Executive summary describing the overall Commissioning Process.

b. Results of the Commissioning Process.

c. Issues And Resolution Log.

d. Commissioning Design Review Reports.

e. Approved Construction Phase Final Commissioning Plan.

f. Approved Pre-Final Test and Balance Reports.

g. Completed Pre-Functional Checklists.

i. Completed Functional Performance Test Checklists.

k. Approved Training Plans.

l. Completed Training Attendance Rosters.

n. Indication that equipment, systems, and assemblies meet requirements of the Owner's Project Requirements, Basis of Design, and Plans and Specifications.

q. Identification of all deficiencies complete with corrective actions taken.

r. Identification of all repairs, replacements, and calibrations.

s. Identification of unresolved deficiencies complete with resolution plan and responsible Commissioning Team member.

t. List and plan for completion of any testing that must be performed during the Post-Construction (Warranty) Phase.

3.1.19.2 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must, at a minimum, perform activities specified in the following paragraphs.

a. Prepare and submit the Final Commissioning Report no later than 30 calendar days after Beneficial Occupancy.

b. File one copy of Approved Final Commissioning Report in the Sustainability eNotebook no later than 14 calendar days after receiving approval of the Final Commissioning Report.

3.2 POST-CONSTRUCTION (WARRANTY) PHASE

3.2.1 Post-Construction Phase International Green Construction Code Commissioning Compliance

3.2.1.1 General Requirements

Activities must include, but not be limited to, Post-Construction Phase Commissioning Activities listed in ICC IgCC paragraphs 1001.1 through 1001.3.1.3.6, ICC IgCC Informative Appendix I, and ASHRAE 202 as modified in this Section, Post-Construction Phase Commissioning Activities listed in references contained in ICC IgCC's paragraphs and ASHRAE 202 as modified in this Section, and Post-Construction Phase Commissioning Activities specified in this Section.

3.2.1.2 Lead Commissioning Specialist and Commissioning Specialists Responsibilities

The Lead Commissioning Specialist and Commissioning Specialists must, at a minimum, perform all activities specified under item entitled "Post-Construction Phase International Green Construction Code Commissioning Compliance."

3.2.2 Post-Construction Phase Sustainability Third Party Certification (TPC) Commissioning Compliance

3.2.2.1 General Requirements

Activities must include, but not be limited to, Post-Construction Phase Commissioning Activities listed in the reference for pursuing Sustainability TPC, GBI DOD GP Compliance, as modified in this Section, Post-Construction Phase Commissioning Activities listed in all of its references as modified in this Section, and Post-Construction Phase Commissioning Activities specified in this Section.

3.2.2.2 Lead Commissioning Specialist and Commissioning Specialists Responsibilities

The Lead Commissioning Specialist and Commissioning Specialists must, at a minimum, perform activities specified in the following paragraphs.

a. The Lead Commissioning Specialist must submit all Post-Construction Phase documentation of Commissioning Activities directly to the Suitability TPC organization as modified in this Section.

b. The Lead Commissioning Specialist and Commissioning Specialists must perform all activities specified under item entitled "Post-Construction Phase Sustainability Third Party Certification (TPC)."

3.2.3 Post-Construction Phase Issues And Resolution Log

3.2.3.1 General Requirements

The Post-Construction Phase Issues and Resolution Log must be prepared and maintained to track all Commissioning Issues identified by any member of the Commissioning Team. The Post-Construction Phase Issues and Resolution Log must be prepared in an electronic format that can be used throughout the Post-Construction Phase such that it can be provided to the Government upon request. Post-Construction Phase Issues and Resolution Log contents must include, but not be limited to, contents specified in the following paragraphs.

a. Project title and location.

b. Lead Commissioning Specialist's contact information.

c. Issue number.

d. Date issue was discovered.

e. Name of Commissioning Team member identifying the issue.

f. Commissioning Team member responsible for resolving the issue.

g. Current status.

h. Issue description.

i. Pictures of item if available and appropriate.

j. Effects of issue on project or building operation.

k. Possible cause of issue.

l. Proposed resolution.

m. Final resolution and final resolution date.

n. Approvals of issue resolution, including approver's name.

3.2.3.2 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must prepare and maintain the Post Construction Phase Issues And Resolution Log and must submit one electronic copy no later than 14 calendar days after completion of any Post-Construction Phase Commissioning Activity.

3.2.4 Post-Construction Phase Site Observations

3.2.4.1 General Requirements

Post-Construction Phase Site Observations must be performed for each systems category specified in the following item entitled "Number of Trips" between eight and 10 months after Beneficial Occupancy to verify and document that all commissioned equipment, systems, and assemblies are operating in accordance with the Owner's Project Requirements.

Post-Construction Phase Site Observations are prohibited from being combined with witnessing Post-Construction Phase Functional Performance Testing.

3.2.4.2 Number of Trips

The Number of Post-Construction Phase Site Observations inclusive of all commissioned buildings in this project must be as follows

a. Heating, Ventilation, and Air-Conditioning (HVAC) Systems Category: One eight-hour trip.

b. Plumbing Systems Category: One eight-hour trip.

d. Utility Systems Category: No trips.

e. Electrical Type I Systems Category: No trips.

f. Electrical Type II Systems Category: One eight-hour trip.

i. Building Envelope Systems, Components, and Assemblies Category: One eight-hour trip.

3.2.4.3 Site Observation Reports

Site Observation Reports must be prepared for each Site Observation for the purpose of documenting issues discovered during Site Observation.

3.2.4.4 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must, at a minimum, perform activities specified in the following paragraphs.

a. Contact Contracting Officer's Technical Representative no later than 30 calendar days prior to performing Site Observation to schedule attendance of Operations and Maintenance staff and occupants and to make provisions for access to all commissioned equipment, systems, and assemblies.

b. Submit Post-Construction Phase Site Observation Reports no later than 14 calendar days after Site Observation.

3.2.4.5 Commissioning Specialists Responsibilities

Commissioning Specialists must, at a minimum, perform activities specified in the following paragraphs for equipment, systems, and assemblies listed under systems categories assigned to them in this Section. Commissioning Specialists are prohibited from performing these responsibilities for equipment, systems, and assemblies listed under systems categories assigned to other Commissioning Specialists.

a. Interview Operations and Maintenance staff.

b. Interview occupants.

c. Determine status of unresolved Commissioning Issues.

d. Compare current operations to operations identified throughout the Commissioning Process.

e. Prepare Post-Construction Phase Site Observation Reports.

3.2.5 Certified Certificates of Readiness and Certificates of Readiness

Certified Certificates of Readiness and Certificates of Readiness are not required for any Post-Construction Phase activity.

3.2.6 Post-Construction Phase Functional Performance Testing

3.2.6.1 General Requirements

Post-Construction Phase Functional Performance Testing must be performed for all commissioned equipment, systems, and assemblies that could not be fully or successfully tested during the Construction Phase. Testing must be performed using approved checklists and all required Commissioning Team participants must be present prior to start of testing. Testing must be aborted and rescheduled to occur at a later date if any Commissioning Team participant is not present or if deficiencies discovered during testing prevent successful completion.

Post-Construction Phase Functional Performance Testing requirements and activities must include, but not be limited to, requirements and activities specified for Construction Phase Functional Performance Testing as modified in paragraphs under paragraph POST-CONSTRUCTION (WARRANTY) PHASE.

3.2.6.2 Commissioning Team Participants

Participants of Functional Performance Testing must include, but not be limited to, participants specified in the following paragraphs. The Contracting Officer's Technical Representative, Public Works Department Division (PWD) Representatives, and Using Agent's Representatives (Users)

may, but are not required to, participate in any testing.

a. Lead Commissioning Specialist.

b. Commissioning Specialists.

c. Installing Contractors.

d. Equipment Suppliers.

3.2.6.3 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must, at a minimum, perform activities specified in the following paragraphs.

a. Contact Contracting Officer's Technical Representative no later than 30 calendar days prior to witnessing Post-Construction Phase Functional Performance Testing to make provisions for access to all commissioned equipment, systems, and assemblies.

b. Coordinate logistics with Installing Contractors.

c. Submit completed Final Functional Performance Test Checklists for each systems category listed under paragraph SYSTEMS TO BE COMMISSIONED as a single submittal no later than 14 calendar days after successful testing of all systems listed under the respective systems category.

3.2.7 Updated Systems Manuals

3.2.7.1 General Requirements

Updated Systems Manuals must be prepared and must be an update to Systems Manuals prepared during the Construction Phase and contents must include, but not be limited to, changes resulting from Post-Construction Phase Commissioning Activities.

3.2.7.2 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must, at a minimum, provide all review comments to the Installing Contractors as a single package 45 calendar days after Post-Construction Phase Site Observations or no later than 45 calendar days after Post-Construction Phase Functional Performance Testing, whichever occurs last. Review comments are not required to be submitted to the Government.

3.2.7.3 Commissioning Specialist Responsibilities

Commissioning Specialists must, at a minimum, review and prepare review comments for all Updated Systems Manuals. Commissioning Specialists are prohibited from performing these responsibilities for equipment, systems, and assemblies listed under systems categories assigned to other Commissioning Specialists.

3.2.7.4 Installing Contractors Responsibilities

Installing Contractors must, at a minimum, perform activities specified in the following paragraphs.

a. Prepare and provide all Updated Systems Manuals to the Lead

Commissioning Specialist as a single package no later than 30 calendar days after Post-Construction Phase Site Observations or no later than 30 calendar days after Post-Construction Phase Functional Performance Testing, whichever occurs last.

b. Incorporate all review comments.

3.2.8 Updated Final Commissioning Report

3.2.8.1 General Requirements

The Updated Final Commissioning Report must be prepared and must be an update to the Final Commissioning Report prepared during the Construction Phase and contents must include, but not be limited to, changes resulting from Post-Construction Phase Commissioning Activities.

3.2.8.2 Lead Commissioning Specialist Responsibilities

The Lead Commissioning Specialist must, at a minimum, prepare and submit the Updated Final Commissioning Report no later than 30 calendar days after completion of all Functional Performance Testing.

File one copy of Approved Updated Final Commissioning Report in the Sustainability eNotebook no later than 14 calendar days after receiving approval of the Updated Final Commissioning Report.

-- End of Section --

SECTION 02 41 00

DEMOLITION AND DECONSTRUCTION
08/22

PART 1 GENERAL

1.1 REFERENCES

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

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI Guideline K	(2009) Guideline for Containers for Recovered Non-Flammable Fluorocarbon Refrigerants

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.6	(2006) Safety & Health Program Requirements for Demolition Operations - American National Standard for Construction and Demolition Operations

CARPET AND RUG INSTITUTE (CRI)

CRI 104	(2015) Carpet Installation Standard for Commercial Carpet
CRI 105	(2015) Carpet Installation Standard for Residential Carpet

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety -- Safety and Occupational Health (SOH) Requirements

U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA 4145.25	(Jun 2000; Reaffirmed Oct 2010) Storage and Handling of Liquefied and Gaseous Compressed Gases and Their Full and Empty Cylinders; https://www.dla.mil/Portals/104/Documents/DispositionS /ddsr/docs/cylinderjointpub.pdf

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 4000.25-1-M	(2006) MILSTRIP - Military Standard Requisitioning and Issue Procedures
MIL-STD-129	(2014; Rev R; Change 1 2018; Change 2 2019) Military Marking for Shipment and Storage

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

40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 82	Protection of Stratospheric Ozone
49 CFR 173.301	Shipment of Compressed Gases in Cylinders and Spherical Pressure Vessels

1.2 PROJECT DESCRIPTION

1.2.1 Definitions

1.2.1.1 Demolition

Demolition is the process of tearing apart and removing any feature of a facility together with any related handling and disposal operations.

1.2.1.2 Deconstruction

Deconstruction is the process of taking apart a facility with the primary goal of preserving the value of all useful building materials.

1.2.1.3 Demolition Plan

Demolition Plan is the planned steps and processes for managing demolition activities and identifying the required sequencing activities and disposal mechanisms.

1.2.1.4 Deconstruction Plan

Deconstruction Plan is the planned steps and processes for dismantling all or portions of a structure or assembly, to include managing sequencing activities, storage, re-installation activities, salvage, and disposal mechanisms.

1.2.2 Demolition/Deconstruction Plan

Prepare a Demolition Plan and Deconstruction Plan and submit proposed salvage, demolition, deconstruction, 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, and a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Identify components and materials to be salvaged for reuse or recycling with reference to paragraph Existing Facilities to be Removed. Append tracking forms for all removed materials indicating type, quantities, condition, destination, and end use. Coordinate with Waste Management Plan in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL. Include statements affirming Contractor inspection of the existing roof deck and its suitability to perform as a safe working platform or if inspection reveals a safety hazard to workers, state provisions for securing the safety of the workers throughout the performance of the work. Provide procedures for safe conduct of the work in accordance with EM 385-1-1. Plan must be approved by Contracting Officer prior to work beginning.

1.2.3 General Requirements

Do not begin demolition or deconstruction until authorization is received from the Contracting Officer. The work of this section is to be performed in a manner that maximizes 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 buildings. The work includes demolition, deconstruction, 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

Comply with FAR 52.236-9 to protect existing vegetation, structures, equipment, utilities, and improvements. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract. Do not overload structural elements or pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove snow, dust, dirt, and debris from work areas daily.

1.3.2 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas.

1.3.3 Trees

Protect trees within the project site which might be damaged during demolition or deconstruction, and which are indicated to be left in place, by a 6-foot-high fence. Erect and secure fence a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Contracting Officer.

1.3.4 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Prior to

start of work, utilities serving each area of alteration or removal will be shut off by the Government or utility provider and disconnected and sealed by the Contractor.

1.3.5 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished or deconstructed, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.

1.4 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

Subpart titled "AVAILABILITY OF WORK AREAS" deleted.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Demolition Plan; G

Deconstruction Plan; G

Existing Conditions

SD-07 Certificates

Notification; G

SD-11 Closeout Submittals

Receipts

Waste Diversion from Landfill Report; S

1.6 QUALITY ASSURANCE

Submit timely notification of demolition and deconstruction projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the Regional Office of the United States Environmental Protection Agency (USEPA), State's environmental protection agency, local air pollution control district/agency, and the Contracting

Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSP A10.6. Comply with the Environmental Protection Agency requirements specified. Use of explosives will 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. Anchor barricades in a manner to prevent displacement by wind. Notify the Contracting Officer prior to beginning such work.

1.7.2 Protection of Personnel

Before, during and after the demolition and deconstruction work continuously evaluate the condition of the site specific features and structure being demolished and deconstructed and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair or replace items to be relocated which are damaged by the Contractor with new undamaged items as approved by the Contracting Officer.

1.9 EXISTING CONDITIONS

Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer or the Contracting Officer's Representative showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs or electronic images with a minimum resolution of 3072 x 2304 pixels, capable of a print resolution of 300 dpi, 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 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 to the

Contracting Officer or the Contracting Officer's Representative.

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. Provide fill material conforming to the definition of satisfactory soil material as defined in Section 31 00 00 EARTHWORK. In addition, fill material must 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, and compacted as specified in Section 31 00 00 EARTHWORK

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures onsite for reuse. Disassemble existing construction scheduled to be removed for reuse. 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. Designate materials for reuse onsite whenever possible.

3.1.1 Structures

a. Demolish and remove existing structures indicated to be removed to include slab-on-grade, foundation walls, and footings in their entirety. Remove interior walls, other than retaining walls and partitions, in their entirety. Break up basement slabs and remove in their entirety. Entirely remove sidewalks, curbs, gutters and street light bases as indicated.

b. Demolish and Deconstruct 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 and deconstruct concrete and masonry walls in small sections. Remove structural framing members and lower to ground by means of derricks, platforms hoists, or other suitable methods as approved by the Contracting Officer.

c. Locate demolition and deconstruction equipment throughout the structure and remove materials so as to not impose excessive loads to supporting walls, floors, or framing.

d. Building not exceeding 80 feet in height may be demolished by the mechanical method of demolition.

e. Submit Waste Diversion from Landfill Report in compliance with Section 017419 for waste materials diverted from landfill for reuse, reclamation, or recycling.

3.1.2 Utilities and Related Equipment

3.1.2.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.2.2 Disconnecting Existing Utilities

Remove existing utilities, as indicated or 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 Chain Link Fencing

Remove chain link fencing, gates and other related salvaged items scheduled for removal and transport to designated areas. Remove gates as whole units. Cut chain link fabric to 25-foot lengths and store in rolls off the ground.

3.1.4 Paving and Slabs

Remove sawcut concrete and asphaltic concrete paving and slabs including aggregate base as indicated. Provide neat saw cuts at limits of pavement removal as indicated. Move, grind and store pavement and slabs designated to be recycled and utilized in this project as directed by the Contracting Officer. Remove pavement and slabs not to be used in this project from the installation at Contractor's expense.

3.1.5 Roofing

Remove existing roof system and associated components in their entirety down to existing roof deck.

3.1.6 Masonry

Sawcut and remove masonry so as to prevent damage to surfaces to remain, to removed materials being salvaged, and to facilitate the installation of new work. Where new masonry adjoins existing, abut or tie the new work into the existing construction as indicated or specified for the new work. Provide square, straight edges and corners where existing masonry adjoins new work and other locations. Masonry removed in pieces must be crushed for use as aggregate.

3.1.7 Concrete

Saw concrete along straight lines to a depth of a minimum 2 inch. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided

that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete. Saw cuts in existing concrete sidewalk, roads, concrete pads, and parking areas must be at the nearest existing expansion joint or weakened plane joint and at full depth.

3.1.8 Structural Steel

Dismantle structural steel at field connections and in a manner that will prevent bending or damage. Salvage for recycle structural steel, steel joists, girders, angles, plates, columns, and shapes. Flame-cutting torches are permitted when other methods of dismantling are not practical. Transport steel joists and girders as whole units and not dismantled. Transport structural steel shapes to a designated recycling facility or area as directed by the Contracting Officer, stacked according to size, type of member and length, and stored off the ground, protected from the weather.

3.1.9 Miscellaneous Metal

Salvage shop-fabricated items such as access doors and frames, steel gratings, metal ladders, wire mesh partitions, metal railings, metal windows and similar items as whole units. Salvage light-gage and cold-formed metal framing, such as steel studs, steel trusses, metal gutters, roofing and siding, metal toilet partitions, toilet accessories and similar items. Scrap metal is the Contractor's property. Recycle scrap metal as part of demolition and deconstruction operations. Provide separate containers to collect scrap metal and transport to a scrap metal collection or recycling facility, in accordance with the Waste Management Plan.

3.1.10 Carpentry

Salvage for recycle lumber, millwork items, and finished boards, and sort by type and size. Chip or shred and recycle salvaged wood unfit for reuse, except stained, painted, or treated wood. Remove windows, doors, frames, and cabinets, and similar items as whole units, complete with trim and accessories. Do not remove hardware attached to units, except for door closers.

3.1.11 Carpet

Remove existing carpet for reclamation in accordance with manufacturer recommendations and as follows. Remove used carpet in large pieces, roll tightly, and pack neatly in a container. Remove adhesive according to recommendations of the Carpet and Rug Institute (CRI). Provide adhesive removal solvents in compliance with CRI 104/CRI 105. Recycle removed carpet cushion.

3.1.12 Acoustic Ceiling Tile

Remove, neatly stack, and recycle acoustic ceiling tiles. Recycling may be available with manufacturer. Otherwise, give priority to a local recycling organization. Recycling is not required if the tiles contain or may have been exposed to asbestos material.

3.1.13 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Make finished surfaces of patched area flush with the adjacent existing surface and match the existing adjacent surface as closely as possible to texture and finish. Provide patching as specified and indicated, and include the following:

a. Concrete and Masonry: Completely fill holes and depressions, caused by previous physical damage or left as a result of removals in existing masonry walls to remain, with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.

b. Where existing partitions have been removed leaving damaged or missing resilient tile flooring, patch to match the existing floor tile.

c. Patch acoustic lay-in ceiling where partitions have been removed. Make the transition between the different ceiling heights by continuing the higher ceiling level over to the first runner on the lower ceiling and closing the vertical opening with a painted sheet metal strip.

3.1.14 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)." Turn in salvaged Class I ODS refrigerants as specified in paragraph, "Salvaged Materials and Equipment."

3.1.15 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)."

3.1.16 Locksets on Swinging Doors

Remove all locksets from all swinging doors indicated to be removed and disposed of. Deliver the locksets and related items to a designated location for receipt by the Contracting Officer after removal.

3.1.17 Mechanical Equipment and Fixtures

Disconnect mechanical hardware at the nearest connection to existing services to remain, unless otherwise noted. Disconnect mechanical equipment and fixtures at fittings. Remove service valves attached to the unit. Salvage each item of equipment and fixtures as a whole unit; listed, indexed, tagged, and stored. Salvage each unit with its normal operating auxiliary equipment. Transport salvaged equipment and fixtures, including motors and machines, to a designated recycling service for disassembly and recycling of parts.

3.1.17.1 Preparation for Storage

Remove water, dirt, dust, and foreign matter from units; drain tanks, piping, and fixtures; if previously used to store flammable, explosive, or other dangerous liquids, steam clean interiors. Seal openings with caps, plates, or plugs. Secure motors attached by flexible connections to the unit. Change lubricating systems with the proper oil or grease.

3.1.17.2 Piping

Disconnect piping at unions, flanges and valves, and fittings as required to reduce the pipe into straight lengths for practical storage. Store salvaged piping according to size and type. If the piping that remains can become pressurized due to upstream valve failure, attach end caps, blind flanges, or other types of plugs or fittings with a pressure gage and bleed valve to the open end of the pipe to ensure positive leak control. Carefully dismantle piping that previously contained gas, gasoline, oil, or other dangerous fluids, with precautions taken to prevent injury to persons and property. Store piping outdoors until all fumes and residues are removed. Box prefabricated supports, hangers, plates, valves, and specialty items according to size and type. Wrap sprinkler heads individually in plastic bags before boxing. Classify piping not designated for salvage, or not reusable, as scrap metal.

3.1.17.3 Ducts

Classify removed duct work as scrap metal.

3.1.17.4 Fixtures, Motors, and Machines

Remove and salvage fixtures, motors and machines associated with plumbing, heating, air conditioning, refrigeration, and other mechanical system installations. Salvage, box and store auxiliary units and accessories with the main motor and machines. Tag salvaged items for identification, storage, and protection from damage. Classify non-porcelain broken, damaged, or otherwise unserviceable units and not caused to be broken, damaged, or otherwise unserviceable as debris to be disposed of by the Contractor.

3.1.18 Electrical Equipment and Fixtures

Salvage motors, motor controllers, and operating and control equipment that are attached to the driven equipment. Salvage wiring systems and components. Box loose items and tag for identification. Disconnect primary, secondary, control, communication, and signal circuits at the point of attachment to their distribution system.

3.1.18.1 Fixtures

Remove and salvage electrical fixtures. Salvage unprotected glassware from the fixture and salvage separately. Salvage incandescent, mercury-vapor, and fluorescent lamps and fluorescent ballasts manufactured prior to 1978, boxed and tagged for identification, and protected from breakage.

3.1.18.2 Electrical Devices

Remove and salvage switches, switchgear, transformers, conductors including wire and nonmetallic sheathed and flexible armored cable,

regulators, meters, instruments, plates, circuit breakers, panelboards, outlet boxes, and similar items. Box and tag these items for identification according to type and size.

3.1.18.3 Wiring Ducts or Troughs

Remove and salvage wiring ducts or troughs. Dismantle plug-in ducts and wiring troughs into unit lengths. Remove plug-in or disconnecting devices from the busway and store separately.

3.1.18.4 Conduit and Miscellaneous Items

Salvage conduit except where embedded in concrete or masonry. Consider corroded, bent, or damaged conduit as scrap metal. Sort straight and undamaged lengths of conduit according to size and type. Classify supports, knobs, tubes, cleats, and straps as debris to be removed and disposed.

3.1.19 Elevators and Hoists

The manual chain falls on all existing cranes within existing magazines are to be salvaged and returned to the government at the Rigging Loft in Building B460. The remaining crane components, including rails, beams, and trolleys are to be demolished and disposed of off government property. Remove and prepare items for salvage without damage to any of the various parts. Salvage and store rails for structural steel with the equipment as an integral part of the unit.

3.1.20 Items with Unique/Regulated Disposal Requirements

Remove and dispose of items with unique or regulated disposal requirements in the manner dictated by law or in the most environmentally responsible manner.

3.2 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition or deconstruction work in areas occupied by structures to be demolished or deconstructed until all demolition and deconstruction in the area has been completed and debris removed. Fill holes, open basements, and other hazardous openings.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, become the property of the Contractor and must be removed from Government property. Materials approved for storage by the Contracting Officer must be removed before completion of the contract. Title to materials resulting from demolition and deconstruction, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.3.2 Reuse of Materials and Equipment

Remove and store materials and equipment listed in the Demolition and Deconstruction Plan and indicated to be reused or relocated to prevent damage and reinstall as the work progresses. Coordinate the re-use of materials and equipment with the re-use requirements in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL. Capture re-use of materials in the diversion calculations for the project.

3.3.3 Salvaged Materials and Equipment

Remove materials and equipment that are listed in the Demolition and Deconstruction Plan and indicated and specified to be removed by the Contractor and that are to remain the property of the Government, and deliver to a storage site, as directed by the Contracting Officer.

a. Salvage items and material to the maximum extent possible.

b. Store all materials salvaged for the Contractor as approved by the Contracting Officer and remove from Government property before completion of the contract. Coordinate the salvaged materials with tracking requirements in accordance with Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL. Capture salvaged materials in the diversion calculations for the project.

c. Remove salvaged items to remain the property of the Government in a manner to prevent damage, and packed or crated to protect the items from damage while in storage or during shipment. Items damaged during removal or storage must be repaired or replaced to match existing items. Properly identify the contents of containers.

d. Remove historical items in a manner to prevent damage. Deliver the following historical items to the Government for disposition: Corner stones, contents of corner stones, and document boxes wherever located on the site.

e. Remove and capture all Class I ODS refrigerants in accordance with the Clean Air Act Amendment of 1990, and turn in to the Navy by shipping the refrigerant container to the Defense Logistics Agency at the following address:

Defense Depot Richmond VA (DDRV)
SW0400
Cylinder Operations
8000 Jefferson Davis Highway
Richmond, VA 23297-5900

3.3.4 Disposal of Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in Section, 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting AHRI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. Remove recovered ODS from Government property and dispose of in accordance with 40 CFR 82. Dispose products, equipment and appliances containing ODS in a sealed, self-contained system (e.g., residential refrigerators and window air conditioners) 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.

3.3.4.1 Special Instructions

No more than one type of ODS is permitted in each container. Apply a warning/hazardous label to the containers in accordance with Department of Transportation regulations. Provide a tag with the following information on all cylinders including but not limited to fire extinguishers, spheres, or canisters containing an ODS:

a. Activity name and unit identification code

b. Activity point of contact and phone number

c. Type of ODS and pounds of ODS contained

d. Date of shipment

e. National stock number (for information, call (804) 279-4525).

3.3.4.2 Fire Suppression Containers

Deactivate fire suppression system cylinders and canisters with electrical charges or initiators prior to shipment. Also, safety caps must be used to cover exposed actuation mechanisms and discharge ports on these special cylinders.

3.3.5 Transportation Guidance

Ship all ODS containers in accordance with MIL-STD-129, DLA 4145.25 (also referenced one of the following: Army Regulation 700-68, Naval Supply Instruction 4440.128C, Marine Corps Order 10330.2C, and Air Force Regulation 67-12), 49 CFR 173.301, and DOD 4000.25-1-M.

3.3.6 Unsalvageable and Non-Recyclable Material

Dispose of unsalvageable and non-recyclable noncombustible material in a licensed disposal facility located off the installation. Dispose of unsalvageable and non-recyclable combustible material in a licensed facility located off the installation.

3.4 CLEANUP

Remove debris and rubbish from project site and similar excavations. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.5 DISPOSAL OF REMOVED MATERIALS

3.5.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified in the Waste Management Plan. Storage of removed materials on the project site is prohibited.

3.5.2 Burning on Government Property

Burning 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 and per Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

-- End of Section --

SECTION 03 70 00

MASS CONCRETE
02/10, CHG 2: 08/20

PART 1 GENERAL

1.1 UNIT PRICES

1.1.1 Concrete for thicknesses 3 feet or more.

1.1.1.1 Payment

Payment will be made for costs associated with completing the concrete work for concrete placed in the Earth covered magazine foundations.. However, these costs will not include the cost of the cement, pozzolan, slag, reinforcement, water-reducing admixture, high range water reducer, and embedded parts that are specified to be paid for separately. No payment will be made for concrete, as such, that is placed in structures of which payment is made as a lump sum.

1.1.1.2 Measurement

Concrete will be measurement for payment based upon the actual volume of concrete within the pay lines of the structures as indicated on the drawings. Measure concrete placed against the sides of any excavation without the use of intervening forms only within the pay lines of the structure. Do not make deductions for rounded or beveled edges, space occupied by metal work, electrical conduits or reinforcing steel, nor for voids or embedded items that are either less than 5 cubic feet in volume or 1 square foot in cross section.

1.1.1.3 Unit of Measure

Unit of measure: cubic yards.

1.1.2 Portland Cement

1.1.2.1 Payment

Payment will be made for costs associated with Portland cement, which includes the cost of required unloading, hauling, handling, and storage at the site, of all portland cement used in the work.

1.1.2.2 Measurement

Portland cement will be measured for payment based upon the number of tons of portland cement used unless specifically excepted, wasted, or used for the convenience of the Contractor. The quantity to be paid for will be determined by multiplying the approved batch weight in pounds/cubic yard of portland cement in each type of concrete used by the number of cubic yards of concrete types placed within the pay lines of the structure, as determined in accordance with the concrete bid items, and dividing by 2,000.

1.1.2.3 Unit of Measure

Unit of measure: tons (2000 lb).

1.1.3 Pozzolan

1.1.3.1 Payment

Payment will be made for costs associated with pozzolan, which includes the cost of required unloading, hauling, handling, and storage at the site, of all pozzolan used in the concrete bid items.

1.1.3.2 Measurement

Pozzolan will be measured for payment based upon the number of cubic feet solid volume of pozzolan used unless specifically excepted, wasted, or used for the convenience of the Contractor. The quantity to be paid for will be determined by multiplying the approved batch weight in pounds/cubic yard of pozzolan in each type of concrete used by the number of cubic yards of concrete of the types placed within the pay lines of the structure, as determined in accordance with the concrete bid items, and dividing by the product of the average specific gravity of the pozzolan multiplied by 62.4 pounds/cubic foot. The average specific gravity is the average of the test results for all material accepted during the period covered by the payment.

1.1.3.3 Unit of Measure

Unit of measure: cubic feet solid volume.

1.1.4 Ground Granulated Blast-Furnace Slag

1.1.4.1 Payment

Payment will be made for costs associated with ground granulated blast-furnace slag, which includes the cost of required unloading, hauling, handling, and storage at the site, of all ground granulated blast-furnace slag used in the concrete bid items.

1.1.4.2 Measurement

Ground granulated blast-furnace slag will be measured for payment based upon the number of tons of ground granulated blast-furnace slag used excluding the amount specifically excepted, wasted, or used for the convenience of the Contractor. The quantity to be paid for will be determined by multiplying the approved batch weight in pounds/cubic yard of ground granulated blast-furnace slag in each type of concrete used by the number of cubic yards of concrete types placed within the pay lines of the structure, as determined in accordance with the concrete bid items, and dividing by 2,000.

1.1.4.3 Unit of Measure

Unit of measure: tons (2000 lb).

1.1.5 Water-Reducing Admixture (WRA)

1.1.5.1 Payment

Payment will be made for costs associated with water-reducing admixture (WRA) at the applicable contract unit price per cubic yard of concrete containing water-reducing admixture.

1.1.5.2 Measurement

Water-reducing admixture (WRA) will be measured for payment based upon the actual volume of concrete containing the admixture and within the pay lines of the structures, as determined in accordance with the concrete bid items.

1.1.5.3 Unit of Measure

Unit of measure: cubic yards.

1.1.6 High-Range Water-Reducing Admixture (HRWR)

1.1.6.1 Payment

Payment will be made for costs associated with high-range water-reducing admixture (HRWR) at the applicable contract unit price per cubic yard of concrete containing water-reducing admixture.

1.1.6.2 Measurement

High-Range water-reducing admixture (HRWR) will be measured for payment based upon the actual volume of concrete containing the admixture and within the pay lines of the structures, as determined in accordance with the concrete bid items.

1.1.6.3 Unit of Measure

Unit of measure: cubic yards.

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 ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(2005; R 2017) Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 214R	(2011) Evaluation of Strength Test Results of Concrete
ACI 306R	(2016) Guide to Cold Weather Concreting

ASTM INTERNATIONAL (ASTM)

ASTM C31/C31M	(2022) 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 C40/C40M	(2020) Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
ASTM C94/C94M	(2021b) Standard Specification for Ready-Mixed Concrete
ASTM C117	(2017) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C123/C123M	(2023) Standard Test Method for Lightweight Particles in Aggregate
ASTM C127	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C128	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C142/C142M	(2017) Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2021) Standard Specification for Portland Cement
ASTM C171	(2020) Standard Specification for Sheet Materials for Curing Concrete
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
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 C295/C295M	(2019) Standard Guide for Petrographic Examination of Aggregates for Concrete
ASTM C309	(2019) Standard Specification for Liquid

	Membrane-Forming Compounds for Curing Concrete
ASTM C494/C494M	(2019) Standard Specification for Chemical Admixtures for Concrete
ASTM C535	(2016) Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C566	(2013) Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM C618	(2019) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C666/C666M	(2015) Resistance of Concrete to Rapid Freezing and Thawing
ASTM C881/C881M	(2020a) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C928/C928M	(2020a) Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs
ASTM C989/C989M	(2018a) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1059/C1059M	(2021) Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C1064/C1064M	(2023) 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 C1107/C1107M	(2020) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D4791	(2019) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(2018) Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices

NATIONAL READY MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(2000; R 2006) Concrete Plant Standards

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 55	(1992) Test Method for Within-Batch Uniformity of Freshly Mixed Concrete
COE CRD-C 94	(1995) Corps of Engineers Specification for Surface Retarders
COE CRD-C 100	(1975) Method of Sampling Concrete Aggregate and Aggregate Sources, and Selection of Material for Testing
COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 130	(2001) Standard Recommended Practice for Estimating Scratch Hardness of Coarse Aggregate Particles
COE CRD-C 143	(1962) Specifications for Meters for Automatic Indication of Moisture in Fine Aggregate
COE CRD-C 144	(1992) Standard Test Method for Resistance of Rock to Freezing and Thawing
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Concrete Lifts; G

Equipment; G

SD-03 Product Data

Batch Plant; G

Mixers

Construction Joint Treatment; G

Curing and Protection; G

Cold-Weather Protection; G

Hot-weather Placing; G

SD-07 Certificates

Sheet Curing

Nonshrink Grout; G

Bonding Agents

1.4 QUALITY ASSURANCE

1.4.1 Government Preconstruction Testing

1.4.1.1 Aggregate Sources

The aggregate sources listed in paragraph COMMERCIAL CONCRETE AGGREGATE SOURCES, have been tested, and at the time testing was performed, these sources were capable of producing materials of the quality and quantity required for this project provided suitable processing is performed. Deliver samples from any source selected, taken under the supervision of the Contracting Officer in accordance with COE CRD-C 100, within 15 days after notice to proceed. Sampling and shipment of samples is the Contractor's expense. 14 days will be required to complete evaluation of the aggregates. Testing will be performed by the Government in accordance with the applicable COE CRD-C or ASTM test methods. Tests to which aggregate may be subjected are listed in paragraph AGGREGATES. The material from the proposed source must meet the quality requirements of this paragraph to be used for the project. The Government test data and other information on aggregate quality of those sources listed in paragraph COMMERCIAL CONCRETE AGGREGATE SOURCES and are available for review in the District Office. Quality assurance testing of aggregates by the Government does not relieve the Contractor of quality control requirements.

1.4.1.2 Cementitious Materials, Admixtures, and Curing Materials

Notify the Contracting Officer of the source, brand name, type, and quantity of all materials (other than aggregates) to be used in the manufacture and curing of the concrete at least 60 days in advance of submitting samples for mixture proportioning studies. Assist the Contracting Officer in obtaining samples of each material. Sampling and testing as determined appropriate will be performed by and at the expense of the Government. If cement or pozzolan are to be obtained from more than one source, state the estimated amount of cement or pozzolan to be obtained from each source and the proposed schedule of shipments in the notification. When pozzolan other than fly ash is used, it must be from one source.

1.4.1.3 Materials for Mixture-Proportioning Studies

At least 30 days in advance of the time when placing of concrete is expected to begin, deliver samples of representative materials proposed for this project and meeting all the requirements of this specification by the Contractor at its expense. Take samples of aggregates under the supervision of the Contracting Officer in accordance with COE CRD-C 100, accompanied by test reports indicating conformance with grading and

quality requirements hereinafter specified. Provide samples of materials other than aggregates that are representative of those proposed for the project and submit accompanied by manufacturer's test reports indicating compliance with applicable specified requirements. Quantities of the following materials must be submitted:

MATERIAL	QUANTITY
6 inch nominal maximum-size coarse aggregate	
3 inch nominal maximum-size coarse aggregate	
1-1/2 inch nominal maximum-size coarse aggregate	
3/4 inch nominal maximum-size coarse aggregate	
Fine aggregate	
Cement	
Pozzolans	
Air-entraining admixture	
Other admixtures (each)	

Mixture-proportioning studies will be made by the Government.

1.4.2 Construction Testing by the Government

1.4.2.1 General

The Government will sample and test cementitious materials, admixtures, aggregates, and concrete during construction as considered appropriate to determine compliance with the specifications. 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 COE CRD-C 100. Slump and air content will be determined in accordance with ASTM C143/C143M and ASTM C231/C231M, respectively, except the point of sampling will be as directed. Compression test specimens will be made and laboratory cured in accordance with ASTM C31/C31M and will be tested in accordance with ASTM C39/C39M.

1.4.2.2 Testing Aggregates

Testing performed by the Government will not relieve the Contractor of its responsibility for testing as appropriate for quality control. During construction, aggregates will be sampled for acceptance testing as delivered to the mixer to determine compliance with specification provisions. Provide necessary facilities and labor for the ready procurement of representative samples under Contracting Officer supervision. The Government will test such samples at its expense using appropriate COE CRD-C and ASTM methods.

1.4.2.3 Cementitious Materials

Furnish cement or pozzolan or both from a prequalified source or, if not, it (they) will be sampled at the mill, shipping point, or site of the work by the Contracting Office. A list of prequalified cement sources and prequalified pozzolan sources is available from the Director, U.S. Army Corps of Engineers, Engineer Research and Development Center - Structures Laboratory, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199, ATTN: CEERD-SC. If tests prove that a material which has been delivered is unsatisfactory, promptly remove it from the site of the work. Cementitious materials that have not been used within 6 months after being tested will be retested by the Government at the expense of the Contractor when directed.

1.4.2.4 Cement from Prequalified Sources

Deliver and use cement directly from a mill of a producer designated as a prequalified source for the type of cement being used. Samples of cement for quality-assurance testing will be taken at the project site or cement-producing plant by the Contracting Officer for testing at the expense of the Government. Furnish a copy of the mill tests from the cement manufacturer to the Contracting Officer for each lot.

1.4.2.5 Pozzolan from Prequalified Sources

Deliver and use pozzolan directly from a producer designated as a prequalified source. Samples of pozzolan for check testing will be taken at the project site by the Contracting Officer for testing at the expense of the Government. Furnish a copy of the test results from the pozzolan manufacturer to the Contracting Officer for each lot.

1.4.2.6 Cement from Nonprequalified Sources

Cement, if not from a prequalified source, will be sampled and tested by or under the supervision of the Contracting Officer and at Government expense. Do not use cement until notice has been given by the Contracting Officer that test results are satisfactory. In the event of failure, the cement may be resampled and tested at the request of the Contractor and at the Contractor's expense. When the point of sampling is other than at the site of the work, the fill gate or gates of the sampled bin will be sealed and kept sealed until shipment from the bin has been completed. The fill gate or gates of conveyances used in shipment will be sealed by or under the supervision of the Contracting Officer. Conveyances will not be accepted at the site of the work unless received with all seals intact. If tested cement is rehandled at transfer points, the extra cost of inspection will be at the Contractor's expense. The cost of testing cement excess to project requirements will also be at the Contractor's expense and will be deducted from payments due the Contractor.

1.4.2.7 Pozzolan from Nonprequalified Sources

Pozzolan, if not from a prequalified source, will be sampled at the source or at the site of the work and will be stored in sealed bins pending completion of acceptance tests. Pozzolan may be resampled at the site when determined necessary. All sampling and testing will be performed by and at the expense of the Government. Release for shipment and approval for use will be based on compliance with seven day lime-pozzolan strength requirements and other physical, chemical, and uniformity requirements for which tests can be completed by the time the seven day lime-pozzolan

strength test is completed. Release for shipment and approval for use on this basis will be contingent on continuing compliance with the other requirements of the specifications. If test results of a bin fail, the contents may be resampled and tested at the Contractor's expense. The Government will supervise or perform the unsealing and resealing of bins and shipping conveyances. If tested pozzolan is rehandled at transfer points, the extra cost of inspection will be at the Contractor's expense. The cost of testing excess pozzolan in excess of project requirements will be at the Contractor's expense. The amount will be deducted from payment to the Contractor.

1.4.2.8 Ground Granulated Blast-Furnace Slag

Ground granulated blast-furnace slag will be sampled and tests at the mill or shipping point by and at the expense of the Government to determine that the material meets the requirements of the specification under which it is furnished. Do not use ground granulated blast-furnace slag until notice of acceptance has been given by the Contracting Officer. Ground granulated blast-furnace slag will be subject to check testing from samples obtained at the project site, as scheduled, and such sampling will be by or under the supervision of the Contracting Officer and at Government expense. Remove material not meeting specifications promptly from the site of work.

1.4.2.9 Chemical Admixtures

Provide satisfactory facilities for ready procurement of test samples. All sampling and testing of a chemical admixture will be by and at the expense of the Government. Tests will be conducted using samples of materials proposed for the project.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Cementitious Materials

1.5.1.1 Transportation

When bulk cement, pozzolan, or ground granulated blast-furnace slag is not unloaded from primary carriers directly into weather-tight hoppers at the batching plant, accomplish transportation from the railhead, mill, or intermediate storage to the batching plant in weather-tight trucks, conveyors, or other means that will protect the material from exposure to moisture. Transportation facilities for dry bulk silica fume must be approved in advance.

1.5.1.2 Storage

Furnish cementitious materials in bulk except that cement used for finishing and patching may be packaged, and silica fume may be packaged or in slurry form. Immediately upon receipt at the site of the work, store all cementitious materials in separate dry, weather-tight, and properly ventilated structures. All storage facilities must permit easy access for inspection and identification. Maintain sufficient materials in storage to complete any lift of concrete started. In order that cement may not become unduly aged after delivery, use any cement that has been stored at the site for 60 days or more before using cement of lesser age. Do not use silica fume in slurry form that has been in storage at the project site for longer than recommended by the manufacturer or that has been subjected to freezing in the work and remove from the site.

1.5.1.3 Separation of Materials

Provide separate facilities for unloading, transporting, and handling each cementitious material. Provide separate appropriate storage facilities for each type of cement and each source of pozzolan, or slag. Plainly mark the contents of each storage facility marked with a large permanent sign posted near the loading port.

1.5.2 Aggregates Storage

Store fine aggregate and each size of coarse aggregate in separate size groups adjacent to the batch plant and in such a manner as to prevent the intermingling of size groups or the inclusion of foreign materials in the concrete. Maintain sufficient fine and coarse aggregate at the site at all times to permit continuous placement and completion of any lift of concrete started.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide concrete composed of cementitious materials, water, fine and coarse aggregates, and admixtures. Use cementitious materials that are portland cement, portland cement in combination with pozzolan, portland blast-furnace slag cement, portland cement in combination with ground granulated blast-furnace slag, or portland-pozzolan cement. Use a retarding admixture, a WRA, a HRWRA, or an accelerating admixture. A retarding admixture may be used at the request of the Contractor when approved. Do not use chemical admixtures other than those listed above.

Subpart "Proportioning Responsibility" Deleted.

2.1.1 Design Requirements

The proportions of all material entering into each concrete mixture will be furnished to the Contractor. The proportions will be changed by the Contracting Officer as necessary. Make adjustments to the batch weights of aggregates and water as necessary to compensate for free moisture in the aggregates. Adjust the quantity of air-entrainment admixture to maintain the specified air content.

2.1.2 Air Content

Determine the air content by volume by ASTM C231/C231M. When the nominal maximum size of coarse aggregate is 1-1/2 inches or larger, the air content of the sample measured in accordance with ASTM C231/C231M must be 5-1/2 ± 1-1/2 percent. When the nominal maximum-size coarse aggregate is 3/4 inch, the air content must be 6 ± 1 percent. The specified air content must be present in the concrete when the concrete has been placed in the forms.

2.1.3 Slump

Determine slump in accordance with ASTM C143/C143M of 2 inches ± 1 inch for massive features and between 1 and 4 inches for all others except where placement by pump is approved, in which case the slump must be 4-1/2 ± 1-1/2 inches. In addition, the range of each set of two consecutive tests for each mixture must be no more than 2 inches. The above specified

slump is that required at the forms.

2.1.4 Construction Tolerances

Make level and grade tolerance measurements of slabs as soon as possible after finishing. When forms or shoring are used, make the measurements prior to removal. Tolerances are not cumulative. The most restrictive tolerance controls. Do not allow tolerances to extend the structure beyond legal boundaries. Except as specified otherwise, plus tolerance increases the amount or dimension to which it applies, or raises a level alignment and minus tolerance decreases the amount or dimension to which it applied, or lowers a level alignment. A tolerance without sign means plus or minus. Where only one signed tolerance is specified, there is no limit in the other direction. Finish unformed finished surfaces subject to high-velocity flow (40 fps) to meet the tolerances for A-HV surfaces specified in Table, "TOLERANCES FOR FINISHED FORMED CONCRETE SURFACES".

2.1.5 Tabulations and Definitions

The definitions of the terms used in the following tabulations are used as defined and used in ACI 117. Make level and grade tolerance measurements of slabs as soon as possible after finishing.

TOLERANCES FOR FOUNDATIONS		
(1)	Lateral alignment	
	As cast to the center of gravity as specified; 0.02 times width of footing in direction of misplacement but not more than	2 inches
	Supporting masonry construction	1/2 inch
(2)	Level alignment	
	Top of footings supporting masonry	1/2 inch
	Top of other footings	+1/2 inch, -2 inch

TOLERANCES FOR FOUNDATIONS		
(3)	Cross-sectional dimensions	
	Horizontal dimensions of formed members	+2 in.,-1/2 in.
	Horizontal dimensions of unformed members cast against soil	
	2 feet or less	+3 in., -1/2 in.
	Greater than 2 feet but less than 6 feet	+6 in., -1/2 in.
	Over 6 feet	+12 in., -1/2 in.
	Vertical dimension (thickness)	-5 percent
(4)	Relative alignment	
	Slope of footing side and top surfaces with respect to the specified plan	1 in./10 ft

TOLERANCES FOR CAST-IN-PLACE REINFORCED CONCRETE FOR BUILDINGS			
(1)	Vertical alignment		
	For heights 100 feet		
		Lines, surfaces, and arrises	1 inch
		Outside corner of exposed corner columns and control joint grooves in concrete exposed to view	1/2 inch
	For heights greater than 100 ft		
		Lines, surfaces, and arrises, 1/1,000 times the height at any point but not more than	6 inches
		Outside corner of exposed corner columns and control joint grooves in concrete, 1/2,000 times the height at any point but not more than	3 inches
(2)	Lateral alignment		
	Members		1 inch
	In slabs, centerline location of openings 12 in. or smaller and edge location of larger openings		1/2 inch
	Sawcuts, joints, and weakened plane embedment in slabs		3/4 inch

TOLERANCES FOR CAST-IN-PLACE REINFORCED CONCRETE FOR BUILDINGS			
(3)	Level alignment		
	Top of slabs		
		Elevation of slabs-on-grade	3/4 inch
		Elevation of top surfaces of formed slabs before removal of supporting shores	3/4 inch
	Elevation of formed surfaces before removal of shores		3/4 inch
	Lintels, sills, parapets, horizontal grooves, and other lines exposed to view		1/2 inch
(4)	Cross-sectional dimensions		
	Members, such as columns, beams, piers, walls (thickness only) and slabs (thickness only)		
		12 inches dimension or less	+3/8, -1/4 inch
		More than 12 inches but not over 3 feet dimension	+1/2, -3/8 inch
		Over 3 feet dimension	+1, -3/4 inch
(5)	Relative alignment		
	Stairs		
		Different in height between adjacent risers	1/8 inch
		Different in width between adjacent treads	1/4 inch
	Grooves		
		Specified width 2 inches or less	1/8 inch
		Specified width more than 2 inches but not more than 12 inches	1/4 inch
	Sawcuts, joints, and weakened plane on slab		
		Lateral, gradual	3/4 inch in 10 feet
		Lateral, abrupt	0 inch
(6)	Openings through members		
	Cross-sectional size of opening		+1, -1/4 inch
	Location of centerline of opening		1/2 inch

TOLERANCE FOR FINISHED FORMED CONCRETE SURFACES		
(1)	Vertical alignment: Formed surfaces slope with respect to the specified plane	
	Vertical alignment of outside corner of exposed corner columns and control joint grooves in concrete exposed to view	1/4 in. in 10 ft
	All other conditions	3/8 in. in 10 ft
(2)	Abrupt variation: The offset between concrete surfaces under adjacent pieces of formwork for the following classes of surface: (For Class A-HV, positive means raise of elevation in the direction of waterflow, negative means drop of elevation in the direction of waterflow)	
	Class A-HV, in the direction of waterflow	+0, -1/8 inch
	*Class A-HV, perpendicular to the direction of waterflow	1/8 inch
	Class A	1/8 inch
	Class B	1/4 inch
	Class C	1/4 inch
	Class D	1 inch
(3)	Gradual variation: Surface finish tolerances as measured by placing a freestanding (unleveled), 5 foot straightedge for plane surface or curved template for curved surface anywhere on the surface and allowing it to rest upon two high spots within 72 hr after concrete placement. The gap at any point between the straightedge or template and the surface must not exceed:	
	*Class A (including Class A-HV)	1/8 inch
	Class B	1/4 inch
	Class C	1/2 inch
	Class D	1 inch
*Includes any high-velocity flow surface.		

TOLERANCES FOR CAST-IN-PLACE, VERTICALLY SLIPFORMED BUILDING ELEMENTS		
(1)	Translation and rotation from a fixed point at the base of the structure:	
	For heights 100 feet or less	2 inches
	For heights greater than 100 feet, 1/600 times the height but not more than	8 inches

TOLERANCES FOR CAST-IN-PLACE, VERTICALLY SLIPFORMED BUILDING ELEMENTS		
(2)	Lateral alignment	
	Between adjacent elements	2 inches
(3)	Cross-sectional dimensions	
	Wall thickness	+3/4 inch, -3/8 inch
(4)	Relative alignment	
	Formed surface slope with respect to the specified plane	3/4 in. in 10 ft

TOLERANCES FOR MASS CONCRETE STRUCTURES OTHER THAN BUILDINGS		
(1)	Vertical alignment	
	Visible surfaces	1-1/4 inch
	Concealed surfaces	2-1/2 inches
	Side walls for radial gates and similar watertight joints	3/16 inch
(2)	Lateral alignment	
	Visible surfaces	1-1/4 inch
	Concealed surfaces	2-1/2 inches
(3)	Level alignment	
	Visible flatwork and formed surfaces	1/2 inch
	Concealed flatwork and formed surfaces	1 inch
	Sills for radial gates and similar watertight joints	3/16 inch

TOLERANCES FOR MASS CONCRETE STRUCTURES OTHER THAN BUILDINGS			
(4)	Relative alignment: Formed surface slope with respect to the specified plane		
	Slopes in lateral and level alignments		
		Visible surfaces	1/4 in. in 10 ft
		Concealed surfaces	1/2 in. in 10 ft
	Slopes in vertical alignment		
		Visible surfaces	1/2 in. in 10 ft
		Concealed surfaces	1 in. in 10 ft

TOLERANCES FOR CANAL LINING		
(1)	Lateral alignment	
	Alignment of tangents	2 inches
	Alignment of curves	4 inches
	Width of section at any height	0.0025W + 1 inch
(2)	Level alignment	
	Profile grade	1 inch
	Surface of invert	1/4 inch
	Surface of side slope	1/2 inch
	Height of lining	0.005H + 1 inch
(3)	Cross-sectional dimensions	
	Thickness of lining cross section: percent of specified thickness provided average thickness is maintained as determined by daily batch volumes	10

TOLERANCES FOR TUNNEL LININGS, CONDUITS, AND FILLING AND EMPTYING CULVERTS			
(1)	Lateral alignment		
	Centerline alignment		
		Water conveying tunnels, conduits, and culverts	1/2 inch
		Other	1 inch
	Inside dimensions		0.005 times inside dimension

(2)	Level alignment		
	Profile grade		
		Water conveying tunnels, conduits, and culverts	1/2 inch
		Other	1 inch
	Surface of invert		1/4 inch
	Surface of side slope		1/2 inch
(3)	Cross-sectional dimension		
	Thickness at any point		
		Tunnel and culvert lining	-0 inch
		Conduits	+5 percent thickness but not less than1/2 inch
			-2.5 percent thickness but not less than 1/4 inch

2.2 MATERIALS

2.2.1 Cementitious Materials

2.2.1.1 Portland Cement

Provide portland cement conforming to ASTM C150/C150M, Type I or II, including the heat of hydration requirement at 7 days .

2.2.1.2 Pozzolan Other

Provide pozzolan conforming to ASTM C618, Class C or F, including low alkali. Uniformity Requirements (for entrained air) must apply to all fly ash.

2.2.1.3 Ground Granulated Blast-Furnace Slag

Provide ground granulated blast-furnace slag conforming to ASTM C989/C989M, Grade 100.

2.2.1.4 Temperature of Cementitious Materials

The temperature of the cementitious materials as delivered to the site must not exceed 150 degrees F.

2.2.2 Admixtures

All chemical admixtures furnished as liquids must be in a solution of suitable viscosity for field use as determined by the Contracting Officer.

2.2.2.1 Air-Entraining Admixtures

Provide air-entraining admixture conforming to ASTM C260/C260M and consistently entrain air in the specified ranges under field conditions.

2.2.2.2 Accelerating Admixture

Do not use calcium chloride. Use accelerators that meet the requirements of ASTM C494/C494M, Type C.

2.2.2.3 Retarding Admixture

Provide retarding admixture meeting the requirements of ASTM C494/C494M, Type B, or D, except that the 6-month and 1-year compressive strength tests are waived. The admixture may be added to the concrete mixture only when approved. Do not use Type D as the reason to reduce the cementitious material content unless used in mixture proportioning studies.

2.2.2.4 Water-Reducing Admixture

Provide a water-reducing admixture meeting the requirements of ASTM C494/C494M, Type A , except that the 6-month and 1-year compressive strength tests are waived. The admixture may be added to the concrete mixture only when its use is approved or directed and after mixture proportioning studies.

2.2.2.5 High-Range Water-Reducing Admixture (HRWRA)

Use high-range water-reducing admixture that meets the requirements of ASTM C494/C494M, Type F , except the 6-month and 1-year strength requirements are waived.

2.2.3 Curing Materials

2.2.3.1 Sheet Materials

Provide sheet curing materials conforming to ASTM C171, type optional, except do not use polyethylene sheet. Submit a manufacturer's certificate certifying that the materials comply with the requirements of ASTM C171, if sheet curing is used.

2.2.3.2 Membrane-Forming Curing Compound

Provide membrane-forming curing compound conforming to ASTM C309, Type 1D or 2, except a styrene acrylate or chlorinated rubber compound meeting ASTM C309, Class B, requirements may be used for surfaces that are to be painted or are to receive subsequent coatings, or floors that are to receive adhesive applications of resilient flooring. Select curing compound selected that is compatible with any subsequent paint, roofing, coating, or flooring specified.

2.2.3.3 Burlap

Provide burlap for curing purposes conforming to AASHTO M 182.

2.2.4 Water

Use water for washing aggregates and for mixing and curing concrete that is free from injurious amounts of oil, acid, salt, alkali, organic matter,

or other deleterious substances and in compliance with COE CRD-C 400.

2.2.5 Aggregates

2.2.5.1 Aggregate Composition

Provide fine aggregate consisting of natural sand, manufactured sand, or a combination of natural and manufactured sands. Provide coarse aggregate consisting of gravel, crushed gravel, crushed stone, air-cooled blast-furnace slag, or a combination thereof. ""

2.2.5.2 Grading

2.2.5.2.1 Fine Aggregate

Deliver fine aggregate to the mixers with a grading such that the individual percent retained on any sieve does not vary more than 3 percent from the percent retained on that sieve in a fixed grading selected by the Contractor with the approval of the Contracting Officer. The fixed grading may be selected at the start of concrete placement and based upon 30 days fine aggregate production or selected after the first 30 days of concrete placement. The minimum individual percent retained on the 2.36 mm (No. 8) sieve must be 5 percent and on all smaller sieves, except the 75 µm (No. 200), must be 10 percent. In addition to the grading limits, the fine aggregate, as delivered to the mixer, must have a fineness modulus of no less than 2.25 nor more than 2.85. Also control the grading of the fine aggregate so that the fineness moduli groups (average of the current test and the previous two tests) of the fine aggregate as delivered to the mixer do not vary more than 0.10 from the target fineness modulus of the fixed grading selected by the Contractor and approved by the Contracting Officer. The range of each group must not exceed 0.20. Determine the fineness modulus in accordance with COE CRD-C 104. At the option of the Contractor, fine aggregate may be separated into two or more sizes or classifications, but control the uniformity of grading of the separate sizes so that they may be combined throughout the job in fixed proportions established during the first 30 days of concrete placement. The selected fixed grading must be within the following limits, except any individual test result may be outside these limits if within the allowable 3 percent variation from the selected grading.

SIEVE DESIGNATION U.S. STANDARD SQUARE MESH	PERMISSIBLE LIMITS PERCENT BY MASS, PASSING
3/8 inch	100
No. 4	95 - 100
No. 8	80 - 95
No. 16	60 - 80
No. 30	35 - 60
No. 50	15 - 30

SIEVE DESIGNATION U.S. STANDARD SQUARE MESH	PERMISSIBLE LIMITS PERCENT BY MASS, PASSING
No. 100	5 - 10
No. 200	0 - 5

2.2.5.2.2 Coarse Aggregate

Rescreen coarse aggregate just prior to delivery to the concrete batch plant bins. The grading of the coarse aggregate within the separate size groups must conform to the following requirements as delivered to the mixer.

PERCENT BY MASS PASSING INDIVIDUAL SIEVES				
U.S. STANDARD SIEVE SIZE	No. 4 to 3/4 inch	3/4 inch to 1-1/2 inch	1-1/2 inch to 3 inch	3 inch to 6 inch
7 inch				100
6 inch				90 - 100
4 inch			100	20 - 55
3 inch			90 - 100	0 - 15
2 inch		100	20 - 55	0 - 5
1-1/2 inch		90 - 100	0 - 10	
1 inch	100	20 - 45	0 - 5	
3/4 inch	90 - 100	0 - 10		
3/8 inch	20 - 55	0 - 5		
No. 4	0 - 10			
No. 8	0 - 5			

2.2.5.3 Particle Shape

The quantity of flat and elongated particles in the separate size groups of coarse aggregate, as determined by ASTM D4791, using a value of 3 for width-thickness ratio and length-width ratio must not exceed 25 percent in any size group.

2.2.5.4 Nominal Maximum-Size of Aggregate

Use nominal maximum-size of coarse aggregate in the various parts of the work in accordance with the following tabulation except as directed. The NMSA may be changed for sections requiring a special quality of concrete as directed.

FEATURES	NOMINAL MAXIMUM-SIZE AGGREGATE
Sections 7-1/2 inches or less in width or slabs 4 inches or less in thickness or any section with a clear distance between reinforcement less than 2-1/4 inches	3/4 inch
Sections over 7-1/2 inches or slabs at least 4 inch in thickness. However, do not use this size in any section in which the clear distance between reinforcement is less than 2-1/4 inch	1-1/2 inch
Unreinforced sections over 12 inches in width and reinforced sections over 18 inches in width or slabs 10 inches or greater in thickness. However, do not use this size in any section in which the clear distance between reinforcing bars is less than 4-1/2 inches	3 inches
Massive sections exceeding 6 feet in width and slabs 24 inches in thickness, in which the clear distance between reinforcing bars is at least 9 inches	6 inches

2.2.5.5 Moisture Content

Do not place fine aggregate in bins at the batch plant until it is in a stable state of moisture content. Reach a stable moisture content when the variation in the percent of total moisture tested in accordance with ASTM C566 and when sampled at the same location will not be more than 0.5 percent during 1 hour of the 2 hours prior to placing the material in the batch plant bins and the variation in moisture content when sampled at the same location must not be more than 2.0 percent during the last 8 hour period that the aggregate remains in the stockpile. Deliver coarse aggregate to the mixers with the least amount of free moisture and the least variation in free moisture practicable under the job conditions. Under no conditions deliver coarse aggregate to the mixer "dripping wet".

2.2.5.6 Commercial Concrete Aggregate Sources

Concrete aggregates may be furnished from any source capable of meeting the quality requirements stated in paragraph AGGREGATES above.

a. Selection of Source - After the award of the contract, designate in writing only one source or combination of sources from which the Contractor proposes to furnish aggregates. Regardless of the source selected, provide samples for quality-assurance testing as required by paragraphs GOVERNMENT PRECONSTRUCTION TESTING and MATERIALS FOR MIXTURE-PROPORTIONING STUDIES IN part 1. If a source for coarse or

fine aggregate so designated by the Contractor does not meet the quality requirements stated above, do not submit for approval other sources but furnish the coarse or fine aggregate, as the case may be, from one or a combination of the sources listed at no additional cost to the Government.

2.2.6 Nonshrink Grout

Use nonshrink grout for use in setting base plates and machinery conforming to ASTM C1107/C1107M, and is a commercial formulation suitable for the application proposed. Submit descriptive literature of the grout proposed for use containing certified laboratory test results showing that it meets ASTM C1107/C1107M 60 days prior to its use together with a certificate from the manufacturer stating that the grout is suitable for the application or exposure for which it is being considered. In addition, a detailed plan for review, showing equipment and procedures for use in mixing and placing the grout.

2.2.7 Packaged Dry Repair Materials

Provide packaged dry rapid-hardening cementitious materials for concrete repairs that is a commercial formulation conforming to ASTM C928/C928M requiring only the addition of water.

2.2.8 Bonding Agents

Submit descriptive literature and certification in advance of their use. Bonding agents must meet the following requirements:

2.2.8.1 Latex Bonding Agent

Provide latex agents for bonding fresh to hardened concrete conforming to ASTM C1059/C1059M, Type II.

2.2.8.2 Epoxy Resin

Provide epoxy resins for use in repairs conforming to ASTM C881/C881M, Type V, Grade I or II.

2.2.9 Surface Retarder

Provide surface retarder conforming to COE CRD-C 94.

2.3 PLANT AND EQUIPMENT

Submit the methods and description of the equipment proposed for transporting, handling, and depositing the concrete for review, 60 days before concrete placement begins. Include site drawings or sketches with locations of equipment and placement site.

2.3.1 Batch Plant

Submit details and data on the concrete plant, within 60 days prior to assembly, to the Contracting Officer for conformance review with the requirements of paragraph PLANT AND EQUIPMENT. Batch plant must meet the following requirements:

2.3.2 Location

The concrete plant may be located at the site of the work in the general area indicated on the drawings, or may be located offsite.

2.3.3 Bins and Silos

Provide separate bins, compartments, or silos for each size or classification of aggregate and for each of the cementitious materials. Provide compartments of ample size and constructed so that the various materials will be maintained separately under all working conditions. Separate all compartments containing bulk cement, pozzolan, ground granulated blast-furnace slag, or silica fume from each other by a free-draining air space. Clearly mark all filling ports with a permanent sign stating the contents.

2.3.4 Batching Equipment

2.3.4.1 Batchers

Weigh aggregate in separate weigh batchers with individual scales. Weigh each bulk cement and/or other cementitious materials on a separate scale in a separate weigh batcher. Measure water by weight or by volume. If measured by weight, do not weigh cumulatively with another ingredient. Measure ice separately by weight. Batch admixtures separately and batch by weight or by volume in accordance with the manufacturer's recommendations.

2.3.4.2 Water Batcher

Provide a suitable water-measuring and batching device that will be capable of measuring and batching the mixing water within the specified tolerances for each batch. Use mechanism for delivering water to the mixers that is free from leakage when the valves are closed. Interlock the filling and discharge valves for the water batcher so that the discharge valve cannot be opened before the filling valve is fully closed. When a water meter is used, provide a suitable strainer ahead of the metering device.

2.3.4.3 Admixture Dispensers

Provide a separate batcher or dispenser for each admixture. Equip each plant with the necessary calibration devices that will permit convenient checking of the accuracy of the dispensed volume of the particular admixture. Use batching or dispensing devices capable of repetitively controlling the batching of the admixtures to the accuracy specified. Use piping for liquid admixtures that are free from leaks and properly valved to prevent backflow or siphoning. Include a device or devices that will detect and indicate the presence or absence of the admixture or provide a means of visually observing the admixture in the process of being batched or discharged in the dispensing system. Ensure each system is capable of ready adjustment to permit varying the quantity of admixture to be batched. Interlock each dispenser with the batching and discharge operations so that each admixture is added separately to the batch in solution in a separate portion of the mixing water or in fine aggregate in a manner to ensure uniform distribution of the admixtures throughout the batch during the required mixing period. Store and handle admixtures in accordance with the manufacturers recommendations.

2.3.4.4 Moisture Control

Provide plant which is capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the weights of the materials being batched. Provide a moisture meter complying with the provisions of COE CRD-C 143 for measurement of moisture in the fine aggregate. Arrange the sensing element so that the measurement is made near the batcher charging gate of the fine aggregate bin or in the fine aggregate batcher.

2.3.4.5 Scales

Provide facilities for the accurate measurement and control of each of the materials entering each batch of concrete. Use weighing equipment and controls conforming to the applicable requirements of NIST HB 44, except that the accuracy must be within 0.2 percent of the scale capacity. Provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring device. Make tests at the frequency required in paragraph TESTS AND INSPECTIONS in PART 3, and in the presence of a Government quality assurance representative. Include a visible indicator for each weighing unit that indicates the scale load at all stages of the weighing operation and shows the scale in balance at zero load. Arrange weighing equipment so that the concrete plant operator can observe the indicators.

2.3.4.6 Operation and Accuracy

Start weighing operation of each material automatically when actuated by a single starter switch and end automatically when the designated amount of each material has been reached. These requirements can be met by providing an automatic batching system as defined in NRMCA CPMB 100. Provide equipment to permit the selection of preset mixes each by the movement of not more than two switches or other control devices. Cumulative weighing will not be permitted. Construct and arrange weigh batchers so that the sequence and timing of batcher discharge gates can be controlled to produce a ribboning and mixing of the aggregates, water, admixtures, and cementitious materials as the materials pass through the charging hopper into the mixer. Include provisions to facilitate the inspection of all operations at all times. Deliver materials from the batching equipment within the following limits of accuracy:

MATERIAL	PERCENT
Cementitious materials	± 1
Water	± 1
Aggregate smaller than 1-1/2 inch size	± 2
Aggregate larger than 1-1/2 inch size	± 3
Chemical admixtures	± 3

2.3.4.7 Interlocks

Interlock batchers and mixers so that:

a. The charging device of each batcher cannot be actuated until all scales have returned to zero balance within ± 0.2 percent of the scale capacity and each volumetric device has reset to start or has signaled empty.

b. The charging device of each batcher cannot be actuated if the discharge device is open.

c. The discharge device of each batcher cannot be actuated if the charging device is open.

d. The discharge device of each batcher cannot be actuated until the indicated material is within the allowable tolerances.

e. One admixture is batched automatically with the water.

f. Each additional admixture is batched automatically with a separate portion of the water or with the fine aggregate.

g. The mixers cannot be discharged until the required mixing time has elapsed.

2.3.4.8 Recorder

Provide an accurate recorder or recorders conforming to the following detailed requirements:

a. Produce a graphical or digital record on a single visible chart or tape of the weight or volume of each material in the batchers at the conclusion of the batching cycle. Produce record prior to delivery of the materials to the mixer. After the batchers have been discharged, show the return to empty condition.

b. House graphical recording or digital printout unit completely in a single cabinet that is capable of being locked.

c. Mark the chart or tape so that each batch may be permanently identified and so that variations in batch weights of each type of batch can be readily observed. Provide chart or tape which is easily interpreted in increments not exceeding 0.5 percent of each batch weight.

d. Show time of day at intervals of no more than 15 minutes.

e. The recorder chart or tape will become the property of the Government.

f. Place recorder in a position convenient for observation by the concrete plant operator and the Government inspector.

g. The recorded weights or volumes when compared to the weights or volumes actually batched must be accurate within ± 2 percent.

2.3.4.9 Batch Counters

Include devices for automatically counting the total number of batches of all concrete batched and the number of batches of each preset mixture.

2.3.4.10 Rescreening Plant

Locate, arrange, and operate rescreening plant in a manner that all coarse aggregate will be routed through the plant and that its operation will ensure delivery to the mixers of graded coarse aggregate free from excessive variation and conforming to the size groups and grading of paragraph AGGREGATES above and with moisture content conforming to the provisions of paragraph MOISTURE CONTENT above. Coarse aggregate may be rescreened and delivered to the batch plant bins one size group at a time or two or more adjacent size groups at a time. Simultaneous rescreening of nonadjacent size groups is not permitted. Waste all material passing the bottom screen of the smallest size of coarse aggregate being screened.

2.3.4.11 Washing Plant

Wash all coarse aggregates immediately prior to entering the rescreening plant. Provide rewashing plant containing water nozzles and vibrating screens to remove foreign materials and coatings from aggregate particles. Use water for washing meeting the requirements of paragraph WATER above.

2.3.4.12 Trial Operation

Not less than 7 days prior to commencement of concrete placing, make a test of the batching and mixing plant in the presence of the Contracting Officer to check operational adequacy. Produce the number of full-scale concrete batches required in trial runs as directed, do not exceed 20, and proportion as directed. Waste or use all concrete produced in these tests for purposes other than inclusion in structures covered by this specification. Correct all deficiencies found in plant operation prior to the start of concrete placing operations. No separate payment will be made to the Contractor for labor or materials required by provisions of this paragraph. Notify the Contracting Officer of the trial operation not less than 7 days prior to the start of the trial operation.

2.3.4.13 Protection

Protect weighing, indicating, recording, and control equipment against exposure to dust, moisture, and vibration so that there is no interference with proper operation of the equipment.

2.3.5 Laboratory Areas

Provide a room in the plant to house the moisture and grading testing equipment for aggregate and to provide working space. Provide another room for testing fresh concrete and for fabricating and initial curing of concrete test specimens in accordance with ASTM C31/C31M. The size, arrangement, and location of these rooms will be subject to approval. Provide electricity, air conditioning, heat, and water as required for use in these laboratory areas.

2.3.6 Mixers

Provide stationary mixers or truck mixers. Each mixer must combine the materials into a uniform mixture and discharge this mixture without segregation. Do not charge mixers in excess of the capacity recommended by the manufacturer on the nameplate. Excessive over-mixing requiring introduction of additional water will not be permitted. Maintain mixers in satisfactory operating condition, and keep mixer drums free of hardened

concrete. Replace mixer blades or paddles when worn down more than 10 percent of their depth when compared with the manufacturer's dimension for new blades. Should any mixer at any time produce unsatisfactory results, discontinue its use promptly ntil it is repaired or replaced. Submit the make, type, capacity, and number of the concrete mixers proposed for use, 60 days prior to installation for review by the Contracting Officer for conformance with the requirements of paragraph PLANT AND EQUIPMENT.

2.3.6.1 Stationary Mixer Uniformity Requirements

Adjust the size of the batch, the mixing time, the charging sequence, and other factors to provide concrete that meets the uniformity limits specified herein and in paragraph MIXER UNIFORMITY IN PART 3. Perform all testing in accordance with COE CRD-C 55. When regular testing is performed, the concrete must meet the limits of any five of the six uniformity requirements. When abbreviated testing is performed, the concrete must meet only those requirements listed for abbreviated testing. The initial mixer evaluation test is a regular test and perform prior to the start of concrete placement. Use concrete proportions for the evaluation that contains the largest size aggregate on the project and as directed. Regular testing consists of performing all six tests on three batches of concrete. The range for regular testing is the average of the ranges of the three batches. Abbreviated testing consists of performing the three required tests on a single batch of concrete. The range for abbreviated testing is the range for one batch. If more than one mixer is used and all are identical in terms of make, type, capacity, condition, speed of rotation, etc., the results of tests on one of the mixers applies to the others, subject to approval. Perform mixer evaluations as specified herein.

	ABBREVIATED	
PARAMETER	REGULAR TESTS ALLOWABLE MAXIMUM RANGE FOR AVERAGE OF 3 BATCHES	TESTS ALLOWABLE MAXIMUM RANGE FOR 1 BATCH
Unit weight of air-free mortar, lb/cu ft	2.0	2.0
Air content, percent	1.0	---
Slump, inches	1.0	---
Coarse aggregate, percent	6.0	6.0
Compressive strength at 7 days, percent	10.0	10.0
Water content, percent	1.5	---

2.3.6.2 Truck Mixers

Provide truck mixers and the mixing of concrete therein conforming to the requirements of ASTM C94/C94M. A truck mixer may be used 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. Do not use truck mixers to mix or agitate concrete with greater than 1-1/2 inch nominal maximum-size aggregate or concrete with a slump of 2 inches or less. Determine the acceptability of truck mixers by uniformity tests in

accordance with ASTM C94/C94M.

2.3.7 Sampling Facilities

Provide suitable facilities and labor for obtaining representative samples of concrete in accordance with ASTM C172/C172M for Contractor quality control (QC) and Government quality control (QA) testing.

2.3.8 Coarse Aggregate

Provide suitable facilities for readily obtaining representative samples of coarse aggregate for test purposes immediately prior to the material entering the mixer.

2.3.9 Transporting Equipment

Design, operate, and maintain transporting equipment so that it does not cause or permit segregation or loss of material. Do not drop concrete vertically more than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized.

2.3.9.1 Buckets

Use bottom-dump buckets conforming to the following requirements: the interior hopper slope must be no less than 70 degrees from the horizontal; the minimum dimension of the clear gate opening must be at least five times the nominal maximum size of the aggregate, and the area of the gate opening must not be less than 2 square feet; the bucket gates must be grout-tight when closed, the double clamshell type, and manually, pneumatically, or hydraulically operated; and design the gate-opening mechanism to close the gates automatically when the control is released or when the air or hydraulic line is broken. If gate actuation is dependent on integral air or hydraulic reservoirs, the capacity of the reservoirs must be sufficient to open and close the gates three times without recharging the reservoir.

2.3.9.2 Trucks

Use truck mixers or agitators for transporting central-mixed concrete conforming to the applicable requirements of ASTM C94/C94M. Do not use truck mixers to transport concrete with larger than 1-1/2 inch nominal maximum-size aggregate or 2 inch or lower slump. Nonagitating trucks may be used for transporting central-mixed concrete over a smooth road when the hauling time is less than 15 minutes and the slump is less than 3 inches. Bodies of nonagitating trucks must be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

2.3.9.3 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating truck, the chutes supplied by the truck manufacturer as standard equipment may be used. Use a discharge deflector when required by the Contracting Officer. Separate chutes and other similar equipment are not permitted for conveying concrete except when specifically approved and do not increase slump to accommodate their use.

2.3.9.4 Belt Conveyors

Design and operate belt conveyors to assure a uniform flow of concrete from mixer or delivery truck to final place of deposit without segregation of ingredients or loss of mortar and provide with positive means for preventing segregation of the concrete or loss of mortar at the transfer point(s) and the point of placing. Do not exceed idler spacing of 36 inches. Use a minimum belt speed of 300 feet per minute and a maximum of 750 feet per minute. Belt width must be a minimum of 24 inches if the NMSA is 6 inches and must be a minimum of 16 inches if the NMSA is 3 inches or less. The NMSA required in mixture proportions furnished by the Government will not be changed to accommodate the belt width.

2.3.9.5 Pump Placement

Concrete may be conveyed by positive-displacement pump when approved. Pump placement will be approved only for areas where placement by bucket or conveyor is difficult or impractical. Provide piston or squeeze-pressure type pumping equipment. Provide rigid-steel pipe or heavy-duty flexible hose pipeline. Do not use aluminum pipe. Use pipe with an inside diameter at least 3 times the nominal maximum size of the coarse aggregate in the concrete to be pumped but no less than 4 inches.

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

3.1.1 Vibrators

Keep an adequate number of vibrators on hand to meet placing requirements, and spare vibrators available to maintain production in the event of breakdown. Make adequate air pressure available for air vibrators and adequate voltage for electric vibrators. Use vibrators of the proper size, frequency, and amplitude for the type of work being performed in conformance with the following requirements:

APPLICATION	HEAD DIAMETER (inch)	FREQUENCY VPM	AMPLITUDE (inch)
Thin walls, beams, etc.	1-1/4 - 2-1/2	9,000 - 13,500	0.020 - 0.04
General construction	2 - 3-1/2	8,000 - 12,000	0.025 - 0.05
Heavy sections	3 - 6	7,000 - 10,500	0.030 - 0.06
Mass concrete	5 - 7	5,500 - 8,500	0.04 - 0.08

Use frequency and amplitude within the range indicated in the tabulation as determined in accordance with paragraph TESTS AND INSPECTIONS below.

3.1.2 Embedded Items

Before placing concrete, take care to determine that all embedded items are securely fastened in place as indicated in the drawings or required. Provide embedded items that are free of oil and other foreign matter such as loose coatings of rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Provide any air or water lines or other materials embedded in structures, as authorized construction expedients, conforming to the above

requirements and upon completion of their use backfill with concrete or mortar as directed. Welding will not be permitted on embedded or otherwise exposed metals which are in contact with concrete surfaces. Tack welding of or to embedded items will not be permitted.

3.1.3 Concrete on Earth Foundations

Place concrete on earth foundations that are clean, damp, and free from frost, ice, and standing or running water. Prior to placement of concrete, compact the earth foundation satisfactorily in accordance with the provisions of Section 31 00 00 EARTHWORK.

3.1.4 Concrete on Rock Foundations

Place concrete on rock surfaces that are clean and free from oil, standing or running water, ice, mud, drummy rock, coatings, debris, and loose, semidetached, overhanging, or unsound fragments. Clean faults or joints to a satisfactory depth and to firm rock on the sides as directed by the Contracting Officer. Immediately before concrete is placed, clean all rock surfaces thoroughly by the use of air-water jet, high-pressure water jet, or sandblasting as described in the paragraph below. Keep all rock surfaces continuously wet for at least 24 hours immediately prior to placing concrete thereon. Cover all approximately horizontal surfaces immediately before the concrete is placed with a 1/2 inch layer of mortar composed of the same sand and cementitious materials used in the concrete. The sand-cementitious materials ratio and the water-cementitious material ratio of the mortar must be approximately the same as those used in the concrete mixture. Cover mortar with concrete before the mortar has reached its initial time of setting.

3.1.5 Construction Joint Treatment

Submit the method and equipment proposed for joint cleanup and waste disposal, for review 30 days before concrete placement begins.

3.1.5.1 Joint Preparation

Prepare concrete surfaces to which other concrete is to be bonded for receiving the next lift or adjacent concrete by cleaning by sandblasting, high-pressure water jet, or air-water cutting. Surface cutting by air-water jets will not be permitted for concrete surfaces congested with reinforcing steel or if they are relatively inaccessible. If, for any other reason, it is considered undesirable to disturb the surface of a lift before it has hardened, the use of sandblasting or high-pressure water jet after hardening will be required. Regardless of the method used, the resulting surface must be free from all laitance and inferior concrete so that clean, well-bonded coarse aggregate particles are exposed uniformly over the lift surface. Apply joint treatment method such that the edges of the larger particles of aggregate are not undercut. Where joint preparation occurs more than 2 days prior to placing the next lift or where the work in the area subsequent to the joint preparation causes dirt or debris to be deposited on the surface, clean the surface as the last operation prior to placing the next lift. Keep the surface of the construction joint continuously wet for the first 12 hours of the 24 hours prior to placing concrete, except that the surface must be damp with no free water at the time of placement.

3.1.5.2 Air-Water Cutting

Perform air-water cutting of a construction joint at the proper time, generally between 4 and 12 hours after placement and only on horizontal construction joints. This period may be modified if a retarder is used to prolong the setting of the cement at surface of the concrete. Use an air pressure of 90 to 110 psi in the jet, and use sufficient water pressure to bring the water into effective influence of the air pressure. When approved a surface retarder complying with the requirements of COE CRD-C 94 may be applied to the surface of the lift to prolong the period of time during which air-water cutting is effective. Prior to receiving approval, furnish samples of the material to be used and demonstrate the method to be used in its application. After cutting, wash and rinse the surface until the wash water is no longer cloudy. If air-water cutting does not produce acceptable results, prepare the surface by high-pressure water jet or sandblasting.

3.1.5.3 High-Pressure Water Jet

A stream of water under a pressure of not less than 3,000 psi may be used for 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 high-pressure water jet is incapable of a satisfactory cleaning, clean the surface by sandblasting.

3.1.5.4 Wet Sandblasting

This method of joint preparation may be used when the concrete has reached sufficient strength to prevent undercutting of coarse aggregate particles. Continue the operation until all accumulated laitance, coatings, stains, debris, and foreign materials are removed. Then wash the surface of the concrete thoroughly to remove all loose material. This method may be used on both horizontal and vertical surfaces.

3.1.5.5 Waste Water Disposal

Use a method in disposing of waste water employed in cutting, washing, and rinsing of concrete surfaces such 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 must meet all requirements of Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

3.2 TRANSPORTING AND PLACING

3.2.1 Transporting

Methods and equipment for conveying and depositing the concrete into the form are subject to approval. Provide transporting system with sufficient capacity to supply concrete at a rate to prevent cold joints forming during placement. A properly designed and sized elephant trunk and rigid drop chute bottom section which will prevent free-fall within the elephant trunk and rigid drop chute will be used if concrete is to drop more than 5 feet. If concrete is to be placed through installed horizontal or sloping reinforcing bars, discharge the concrete into a pipe or elephant trunk that is long enough to extend through the reinforcing bars to within 5 feet of the placing surface. In no case will concrete be discharged to free fall through the reinforcing bars.

3.2.1.1 Transporting by Bucket

Provide indicating and signaling devices to control the identification of types or classes of concrete as they are mixed and discharged into buckets for transfer to the forms. Identify each type or class of concrete visually by placing a colored tag or marker on a bucket as it leaves the mixing plant so that the concrete may be positively identified in the forms and placed in the structure in the desired position.

3.2.1.2 Transporting by Pump

The nominal maximum-size coarse aggregate will not be reduced or mixture proportions changed to accommodate a pump except as specifically determined appropriate. The distance and height to be pumped must not exceed limits recommended by the pump manufacturer. Supply concrete to the pump continuously. When pumping is completed, eject concrete remaining in the pipeline without contamination of concrete in place. After each operation clean the equipment thoroughly and waste flushing water outside the forms.

3.2.1.3 Transporting by Belt Conveyor

Methods and equipment for transporting the concrete by belt conveyor into the form are subject to approval.

3.2.2 Placing

Provide placing system with sufficient capacity to supply concrete at a rate which will prevent cold joints in any placement. Work concrete into the corners and angles of the forms and around all reinforcement and embedded items without permitting the material to segregate. Deposit concrete as close as possible to its final position in the forms, and in so depositing, there must be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Regulate depositing of concrete so that it will be effectively placed and consolidated in horizontal layers not exceeding 5 feet in thickness with a minimum of lateral movement. Deposit amount of concrete such that it can be readily and thoroughly consolidated and do not exceed 4 cubic yards in one pile. All concrete-placing equipment and methods are be subject to approval. Concrete placement will not be permitted when, in the opinion of the Contracting Officer, weather conditions prevent proper placement and consolidation.

3.2.2.1 Time Interval Between Mixing and Placing

Place concrete mixed in stationary mixers and transported by nonagitating equipment within 30 minutes after it has been mixed, unless otherwise authorized. When concrete is truck mixed or when a truck mixer or agitator is used for transporting concrete mixed by stationary mixers, deliver the concrete to the site of the work, and complete discharge within 1 hour after introduction of the cement to either the water or aggregate.

3.2.2.2 Hot-Weather Placing

The temperature of the concrete when deposited in the forms during hot weather must not exceed 90 degrees F at humidity greater than 60%, 85 degrees F at humidity between 40%-60%, and 80 degrees F at humidity less than 40 percent except as further required above. An approved retarding

admixture may be used in accordance with paragraph RETARDING ADMIXTURE to facilitate placing and finishing. Cool steel forms and reinforcement and conveying and placing equipment if necessary to assist in maintaining specified concrete-placing temperature. Measure the temperature of the fresh concrete in accordance with ASTM C1064/C1064M. Submit a description of the materials and methods proposed for protection of the concrete 60 days in advance of anticipated need date for review, when concrete is to be placed under hot-weather conditions.

3.2.2.3 Cold Weather Placing

The temperature of the concrete when deposited in the forms must not be less than 40 degrees F. The ambient temperature of the placement area and all surfaces to receive concrete must be above 32 degrees F. Materials entering the mixer must be free from ice, snow, and frozen lumps. Closely regulate heating of mixing water or aggregates necessary to keep the concrete temperature above 40 degrees F so that the concrete temperature does not exceed 60 degrees F. An accelerator may be used when approved in advance.

3.2.2.4 **Concrete Lifts**

Deposit all concrete in approximately horizontal layers about 1-1/2 feet in thickness in stepped progression at such a rate that the formation of cold joints will be prevented. Place slabs in one lift, unless 2.5 foot or more deep. Where 7.5 foot or greater lift depths are permitted, furnish approved cantilever forms that are jointed or hinged approximately midheight to facilitate placement against surfaces sloping more than 10 degrees from vertical. At the beginning of the placing of a lift, retract the top half of a hinged or jointed form to such a position that it does not interfere with the operation of buckets placing concrete adjacent to the form. Use a minimum of five successive horizontal layers in stepped progression for 7.5 foot lifts. Where 5 foot lifts are required, use a minimum of three successive horizontal layers in stepped progression. Place each new layer of concrete on the oldest exposed layer. Do not exceed 40 feet maximum exposed bulkhead face of concrete between adjacent monoliths except as otherwise approved. Submit a lift drawing and bill of materials for each lift of concrete. (Show only one lift on a drawing). These drawings must be to scale and show all embedded items in sufficient detail for the proper installation and prosecution of the work. Identify all embedded electrical and/or mechanical items. The drawings must not be less than 22 by 34 inches in size and use a sufficiently large scale to clearly show all details of the structure covered by these drawings. Include a note on each lift drawing indicating all contract drawings from which the lift drawing was prepared. Submit 2 copies of each drawing for review at least 60 days prior to scheduling the lift for placement.

3.2.2.5 Consolidation

Immediately after placing, consolidate each layer of concrete by internal vibrating equipment. Do not use vibrators to cause concrete to flow for significant distances within the forms. Hand spading may be used if necessary together with internal vibration along formed surfaces permanently exposed to view. Do not use form vibrators unless forms are specifically designed for this use and unless specifically approved. Insert vibrator vertically at uniform spacing over the entire area of placement. Use distance between insertions that is approximately 1.5 times the radius of action of the vibrator. The vibrator must penetrate rapidly to the bottom of the layer and at least 6 inches into the

preceding unhardened layer if such exists. Hold it stationary until the concrete is consolidated and then withdraw slowly. Consolidate slabs 8 inches or less in depth by approved methods.

3.3 FINISHING

Finish concrete in accordance with Specification Section 03 30 00 CAST-IN-PLACE CONCRETE

3.4 CURING AND PROTECTION

Submit the curing media and methods to be used for review 30 days before concrete placement begins.

3.4.1 Curing Time

Cure all concrete by one of the following methods or combination of methods for the period of time given below corresponding to the cementing materials used in the concrete:

Type III portland cement	3 days
Type I portland cement	7 days
Portland cement in combination with silica fume	7 days
Type II portland cement	14 days
Portland cement blended with 25 percent or less fly-ash or GGBF slag	14 days
Portland cement blended with more than 25 percent fly-ash or GGBF slag	21 days

Begin curing immediately after placing. Provide all equipment needed for curing and protection of the concrete on hand and ready to install before actual concrete placement begins. Use curing medium and method, or the combination of media and methods, as approved in accordance with paragraph SUBMITTALS, SD-03 Product Data, submittal item "Curing".

3.4.2 Moist Curing

Moist cure horizontal and nearly horizontal surfaces by ponding, by covering with a minimum uniform thickness of 2 inches of continuously saturated sand, or by covering with saturated nonstaining burlap or cotton mats. Rinse burlap and cotton mats to remove soluble substances before using. Moist cure other surfaces when approved or directed. Maintain concrete that is moist cured continuously, not periodically, wet for the duration of the entire curing period. Use water for curing complying with the requirements of the paragraph WATER in PART 2. If the water, sand, mats, etc. cause staining or discoloration of permanently exposed concrete surfaces, clean the surfaces by an approved method. When wood forms are left in place during curing, keep the forms continuously wet except for sealed insulation curing in cold weather. When steel forms are left in place on vertical surfaces during curing of concrete, carefully break loose the forms from the hardened concrete and continuously introduce

curing water into the void. The temperature of the water should be tepid. Allow horizontal construction joints to dry sufficiently to remove free water immediately prior to placing the next lift.

3.4.3 Membrane Curing

Membrane curing may be used on surfaces that are not specified or directed to receive moist curing and that are not to receive a grout-cleaned finish. Do not use membrane-forming curing compound on surfaces that contain protruding steel reinforcing, that are heated by free steam, that will have additional concrete bonded to them, or that are to be grout-cleaned.

3.4.3.1 Nonpigmented Curing Compound

Nonpigmented compound conforming to ASTM C309, Type ID, containing a fugitive dye may be used on surfaces that will be exposed to view when the project is completed. The reflective requirements of ASTM C309 are waived. Shield surfaces cured with nonpigmented compound from direct rays of the sun for 3 days.

3.4.3.2 Application

Apply curing compound to formed surfaces immediately after the forms are removed. Moisten surfaces thoroughly with water, and apply the curing compound as soon as free water disappears. Apply curing compound to unformed surfaces as soon as free water has disappeared provided steps have been taken when necessary to prevent premature loss of free water due to excessive evaporation as described in paragraph UNFORMED SURFACES above. Apply curing compound in a two-coat continuous operation by motorized power-spraying equipment or pressure-tank equipment operating at a minimum pressure of 75 psi with provisions for continuous agitation. The application equipment must be approved in advance. Do not use hand-operated pressure applicators ("garden sprayers") except in small, isolated areas as approved. Apply compound at a uniform coverage of no more than 400 square feet/gallon for each coat. Apply the second coat perpendicular to the first coat. Respray concrete surfaces that have been subjected to rainfall within 3 hours after the curing compound has been applied by the method and at the coverage specified. Protect all concrete surfaces on which the curing compound has been applied for the duration of the entire curing period from pedestrian and vehicular traffic and from any other influence that will disrupt the continuity of the curing membrane.

3.4.4 Sheet Curing

Use sheets only on horizontal or near horizontal surfaces. Use sheets complying with the requirements of ASTM C171, except do not use polyethylene sheet. Wet all surfaces thoroughly and completely cover with waterproof paper, or polyethylene-coated burlap. Lay covering with light-colored side up. Lap covering no less than 4 inches and tape to form a continuous cover with completely closed joints. Use weighted sheet to prevent displacement so that it remains in contact with the concrete during the specified length of curing. Fold coverings down over exposed edges of slabs and secure by approved means. Repair sheets immediately or replace if tears or holes appear during the curing period.

3.4.5 Sealed Insulation Curing

Between dates listed in paragraph COLD WEATHER PROTECTION below where cold weather protection is provided entirely by insulation, seal all joints in the insulation to retard moisture loss and maintain a seal throughout the curing period.

3.4.6 Protection

No fire or excessive heat is permitted near or in direct contact with concrete at any time. Do not operate vibratory earth compaction equipment or pile-driving equipment within 100 feet horizontally of concrete less than 5 days old. Blasting is not permitted within 100 feet horizontally of concrete less than 90 days old. Blasting plans must be approved by the Contracting Officer. Keep all galleries, conduits, and other openings through the concrete closed or sealed during the entire construction period. Protect the surface of the concrete from rain or snow during placing.

3.4.7 Cold Weather-Protection

During cold weather, as defined by ACI 306R, cover all concrete less than 30 days old . Submit a description of the materials and methods proposed for protection of the concrete, 60 days in advance of anticipated need date for review, when concrete is to be placed under cold-weather conditions.

a. Maintain insulation in such a condition that the R value does not diminish during the period of protection. Protect edges and corners of the placement with a double layer of the insulation specified above for a minimum distance of 2 feet in all directions.

b. Insulate concrete placed prior to the starting date from the starting date until it reaches an age of 5 days. Insulate concrete placed after the starting date continuously during and subsequent to placement.

c. Insulate forms in such a manner that the combined form-insulation system has a thermal resistance (R value) no less than that specified. Keep insulation and the combined form-insulation system in place for at least 5 days after placement of the concrete. After 5 days, forms and insulation on vertical surfaces may be removed for periods not to exceed 4 hours in a 24 hour period to allow forms to be moved, and insulation on horizontal surfaces may be removed for periods not to exceed 8 hours in a 24 hour period to allow reinforcement to be installed, insulation to be installed, lift joints to be prepared, etc. provided that suitable precautions are taken to prevent the concrete from being subjected at any time to ambient temperatures of 20 degrees F or below.

d. Insulate the first 6 feet of all steel protruding from insulated concrete with material having an R value as stated. Insulate all form bolts and metal ribs on the forms in a like manner. During the period of protection there must be no holes or openings in the insulation or between the insulation and concrete which permit ambient air to penetrate the insulation except as noted for construction purposes. Give special attention to seams, corners, and edges to prevent holes or openings in the insulation.

3.5 BASE PLATES AND BEARING PLATES

3.5.1 Setting of Plates

After being plumbed and properly positioned, provide full bearing column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates using nonshrink grout. The space between the top of the concrete bearing surface and the bottom of the plate must not be less than 1/24 of the width of the plate or 1/2 inch, whichever is greater. Concrete surfaces must be clean, free of oil, grease, and laitance, and damp. Metal surfaces must be clean and free of oil, grease, and rust.

3.5.2 Nonshrink Grout

Use nonshrink grout conforming to the requirement of paragraph NONSHRINK GROUT. 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.

3.5.2.1 Mixing and Placing

Perform mixing and placing in conformance with the material manufacturer's instructions and as specified. Dry-mix ingredients thoroughly 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 masonry bearing surface and the plate with the grout. Use forms consisting of wood or other suitable material for retaining the grout and remove after the grout has hardened. If Grade "A" grout is used, form all surfaces, including top surfaces, to provide restraint. Work placed grout to eliminate voids; however, avoid overworking and breakdown of the initial set. Do not retemper or subject grout to vibration from any source. Where clearances are unusually small, make placement under pressure with a grout pump. Maintain temperature of the grout, and of surfaces receiving the grout, at 65 to 85 degrees F until after setting.

3.5.2.2 Treatment of Exposed Surfaces

Those types of grout containing metallic aggregate, Grade B or C grout, must, after setting, have exposed surfaces under cut back 1 inch from the edge of the base plate and immediately cover with a thick coat of mortar proportioned by weight of one part portland cement, two parts sand, and sufficient water to make the mixture placeable. The parge coat must have a smooth, dense finish. The exposed surface of other types of nonshrink grout must have a smooth, dense finish.

3.5.2.3 Curing

Cure grout and parge coats in conformance with paragraph CURING AND PROTECTION above.

3.6 TESTS AND INSPECTIONS

3.6.1 General

Perform the following inspection and tests as described, and, based upon the results of these inspections and tests, take the action required and

submit reports as required. When, in the opinion of the Contracting Officer, the concreting operation is out of control, cease concrete placement. The laboratory performing the tests must be onsite and conform with the requirements given in ASTM C1077. The individuals who sample and test concrete or the constituents of concrete as required in this specification will have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per year thereafter for conformance with ASTM C1077. The individual who performs the inspection will have demonstrated a knowledge and ability equivalent to the ACI minimum guidelines for certification of Concrete Transportation Construction Inspector (CTCI) .

3.6.2 Testing and Inspection Requirements

3.6.2.1 Fine Aggregate

3.6.2.1.1 Grading

At least once during each shift when the concrete plant is operating, there make 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. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. Recoed the results on a sheet on which are also shown the specification limits applicable to the project.

3.6.2.1.2 Fineness Modulus Control Chart

Group results for fineness modulus in sets of three consecutive tests, and plot the average and range of each group on a control chart. Draw the upper and lower control limits for average 0.10 units above and below the target fineness modulus, and the upper control limit for range 0.20 units above the target fineness modulus.

3.6.2.1.3 Corrective Action for Fine Aggregate Grading

When the amount passing any sieve is outside the specification limits, resample and retest the fine aggregate immediately. If there is another failure for any sieve, report the fact immediately. Whenever a point on the fineness modulus control chart, either for average or range, is beyond one of the control limits, double the frequency of testing. If two consecutive points are beyond the control limits, consider the process out of control and stop concreting. Notify the Contracting Officer, and take immediate steps to rectify the situation. After two consecutive points have fallen within the control limits, testing at the normal frequency may be resumed.

3.6.2.1.4 Moisture Content Testing

When in the opinion of the Contracting Officer the electric moisture meter is not operating satisfactorily, perform at least four tests for moisture content in accordance with ASTM C566 during each 8-hour period of mixing plant operation. Select times for the tests randomly within the 8-hour period. Make an additional test whenever the slump is shown to be out of

control or excessive variation in workability is reported by the placing foreman. When an electric moisture meter is operating satisfactorily, make at least two direct measurements of moisture content per week to check the calibration of the meter. Use results of tests for moisture content to adjust the added water in the control of the batch plant.

3.6.2.1.5 Moisture Content Corrective Action

Whenever the moisture content of the fine aggregate changes by 0.5 percent or more, adjust the scale settings for the fine-aggregate batcher and water batcher (directly or by means of a moisture compensation device).

3.6.2.2 Coarse Aggregate

3.6.2.2.1 Grading

At least once during each shift in which the concrete plant is operating, perform a sieve analysis in accordance with ASTM C136/C136M for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production 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. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When facilities are available to test samples five times as large as those required in ASTM C136/C136M, averaging is not permitted.

3.6.2.2.2 Corrective Action for Grading

When the amount passing any sieve is outside the specification limits, resample and retest the coarse aggregate immediately. If the second sample fails on any sieve, report that fact. Where two consecutive averages of five tests (or two consecutive tests where large samples are used) are outside specification limits, consider the operation out of control, and report that fact, stop concreting, and take immediate steps to correct the grading.

3.6.2.2.3 Coarse Aggregate Moisture Content

Make a test for moisture content of each size group of coarse aggregate at least once a shift. When two consecutive readings for smallest size coarse aggregate differ by more than 1.0 percent, increase frequency of testing to that specified previously for fine aggregate.

3.6.2.2.4 Coarse Aggregate Moisture Corrective Action

Whenever the moisture content of any size of coarse aggregate changes by 0.5 percent or more, adjust the scale setting for the coarse aggregate batcher and the water batcher to compensate for this.

3.6.2.2.5 Particle Shape Testing

When directed, a problem exists in connection with aggregate particle shape, make tests in accordance with ASTM D4791. Testing frequency must not be ess than one per day, when directed.

3.6.2.2.6 Particle Shape Corrective Action

When testing for particle shape is required, report two consecutive failures in the same sieve size immediately, and determine what corrective action is needed.

3.6.2.2.7 Material Finer than the No. 200 Sieve

When in the opinion of the Contracting Officer, a problem exists in connection with the cleanliness of aggregate, make tests in accordance with ASTM C117. Testing frequency must be as directed.

3.6.2.2.8 Corrective Action for Material Finer than the No. 200 Sieve

When material finer than the No. 200 sieve exceeds 1.0 percent of the weight of the aggregate finer than 1-1/2 inches or 0.5 percent of the weight of the aggregate coarser than 1-1/2 inches, notify the Contracting Officer and initiate steps, such as washing or other corrective action, immediately.

3.6.2.3 Quality of Aggregates

3.6.2.3.1 Frequency of Quality Tests

Prior to submitting samples for mixture proportioning studies and 30 days prior to the start of concrete placement, perform the tests for aggregate quality in the following list. In addition, after the start of concrete placement, perform tests for aggregate quality in accordance with the following frequency schedule. Take samples tested after the start of concrete placement immediately prior to entering the concrete mixer.

PROPERTY	FINE AGGREGATE	FREQUENCY COARSE AGGREGATE	TEST
Specific Gravity	Every 3 months	Every 3 months	ASTM C127 ASTM C128
Absorption	Every 3 months	Every 3 months	ASTM C127 ASTM C128
Durability (Procedure A)	Factor using Every 12 months	Every 12 months	COE CRD-C 144 ASTM C666/C666M
Clay Lumps and Friable Particles	Every 3 months	Every 3 months	ASTM C142/C142M
Material Finer than the 75-µm (No. 200) Sieve	Every 3 months	Every 3 months	ASTM C117
Organic Impurities	Every 3 months	Not applicable	ASTM C40/C40M

PROPERTY	FINE AGGREGATE	FREQUENCY COARSE AGGREGATE	TEST
L.A. Abrasion	Not applicable	Every 6 months	ASTM C131/C131M ASTM C535
Soft and Friable (Scratch Hardness)	Not applicable	Every 6 months	COE CRD-C 130
Petrographic Examination	Every 6 months	Every 6 months	ASTM C295/C295M
Chert, less than 2.40 specific gravity	Every 6 months	Every 6 months	ASTM C123/C123M
Coal and lignite, less than 2.00 specific gravity	Every 6 months	Every 6 months	ASTM C123/C123M

3.6.2.3.2 Corrective Action for Aggregate Quality

If the result of a quality test fails to meet the requirements for quality during submittal of samples for mixture-proportioning studies or immediately prior to start of concrete placement, change production procedures or materials and perform additional tests until the material meets the quality requirements prior to proceeding with either mixture-proportioning studies or starting concrete placement. After concrete placement commences, whenever the result of a test for quality fails the requirements, rerun the test immediately. If the second test fails the quality requirement, report the fact and take immediate steps to rectify the situation.

3.6.2.4 Scales

3.6.2.4.1 Weighing Accuracy

Check accuracy of the scales by test weights at least once a month for conformance with the applicable requirements of paragraph PLANT AND EQUIPMENT. Also make such tests as directed whenever there are variations in properties of the fresh concrete that could result from batching errors.

3.6.2.4.2 Batching and Recording Accuracy

Check the accuracy of each batching and recording device once a week during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. Confirm that the calibration devices described in paragraph PLANT AND EQUIPMENT in PART 2, for checking the accuracy of dispensed admixtures, are operating properly.

3.6.2.4.3 Scales Corrective Action

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. Correct discrepancies in recording accuracies immediately.

3.6.2.5 Batch-Plant Control

Control the measurement of all constituent materials including cementitious materials, each size of aggregate, water, and admixtures continuously. Adjust 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 plant operation.

3.6.2.6 Concrete

3.6.2.6.1 Air Content

Make at least two tests for air content on randomly selected batches of each concrete mixture produced during each 8 hour period of concrete production. Make additional tests when excessive variation in workability is reported. Make tests in accordance with ASTM C231/C231M. Plot the average of each set of two tests for each mixture on control charts on which the average percent and upper and lower limits are set in accordance with paragraph MATERIALS FOR MIXTURE PROPORTIONING STUDIES, in PART 1, for each NMSA. Plot the range between two consecutive tests for each mixture on a control chart on which the upper control limit is 3.0 percent. Normally take samples for air content at the mixer, however the Contractor is responsible for delivering the concrete to the forms at the proper air content. Take samples at the placement site as often as required, depending on the Contractor's delivery method, to determine any air loss.

3.6.2.6.2 Air Content Corrective Action

Whenever points on the control chart approach the upper or lower control limits, an adjustment should be made in the amount of air-entraining admixture batched. If a single test result is outside the specification limit, immediate adjustment is mandatory. As soon as practical after each adjustment, make another test to verify the correction of the adjustment. Whenever a point falls above the upper control for range, calibrate the dispenser to ensure that it is operating correctly and with good reproducibility. Whenever two consecutive points either for average or range are outside the control limits, notify the Contracting Officer.

3.6.2.6.3 Slump Testing

Make at least two slump tests in accordance with ASTM C143/C143M on each concrete mixture produced during each 8-hour period or less of concrete production each day. Make additional tests when excessive variation in workability is reported. Plot the result of each test for each mixture on a control chart on which the upper and lower limits are set as specified in paragraph SLUMP. Plot the range on a control chart on which the upper control limit is 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 Contractor's materials or transportation methods cause slump loss between the mixer and the placement, take samples at the placement site as often as required by the Contracting Officer.

3.6.2.6.4 Slump Corrective Action

Whenever points on the control chart approach the upper or lower control limits, make an adjustment 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 specified in the mixture proportions provided based on the free water available with the aggregates and that amount of water batched. If the adjustments to the batch weights of water and aggregates do not satisfactorily produce the required slump, the Contracting Officer may adjust the mixture proportions if the fine-aggregate moisture content is stable and within the required limits. When a single slump is outside the control limits, such adjustment is mandatory. As soon as practical 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 above the upper control limits, consider the slump to be out of control, halt the concreting operation, and undertake additional testing for aggregate moisture content required, and take action immediately to correct the problem.

3.6.2.6.5 Compression Test Cylinders

Make at least one set of test cylinders each shift on each different concrete mixture placed during the shift. Make additional sets of test cylinders, as directed, when the mixture proportions are changed or when low strengths have been detected. Develop a random sampling plan for approval by the Contracting Officer prior to start of construction. Assure that sampling is done in a completely random and unbiased, not just haphazard, manner. Provide a set of test cylinders for structural concrete containing Type I or Type II portland cement only consisting of four cylinders, two to be tested at 7 days and two at 28 days. Provide a set of test cylinders for all other concrete consisting of six cylinders, two to be tested at 7 days, two at 28 days, and two at 90 days. In addition, for all concrete except that containing Type I or Type II portland cement only, every 2 months make four additional cylinders and test two at 6 months of age and test two at 12 months of age. Mold and cure all test specimens in accordance with ASTM C31/C31M and test in accordance with ASTM C39/C39M. Report all compressive strength tests immediately. Keep quality control charts for individual strength tests, moving average for strength and moving average for range for each mixture. The charts must be similar to those found in ACI 214R.

3.6.2.7 Inspection Before Placing

Inspect foundation or construction joints, forms, and embedded items in sufficient time prior to each concrete placement in order to certify that they are ready to receive concrete. Report results of each inspection in writing.

3.6.2.8 Concrete Placement

3.6.2.8.1 Placing Inspection

The placing foreman must supervise all placing operations, must determine that the correct quality of concrete or grout is placed in each location as directed, and is responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, yardage placed, and method of

placement.

3.6.2.8.2 Placing Corrective Action

Do not permit placing to begin until an adequate number of vibrators in working order with competent operators are available is verified. 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.

3.6.2.9 Vibrators

3.6.2.9.1 Vibrator Testing and Use

Determine frequency and amplitude of each vibrator in accordance with COE CRD-C 521prior to initial use and at least once a month when concrete is being placed. Make additional tests as directed when a vibrator does not appear to be adequately consolidating the concrete. Determine the frequency while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. Determine the amplitude with the head vibrating in air. Take two measurements, one near the tip and another near the upper end of the vibrator head, and average these results. Report make, model, type, and size of the vibrator and frequency and amplitude results in writing.

3.6.2.9.2 Vibrator Corrective Action

Remove any vibrator not meeting the requirements of paragraph PREPARATION FOR PLACING above immediately from service and repair or replace.

3.6.2.10 Curing

3.6.2.10.1 Moist Curing Inspections

At least twice each shift, and twice per day on nonwork days, inspect all areas subject to moist curing. Note and record the surface moisture condition.

3.6.2.10.2 Moist Curing Corrective Action

When a daily inspection report lists an area of inadequate moistness, take immediate corrective action, and extend the required curing period for those areas by one (1) day.

3.6.2.10.3 Membrane Curing Inspection

Do not apply curing compound until the Contractor's authorized representative 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 and compute the rate of coverage in square feet per gallon. Note whether or not coverage is uniform.

3.6.2.10.4 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.

3.6.2.10.5 Sheet Curing Inspection

At least once each shift and once per day on nonwork days, inspect all areas being cured using sheets. Note and record the condition of the covering and the tightness of the laps and tapes.

3.6.2.10.6 Sheet Curing Corrective Action

When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, repair the tears and holes promptly or replace the sheets, close the joints, and extend the required curing period for those areas by one day.

3.6.2.11 Cold Weather Protection and Sealed Insulation Curing

At least once each shift and once per day on nonwork days inspect all areas subject to cold weather protection. Inspect the protection system for holes, tears, unsealed joints, or other incongruities which could result in damage to the concrete. Take special attention at edges, corners, and thin sections. Note, correct, and report any deficiencies.

3.6.2.12 Cold Weather Protection Corrective Action

When a daily inspection report lists any holes, tears, unsealed joints, or other incongruities, correct the deficiency immediately and extend the period of protection for one (1) day.

3.6.2.13 Mixer Uniformity

3.6.2.13.1 Stationary Mixers

Prior to the start of concrete placing and once every 3 months when concrete is being placed, or once for every 75,000 cubic yards of concrete placed, whichever results in the longest time, determine interval uniformity of concrete mixing in accordance with paragraph PLANT AND EQUIPMENT in PART 2. The initial and every fourth set of tests must be regular tests performed on three batches of concrete. Intermediate uniformity tests must be abbreviated tests performed on a single batch of concrete. If the mixer fails the abbreviated test, perform a regular test immediately. Whenever adjustments in a mixer or increased mixing time are required because of failure of a uniformity test, reevaluate the mixer by a regular test after the adjustments have been completed. If the Contractor proposes to reduce a mixing time, perform a regular test to evaluate the proposed time. Perform additional testing when directed when there is visible evidence of possible improper mixer performance. Report results of all uniformity tests in writing.

3.6.2.13.2 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 in accordance with ASTM C94/C94M. Select 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. Report results of tests in writing.

3.6.2.14 Mixer Uniformity Corrective Action

When a mixer fails to meet mixer uniformity requirements, either increase

the mixing time, change batching sequence, reduce batch size, or make adjustments to the mixer until compliance is achieved.

3.6.3 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, make 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.

-- End of Section --

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SECTION 08 39 55.00 20

NAVY STANDARD EARTH-COVERED MAGAZINE DOORS
11/24

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 (ACI)

ACI 301	(2016) Specifications for Structural 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)

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360	(2016) Specification for Structural Steel Buildings
ANSI/AISC 303	(2022) Code of Standard Practice for Structural Steel Buildings and Bridges

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189	(2020) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel

AMERICAN WELDING SOCIETY (AWS)

AWS A5.4/A5.4M	(2012; R 2022) Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel
AWS D1.3/D1.3M	(2018) Structural Welding Code - Sheet Steel
AWS D1.6/D1.6M	(2017) Structural Welding Code — Stainless Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1	(2000; R 2018) Standard Specification for Carbon Steel Tee Rails
ASTM A240/A240M	(2022b) Standard Specification for

	Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A500/A500M	(2021a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A572/A572M	(2021; E 2021) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A992/A992M	(2020) Standard Specification for Structural Steel Shapes
ASTM F1554	(2020) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F3125/F3125M	(2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA MG 1	(2021) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023) National Electrical Code

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-101-01	(2020; with Change 4, 2024) Architecture
UFC 3-301-01	(2019, with Change 1, 2022) Structural Engineering
UFC 4-010-06	(2016; with Change 1, 2017) Cybersecurity of Facility-Related Control Systems
UFC 4-420-01	(2015, with Change 1, 2022) Ammunition And Explosives Storage Magazines

UL SOLUTIONS (UL)

UL 489	(2016; Rev 2019) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 506	(2017; Reprint Jan 2022) UL Standard for Safety Specialty Transformers

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Manufacturer's Qualifications; G

Installer's Qualifications; G

Acceptance Testing Procedure; G

Field Testing Instructions; G

Coating Submittal Package; G

Sequence of Welding; G

Manufacturer's Installation Instructions; G

Installation Plan; G

Quality Control Plan; G

SD-02 Shop Drawings

Shop Drawings; G

Electrical Package; G

Trench Package; G

Boltworks Locking System; G

SD-03 Product Data

Product Data; G

SD-05 Design Data

Design Data; G

SD-07 Certificates

Welding Procedures and Welder's Qualifications; G

NDT Certificates; G

SD-10 Operation and Maintenance Data

Training Video; G

Door Description Information; G

Draft Operations and Maintenance Manual, Data Package 2; G

Final Operations and Maintenance Manual, Data Package 2; G

SD-11 Closeout Submittals

Weld Inspection Report; G

Report of Special Inspections; G

Shop and Field Operating Test Reports; G

Acceptance Testing Report; G

Manufacturer's Warranty; G

1.3 DOORS

Doors constructed in accordance with this specification are used in magazine standard drawings approved by the Department of Defense Explosive Safety Board (DDESB) as a 7-bar earth covered magazine and may be sited as an exposed site magazine from other potential explosion sites storing up to 500,000 pounds hazard division 1.1 explosives. The design and detailing of the magazine for blast loading is the sole responsibility of the government. The government is the engineer of record for the blast door. Any deviation from these standard drawings, except for foundation modifications, without the written approval from the Department of Defense Explosive Safety Board (DDESB) is not permitted as it may require the magazine to be considered an undefined magazine and may severely restrict the allowable storage capacity.

1.3.1 Door Systems

The general contractor must select a single manufacturer to provide a complete blast door system, including but not limited to the blast door and all associated components, hardware, rail, trench, trench cover assembly, plow-type trench cover lifting system (plow system), and embedded plates, including controls, motors, and installation. Provide blast-resistant magazine door system in accordance with the non-deviational standard drawings for door type indicated on the drawings as either CLWS single bay Box Type G, or Box Type H and UFC 4-420-01. This door system is designed to resist all wind, seismic, and blast effects, including fragment, ballistic, and forced entry resistance. Door system includes flashing, seals, weather stripping, controls, operators, electrical power, low voltage, security, and grounding as well as access for installation, maintenance, and replacement of all door components including, but not limited to, operators, motors, and drive. The door system size and arrangement of doors, top guides, bottom rails with drainage, and plow system, including details at head, sill, jambs, and door/frame and door/sill interfaces are specifically indicated based upon the performance standards required by the Government. The single manufacturer is responsible for providing all door components and

completing the design of items not fully designed in the standard drawings. The entire door system described in the standard drawings must be manufactured and installed by a single manufacturer or the single manufacturer's representative, sanctioned by the manufacturer.

For the Door System: Submit Shop Drawings sealed by the door manufacturer's Registered Professional Engineer, Product Data, and Design Data consisting of catalog cuts, brochures, circulars, specifications, calculations, and product data that show the complete door system including all components. Submit Manufacturer's Installation Instructions and Field Testing Instructions. Submit Door Description Information, bound in manual form consisting of manufacturer's safety precautions, preventive maintenance, and schedules, troubleshooting procedures, special tools, parts list, and spare parts data. All material shown on the shop drawings must be cross referenced to the door designations shown on the standard drawings.

1.3.2 Door System Components

The door design is structurally complete and is non-deviational, including the headwall and locking system. Materials, dimensions, strengths, and connections included in the standard drawings must be strictly adhered to. Stronger material grades will not be permitted as they may result in increased reactions and altered performance under blast loading.

Door seals are critical to door system performance. All seals and weather-stripping must be positively contacted when the door is closed, and all seals and weatherstripping must be inspectable and replaceable with the door in place.

1.3.3 Cybersecurity

Design all control systems (including systems separate from a utility monitoring and control system) in accordance with UFC 4-010-06 and as required by Section 25 05 11.23 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS UTILITY MONITORING AND CONTROL SYSTEM (UMCS) and Section 25 05 11.28 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS ELECTRONIC SAFETY AND SECURITY INCLUDING CCTV, ACCESS CONTROL SYSTEMS, AND INTRUSION DETECTION SYSTEMS. Implement cybersecurity requirements to mitigate vulnerabilities to all facility-related control and security systems.

1.4 QUALITY CONTROL

The blast door manufacturer is solely responsible for manufacturing, shipping, installing, and erecting the blast door system and must submit a Quality Control Plan which details quality control procedures to be undertaken at each phase of this work. The Quality Control Plan will be an item of discussion at the preconstruction meeting.

1.4.1 Welding

Welders, welding operators, and weld inspectors must be qualified in accordance with AWS D1.1/D1.1M except that welders performing arc welding of steel sheet and strip must be qualified in accordance with AWS D1.3/D1.3M.

1.4.2 Quality Control Plan

Develop and submit for approval a blast door system fabrication and

installation quality control plan as specified herein. The plan must include the following:

a. Indicate the contractor's understanding and explanation of the QC process.

b. Include Special inspector qualifications and responsibilities.

c. Include shop QC manager (or in-house inspector) qualifications and responsibilities.

d. A list of challenging issues (available material challenges, shipping challenges, and schedule challenges).

e. Special procedures and processes.

f. Include a discussion of SI record keeping and required bi-weekly submittals and any other submittals to the contractor's QC manager.

g. Show coordination between SI inspector, in-house inspector, Shop QC manager, KTR QC manager.

h. Provide quality control reports to the Contracting Officer and Quality Manager.

i. Inspection and approval of all embedded items prior to placement of concrete.

Upon completion of the Quality Plan and a minimum of 2 weeks prior to beginning fabrication or construction activities, a preconstruction meeting must be held to review the Magazine Door Quality Plan. The meeting must include the DOR, Contractor's Quality Manager, Special Inspector, Fabrication Shop Quality Manager, in-house inspector, Contractor Superintendent, the Government Construction Manager, and a government representative familiar with Blast Doors, or their designated representative(s).

1.4.3 Manufacturer's Qualifications

The manufacturer providing the complete door system, must be regularly engaged in the fabrication, erection, and service of large, horizontal rolling, blast resistant, steel doors of the type, complexity, and size required for this project. The manufacturer must have at least 10 years of demonstrated experience fabricating, erecting, and servicing similar horizontal rolling, blast resistant steel doors weighing a minimum of 30,000 pounds. Similar doors must have comparable function and design including size, configuration, type of use, elements, safety features, controls, and other key engineering elements as the door being specified. It is acceptable to show that a series of similar doors collectively meet all comparable elements to the door being specified, although not necessarily individually. The manufacturer must submit written evidence on a minimum of five examples of similar past doors listing the name, location, contact information of owners, installation dates, overall sizes, features, and other relevant information for experience and qualifications evaluation for approval by the Contracting Officer. Only manufacturers who can submit this evidence of actual installations where the products have proven practical and durable, and require a minimal amount of maintenance, will be qualified under this specification.

1.4.4 Installer's Qualifications

The manufacturer is responsible for the installation of the entire blast door system, including all components, and achieve final approval and acceptance by the Navy. A manufacturer's representative, skilled and experienced in the erection of horizontal rolling, blast resistant, steel doors of the type specified may be utilized if supervised by the manufacturer of the door system in accordance with approved shop drawings. For each installer, submit written evidence of similar past door installations listing the name, locations, contact information of owners, installation dates, overall sizes, features, and other relevant information for experience and qualifications evaluation.

1.4.5 Welding Procedures and Welder's Qualifications

Welders, welding operators, and weld inspectors must be qualified in accordance with AWS D1.1/D1.1M and AWS D1.6/D1.6M except that welders performing arc welding of steel sheet and strip must be qualified in accordance with AWS D1.3/D1.3M. Provide copies of all Welder's Certifications for welders both in the shop and in the field.

Welding procedures which are considered pre-qualified as specified in AWS D1.1/D1.1M and AWS D1.6/D1.6M as applicable will be accepted without further qualification. Submit for approval a listing or an annotated drawing to indicate the joints not pre-qualified. Procedure qualification is mandatory for these joints.

1.4.6 Manufacturer's Warranty

Furnish manufacturer's written warranty covering the blast door assembly for 5 years after acceptance by the Government. Warranty must provide for repair and replacement of the blast door assembly, individual hardware, mechanical, electrical, and accessory items in the event of malfunction due to defects in design, materials, and workmanship.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials which are not shop installed on the doors in original rolls, packages, containers, boxes, or crates bearing the manufacturer's name, brand, and model number. Store materials and equipment in dry locations with adequate ventilation, free from soil, water, dust, and contaminants, and to permit access for inspection and handling. Handle doors carefully to prevent damage. Remove damaged items that cannot be restored to like-new condition and provide new items.

PART 2 PRODUCTS

2.1 DOORS

2.1.1 Structural Steel

Construct all structural steel in accordance with AISC 360. Structural steel bars, plates, and shapes must conform to ASTM A572/A572M, ASTM A992/A992M as indicated in the standard drawings, including steel grades. Hollow Structural Steel Sections must conform to ASTM A500/A500M Grade C, as indicated in the standard drawings. Provide stainless steel in accordance with ASTM A240/A240M Type 304 and design in accordance with AWS D1.6/D1.6M for trench covers, trench weldments, and embedments.

2.1.1.1 Bolted Connections

Provide bolted connections as shown in the standard drawings. Provide bolt heads of the supplied fasteners marked with the manufacturer's identification mark, the strength grade, and type specified by ASTM specifications. Provide the following:

Anchor Bolts: ASTM F1554, Grade as specified

High Strength Bolts: ASTM F3125/F3125M, Grade as specified

Provide compatible nuts and washers corresponding to the bolt grades and strengths above.

2.1.1.2 Welded Connections

Provide welds as shown in the standard drawings.

Provide Welding Electrodes and Rods in accordance with AWS D1.1/D1.1M and AWS D1.6/D1.6M.

2.1.2 Concrete

Concrete properties are specified in the standard drawings and must also comply with Section 03 30 00 CAST-IN-PLACE CONCRETE . For concrete reinforcement, provide stainless steel expanded metal reinforcement of the type, size and gage as specified in the standard drawings. Refer to the standard drawings for the required concrete weight, mix design, admixtures, placement, and curing.

2.1.3 Wood

Refer to the standard drawings for species, size, and arrangement of wood to be utilized in the door. Provide wood that is kiln dried.

2.1.4 Components

2.1.4.1 Top Door Guide Assembly

Provide the Top Door Guide Assembly to resist the minimum lateral load capacity as shown on the standard drawings and permit magazine and door construction tolerances and temperature changes without binding or disengaging the door from the top door guide. Door roller guide will be welded to the door per manufacturer's calculations and recommendations and include horizontal stainless-steel rollers with sealed bearings which can be removed and replaced with the door remaining in place. Size and weld retention angles and plates per manufacturer's calculations and recommendations to resist forces and to permit construction tolerances and smooth door operation.

2.1.4.2 Door Stop

Provide door stops to resist the impact of the door at each extent of travel. The stop must not scratch or scar the door finish when the door engages the stop. Door silencers must also be provided to cushion the impact of the door so that steel-to-steel contact is not made during closing.

2.1.4.3 Door Seals

Door seals are critical to door system performance. Doors must have the full door perimeter and all door penetrations sealed. Provide as indicated between door leaves and on vertical edges, sills, and heads to afford a weathertight installation and form a portion of the Air Barrier in accordance with UFC 3-101-01. All seals must be positively contacted when the door is closed. Seals must be capable of sealing the mating surfaces, resistant to the atmospheric environment, and be inspectable, adjustable, and replaceable with the door in place. One spare set of gasket seals must be provided for each door assembly for which seals are specified.

Provide flexible door seals in all specified locations including on vertical edges, sills, and heads. Seals must be the dimension shown, but not less than 2 inch wide, and be a minimum of two-ply cloth-inserted EPDM material with a minimum thickness of 1/8 inch and retained continuously for its full length with flat head socket cap and secured with rust-resistant fasteners spaced no more than 6 inches on center. Provide weather stripping at bottom of the door to match the lowest height of the jamb weather stripping.

2.1.4.4 Wheel and Motor Drive System

Machine wheels from a single piece of material. Provide steel plate bottom wheels having a minimum tread diameter as required for the actual wheel loading, but not less than 18 inches. Construct wheel assemblies to permit removal of the wheel without requiring removal of the door.

Concrete filled doors require wheels offset nominally toward the interior side of the door to be located at the door's center of gravity. Door manufacturer must calculate and verify center of gravity, prior to final fabrication.

2.1.4.4.1 Treads

Machine wheel treads are to be concentric with bearing seats. The maximum clear distance between flanges cannot exceed the width of the rail by more than 1/8 inch at the tread nor more than 1/4 inch at the edge of the flange. Machine internal bearing seats accurately for a press fit. Heat treat wheels to obtain a rim hardness of 320 Brine1l.

2.1.4.4.2 Wheel Bearings

Provide tapered roller or spherical bearings, either internal or cartridge type, arranged so that both horizontal and vertical loads are transferred to the rail only through the bearing. Provide bearings tightly sealed and equipped with high-pressure grease fittings.

2.1.4.4.3 Traction Drive

Provide a traction drive door system where the leading edge (door closing) wheel box contains both a wheel and a chain drive power system. The trailing edge wheel is not powered and only contains an idler wheel.

Provide a door system with a manual system override including motor brake disengagement and 0.5 inch standard female socket that is capable of both opening and closing the door system.

2.1.4.4.4 Motor Drive

Design motor drive to move its door at a speed of approximately 15 feet per minute. Design the operating units to consist of a separate motor and gear reducer, high-speed shaft brake, and necessary roller chains and sprockets. Provide the systems with overload protection for the drive units. Provide NEMA MG 1, high-starting torque, reversible type motor with sufficient horsepower and torque output to operate its door in both directions from any position at not more than 75 percent of its rated capacity. Select motor to operate on current voltage of the characteristics indicated at not more than 3600 rpm. Provide NEMA totally-enclosed, fan-cooled (TEFC) and design using a minimum service factor of 1.2. Provide calculations and product data.

Provide braking systems to ensure stoppage of the doors under normal, dry rail conditions. Provide either a magnetic, spring-set, solenoid-released brake or hydraulic type braking systems. Provide a hand release to release the brake when it becomes necessary to move the door manually. Provide an automatic reset type hand release so that the brake will be operable during subsequent electrical operation of the door.

2.1.4.5 Rail and Trench System

Provide rail(s) as indicated in the standard drawings per ASTM A1. Provide the plow trench cover system and complete the notionally detailed design shown in the standard drawings. Provide all rail and trench system including all components in the Trench Package.

2.1.4.5.1 Rail Tolerance

In accordance with the design, the blast door and components must meet the following tolerances for trueness and levelness:

All trenches and door guide rail must have a 1/4 inch maximum differential tolerance per every 37 feet.

2.1.4.6 Plow-type Trench Cover Lifting System (Plow System)

The plow trench cover assembly is notionally detailed in the standard drawings. The system to be provided by the manufacturer may vary based upon the door manufacturer's approved design. Dimensions noted with an asterisk (*) must be coordinated with the door manufacturer designing and providing the plow system to provide a door trench cover roller with a smooth transition between closed and open positions.

All plates are to be 1/4 inch thick plate minimum unless noted otherwise and weld all joints with a minimum 3/16 inch fillet unless noted otherwise in the details.

2.2 FABRICATION

Fabricate doors in accordance with the applicable provisions of AISC 360. Workmanship must be equal to standard commercial practice in modern metal shops. Fabricate and assemble in the shop to the greatest extent possible.

2.2.1 Frames and Framing

Provide welded or bolted construction of doors as shown in the standard drawings. Provide continuous vertical members throughout the height of

the door, unless noted otherwise in the standard drawings. Provide frames and framing members true to dimensions and square in all directions; no bowed leaves, warped, or out of line in the vertical or horizontal plane of the door opening by more than 1/8 inch in 20 feet. Do not deviate from the standard drawings for any reason, including to resist operational loads and packaging to withstand shipping loads. Grind smooth any exposed welds and prepare, prime, and coat steel as specified in paragraph FINISHES.

2.2.2 Weldments, Embedments, and Trench Covers

Provide ASTM A240/A240M, Type 304 Stainless Steel for door systems including door jamb, door head and locking pilaster.

2.2.3 Shop Assembly

Welding is a critical component in the success of constructing these doors, including meeting door construction tolerances. Welding must be in accordance with AWS D1.1/D1.1M except that arc welding of steel sheet and strip must be in accordance with AWS D1.3/D1.3M. For the doors, welding might cause significant residual stresses; therefore, the contractor must submit for approval by the Contracting Officer a detailed Sequence of Welding, augmenting the requirements given by the AWS specifications. Stainless steel must be welded using electrodes conforming to AWS A5.4/A5.4M. Fabricated steel must be well-formed to shape and size, with sharp lines and angles. Intermediate and corner joints must be coped or mitered. Exposed welds must be dressed smooth. The stiles and top of built-up structural steel doors must be closed using channel shapes or plates as shown in the standard drawings. Weld all steel in accordance with the standard drawings.

2.2.4 Door Tolerance

In accordance with the design, the blast door and components must meet the following tolerances for trueness and levelness:

Blast door cannot exceed a total maximum flatness tolerance of 1/4 inch either vertically or horizontally.

2.2.5 Quality Assurance Demonstration

The door manufacturer must commence a shop demonstration of each door in the presence of the Contracting Officer or their designee, consisting of a successful cycle of opening and closing the door by controls, opening and closing of trench plates by door plows, locking and unlocking door, and alignment of door in security pilaster. The demonstration must be a minimum of half the length of the door travel. Demonstration must also include manual operation of the blast door in both directions.

2.3 OPERATION

Each door is individually operated. For each door provide a separate, traction-drive operating unit driving one of the bottom wheels. On each door provide a motor-mounted, springset, solenoid-released motor brake. Provide doors that are operated from pilaster mounted controls with visibility of the door's leading edge.

2.3.1 Controls

Provide control equipment conforming to NEMA ICS 1 and NEMA ICS 2. Provide guarded head type push buttons, mounted in heavy-duty, oiltight enclosures conforming to NEMA ICS 6, Type 4, except that enclosure for the VFD with disconnect switch requires Type. Provide watertight enclosures for exterior push buttons conforming to NEMA ICS 6, Type 4.

When the Internal Locking Device (ILD) Boltworks Locking System is locked, the Variable Frequency Drive (VFD) is not powered. When unlocked, the VFD is powered. Provide constant pressure push buttons for each individually operated door. Door movement will be stopped upon removal of pressure from the button. Provide push buttons mounted on the exterior face of locking pilaster next to the ILD locking boltworks. Provide the open control button on top of the color green and provide a closer button below the open button of the color red.

2.3.1.1 Safety Interlocks

When mechanical rooms are included in the design, door controller must be provided for the blast door adjacent to the associated mechanical room with safety interlock feature when sensing mechanical room is open. Door control feature must include a door contact/relay interlocking with blast door control system and mechanical room door so that once the mechanical room door is in 'open mode' or 'unlocked', the control system of the adjacent blast door will be disabled from moving the blast door.

2.3.2 Variable Frequency Drive(s)

For each door, provide a Variable Frequency Drive (VFD) in NEMA ICS 1, Type 12 enclosures equipped with access door-controlled, UL 489 Molded Case Circuit Breaker (MCCB) with a through-the-door disconnect switch. The control system includes but is not limited to a VFD equipped with overload and undervoltage protection, relays and timing devices as required, control circuit transformers, and a numbered terminal strip. Provide a control circuit transformer capable of reducing the voltage in the control circuits to 120 volts or less and conforms to UL 506. Provide each VFD to move its door at a speed of approximately 15 feet per minute. The VFD in each door must automatically transition to crawl speed at each confirmed limit of door movement (full open and full close).

Provide each operating unit with a separate motor and gear reduction unit, highspeed shaft brake, and necessary roller chains and sprockets. Provide the systems with overload protection for the drive units and a means for emergency tractor towing operation.

2.3.2.1 Gear Reduction Unit(s)

Provide gear reduction units that allow a reversal of effort through the gears without damage to the units.

2.3.3 Operations and Maintenance Manual

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. Include wiring and control diagrams. Door manufacturer must submit a complete Draft Operations and Maintenance Manual, Data Package 2 to the Contracting Officer for approval and must also submit a Final Operations and Maintenance Manual, Data Package 2 for record.

2.4 LIGHTNING PROTECTION SYSTEM

The Lightning Protection System (LPS) consists of a complete grounding system which electrically bonds all steel doors, frames, and components to the magazine's reinforcing cage in order to maintain equipotential. Provide a grounding reel at top of the door with a grounding path in the door to all components. Provide local bonding with a dedicated path tied to the facility grounding systems to maintain equipotential. All structural and miscellaneous items embedded in the concrete must be electrically bonded to the reinforcing cage by wire ties.

2.5 ELECTRICAL

Provide conduit, wire, flexible cables, boxes, devices, and accessories, and install trolley duct, under Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. If permanent electrical power is not available when door installation is complete, provide temporary power in accordance with distribution system requirements in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, for testing and adjusting the doors.

Submit the door manufacturer's Electrical Package including complete schematic wiring diagram, field wiring diagram, and a complete physical location drawing showing the location of controls with the runs of conduit, size of conduit, number and size of wires in each conduit, location of junction boxes, and full details of control mountings.

2.5.1 Electrical Work

It is the door manufacturer's responsibility to provide the proper electrical equipment and controls built in accordance with the latest NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 standards. Provide all equipment and controls, and circuits that conform to NFPA 70. Provide automatic control devices necessary for motor operation of the door, including push button stations, limit switches, variable frequency drive with UL 489 MCCB motor circuit protection, control circuit transformers, relays, timing devices, warning devices, and draped or festooned cable system with extra flexible Type SD cable.

2.5.2 Intrusion Detection System (IDS)

Coordinate with the Contracting Officer for the size and locations of balanced magnetic switches and motion sensors, and routing of all IDS conduit. Balanced magnetic switches, motion sensors, and conductors will be installed and connected to the Intrusion Detection System (IDS) by the Government. Pathway, conduit, and junction boxes will be provided by the contractor.

Coordinate with the Contracting Officer for the locations, routing of conduit, and connection of the Internal Locking Device (ILD) Boltworks Locking System which must be installed and connected to the Intrusion Detection System (IDS) by the Government. Pathway, conduit, and junction boxes will be provided by the contractor.

2.6 FINISHES

Clean, prepare, and coat all exposed and non-exposed ferrous metal surfaces as part of the Section 09 97 13.27 HIGH PERFORMANCE COATING FOR STEEL STRUCTURES work, including all requirements, submittals, certifications, testing, and inspections required by Section 09 97 13.27.

Do not coat finished bearing surfaces. Alternative coating systems or products will not be considered. **Prepare surface and apply coatings following all temperature, humidity, and testing requirements listed in Section 09 97 13.27**. After installation of the door, prep and touch up surfaces damaged during assembly and installation of the door. Prep and coat unfinished ferrous metal accessories such as bolts and brackets. Provide details and document compliance path in the Coating Submittal Package.

2.7 SPECIAL INSPECTIONS

Special inspection requirements are included in the standard drawings, UFC 3-301-01, and UFC 4-420-01 which must be adhered to, and the successful final results of all Special Inspections will be submitted in the Report of Special Inspections. Systems requiring special inspections include, but are not limited to:

Fabricator Certification and Quality Control Procedures

Fabrication Inspection

Shop Demonstration

ECM Grounding

Grounding System

Individual Bonds

LPS Components

LPS Testing

Door Laps

Embedded and Attached Items (Doors, Frames, and Trenches)

2.8 ACCESSORIES

2.8.1 Hardware

Coordinate with the Contracting Officer for procurement and installation of the Internal Locking Device (ILD) Boltworks Locking System and the distribution of key sets for each magazine door. The ILD Boltworks Locking System must be procured with two unique keys for operation.

Contact the DoD Lock Program for directions on how to procure the ILD Boltworks Locking System and the qualifications for procuring a qualified Boltworks Manufacturer.

DoD Lock Program: https://navfac.navy.mil/go/locks

Email: ILD_Field_Support@navy.mil

ILD Support Hotline: 805-982-5625

DoD Lock Program Technical Support: 800-290-7607 or 805-982-1212

2.8.2 Nameplate

Each door assembly must have a permanently affixed nameplate that displays the manufacturer's name, place, year of manufacture, and applicable peak overpressure, and impulse. Mount nameplate on a nearby interior wall.

PART 3 EXECUTION

3.1 ERECTION

Assemble and install the doors and accessories in accordance with the manufacturer's recommendations and installation manual. Provide all work associated with these door systems under the direct supervision and control of the manufacturer for safety, quality control, and control of product performance and liability. Coordinate the erection of the doors with the work of other trades. Coordinate electrical work, including locations of all panels, equipment, motors, and other components for required clearances for maintenance, access, and routing of power.

3.1.1 Procedure

Erect and install in accordance with the manufacturer's written instructions, AISC 360, and ACI 318 and submit an Installation Plan which is covered in the preconstruction meeting. Use erecting equipment suitable for the work and in proper working condition. Where parts cannot be assembled or fitted properly as a result of errors in fabrication or of deformation due to handling or transportation, report such condition immediately to the Contracting Officer, obtain approval of the method of correction, and make the correction in their presence. The straightening of plates and angles or other shapes must be done by the methods approved by the Contracting Officer. If heating of metal is approved for straightening, it must not be to a higher temperature than that producing a dark "cherry red" color. After heating, the metal must be cooled as slowly as possible. Evidence of fracture on the surface of the metal after straightening is not allowed. Drain steelwork properly; fill pockets exposed to the weather with an approved waterproof material.

3.1.2 Erection Tolerances

Steel construction must be in accordance with the tolerances in ANSI/AISC 303, unless noted otherwise. Concrete construction must be in accordance with the tolerances in ACI 301, unless noted otherwise.

3.1.3 Temporary Welds and Backing Strips

Temporary Welds and Backing Strips must be removed.

3.2 ELECTRICAL WORK

Provide all conduit, wiring, and mounting of controls in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and NFPA 70. Provide and install all conduit for the control level power. Provide and install all wiring for control level power in accordance with the approved submittals.

3.3 TESTS, INSPECTIONS, AND VERIFICATIONS

Submit Shop and Field Operating Test Reports that include values for opening and closing forces and times, forces required to operate latches, and a description of all operating tests performed.

3.3.1 Inspection

The manufacturer of the doors must provide a field inspection engineer to perform the following:

a. Check installation of embedded items before placing of concrete (after forms or shoring are in place) to ensure that the dimensional tolerances recommended by the door manufacturer have been complied with.

b. Recheck embedded items to verify the accuracy of dimensions after shoring and forms are removed from concrete.

c. Supervise any necessary corrective action.

d. Supervise the job site assembly and installation of the doors and operators.

e. Inspect final assembly of doors and operators after corrections and adjustments have been made to doors.

f. Demonstrate to the Contracting Officer that operation of the door assembly is as specified.

3.3.2 Visual Inspection of Welding

Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification inspections in accordance with AWS D1.1/D1.1M and AWS D1.6/D1.6M. Perform visual inspections on 100 percent of all shop and field welds with a Certified Welding Inspector. Document this inspection in the Weld Inspection Report.

Inspect for proper preparation, size, gaging location, identification marking, and operation and current characteristics of welding sets in use and acceptability of all welds.

3.3.3 Nondestructive Testing

Perform nondestructive testing (NDT) in accordance with AWS D1.1/D1.1M and AWS D1.6/D1.6M. Perform ultrasonic testing in accordance with Table 6.3 of AWS D1.1/D1.1M and Table 8.2 of AWS D1.6/D1.6M. Test 50 percent of all welds, with sampling representative of all weld types and locations for the entire door system, for the duration of the fabrication schedule and both shop and field welds. All personnel performing NDT are required to be certified in accordance with ANSI/ASNT CP-189 in the method of testing being performed. Submit NDT Certificates showing compliance with ANSI/ASNT CP-189 for all NDT technicians. If more than 10 percent of welds made by a welder contain defects identified by testing, then all groove welds made by that welder are required to be tested by ultrasonic testing, and all fillet welds made by that welder are required to be inspected by magnetic particle testing (MT) or dye penetrant testing (PT). When groove welds made by an individual welder are required to be tested, MT or PT may be used only in areas inaccessible to ultrasonic testing. Retest all repaired areas. Submit Weld Inspection Report.

Any weld repairs required must be in accordance with AWS D1.1/D1.1M.

3.4 FINAL CLEANUP, PROTECTION, LUBRICATION, AND ADJUSTMENT

3.4.1 Cleanup

After erection is complete, and before repair of protective coatings, thoroughly clean both the interior and exterior of the door and all abraded surfaces, field welds, and field bolts.

3.4.2 Protective Coatings

Complete all protective coating systems in accordance with the paragraph FINISHES including repair of all damage to the protective coating system in accordance with the requirements of Section 09 97 13.27 HIGH PERFORMANCE COATING FOR STEEL STRUCTURES. Prepare surface and apply coatings following all temperature, humidity, and testing requirements listed in Section 09 97 13.27.

3.4.3 Lubrication and Adjustment

Upon completion of installation, including work by other trades, lubricate, adjust, and perform preliminary door tests to verify operation in accordance with manufacturer's product data. Final adjustments will be made by the manufacturer. Adjust and retest the doors until the entire installation is fully operational and acceptable.

3.5 ACCEPTANCE TESTING PROCEDURE AND REPORT

Submit an Acceptance Testing Procedure for approval. After Government approval, and after installation is complete, field test each door for operation, clearance, fit, seating, and sealing by operating the door and hardware through a minimum of 10 operating cycles (unlock, full open, full close, and lock is one cycle) within the manufacturer's written time interval between cycles. Test the entire door system including every component and door hardware, and confirm maximum operational forces specified are not exceeded. Provide personnel and equipment required to perform field testing. Perform all field tests in the presence of the Contracting Officer. After testing is successfully completed, prepare the Acceptance Testing Report and submit to the Contracting Officer.

3.6 PERSONNEL TRAINING

Provide a 2-hour on-site training session for the Government's door operating personnel and maintenance. Attendees may include base personnel such as facility users, fire department, and others. In the training, outline door safety, normal operation, emergency operation, troubleshooting, maintenance, and repair guidelines. Record this on-site training and provide a Training Video presented in an organized and coherent fashion such that the Government may use the video as the sole training program for future user operators. It is acceptable to utilize stock training video content in this video provided the door operation, safety, and controls are identical to the door system provided.

-- End of Section --

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SECTION 09 97 13.27

HIGH PERFORMANCE COATING FOR STEEL STRUCTURES
02/21, CHG 1: 08/22

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 D1200	(2010; R 2014) Viscosity by Ford Viscosity Cup
ASTM D1640/D1640M	(2014) Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings
ASTM D4285	(1983; R 2018) Indicating Oil or Water in Compressed Air
ASTM D7127	(2017) Standard Test Method for Measurement of Surface Roughness of Abrasive Blast Cleaned Metal Surfaces using a Portable Stylus Instrument
ASTM E11	(2022) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC AB 2	(2015; E 2016) Cleanliness of Recycled Ferrous Metallic Abrasive
SSPC AB 3	(2023; R 2023) Ferrous Metallic Abrasive
SSPC PA 1	(2016) Shop, Field, and Maintenance Coating of Metals
SSPC QP 5	(2022) Standard Procedure for Evaluating the Qualifications of Coating and Lining Inspection Companies
SSPC SP 1	(2015) Solvent Cleaning
SSPC SP 10/NACE No. 2	(2015) Near-White Blast Cleaning
SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS-STD-595A	(2017) Colors used in Government

Procurement

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-22262	(1993; Rev B; Am 1 1994; Am 2 1996; Notice 1 2021) Abrasive Blasting Media Ship Hull Blast Cleaning
MIL-DTL-24441	(2009; Rev D; Notice 1 2021) Paint, Epoxy-Polyamide, General Specification for
MIL-DTL-24441/19	(2009; Rev C; Notice 1 2023) Paint, Epoxy-Polyamide, Zinc Primer, Formula 159, Type III
MIL-DTL-24441/31	(2009; Rev B; Notice 1 2021) Paint, Epoxy-Polyamide, White, Formula 152, Type IV
MIL-PRF-85285	(2022; Rev F) Topcoat, Aircraft and Support Equipment

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

29 CFR 1910-SUBPART Z	Toxic and Hazardous Substances
29 CFR 1926.59	Hazard Communication

1.2 DEFINITIONS

Definitions are provided throughout this Section, generally in the paragraph where used, and denoted by capital letters.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Contract Errors, Omissions, and Other Discrepancies

Corrective Action Procedures

Qualifications Of Individuals Performing Abrasive Blasting

Qualifications of QC Specialist Coating Inspector

Qualifications of Testing Laboratory for Coatings

Qualifications of Testing Laboratory for Abrasive

Metallic Abrasive

SD-08 Manufacturer's Instructions

Joint Sealant Instructions

1.4 QUALITY ASSURANCE

1.4.1 Contract Errors, Omissions, and Other Discrepancies

Submit all errors, omissions, and other discrepancies in contract documents the Contracting Officer within 30 days of contract award for all work covered in this Section, other than the work that will not be uncovered until a later date. All such discrepancies shall be addressed and resolved, and the Coating Work Plan modified, prior to beginning the Initial and Follow-Up phases of work. Discrepancies that become apparent only after work is uncovered shall be identified at the earliest discoverable time and submitted for resolution. Schedule time (Float) should be built into the project schedule at those points where old work is to be uncovered or where access is not available during the first 30 days after award, to allow for resolution of contract discrepancies.

1.4.2 Corrective Action (CA)

CA shall be included in the Quality Control Plan.

1.4.2.1 Corrective Action Procedures

Develop procedures for determining the root cause of each non-compliance, developing a plan to eliminate the root cause so that the non-compliance does not recur, and following up to ensure that the root cause was eliminated. Develop Corrective Action Request (CAR) forms for initiating CA, and for tracking and documenting each step.

1.4.2.2 Implement Corrective Action

The Contractor shall take action to identify and eliminate the root cause of each non-compliance so as to prevent recurrence. These procedures shall apply to non-compliance in the work, and to non-compliance in the QC System. Corrective actions shall be appropriate to the effects of the non-compliance encountered. Each CAR shall be serialized, tracked in a Log to completion and acceptance by the Contracting Officer, and retained in project records. The Corrective Action Log, showing status of each CAR, shall be submitted to the Contracting Officer monthly. A CAR may be initiated by either the Contractor or the Contracting Officer. The Contracting Officer must approve each CAR at the root cause identification stage, the plan for elimination stage, and the close out stage after verification that the root cause has been eliminated.

1.4.3 Qualifications

1.4.3.1 Qualifications of QC Specialist Coating Inspector

Submit documentation that each coating inspector is employed, and qualified to SSPC QP 5, Level III, by the selected coating inspection company. Each inspector shall remain employed by the coating inspection company while performing any coating inspection functions.

1.4.3.2 Qualifications Of Individuals Performing Abrasive Blasting

Submit name, address, and telephone number of each person that will be performing abrasive blasting. Submit documentation that each blaster is qualified by SSPC to the SSPC C-7 Dry Abrasive Blaster Qualification Program. Each blaster shall remain qualified during the entire period of

abrasive blasting, and the Contracting Officer shall be notified of any change in qualification status.

1.4.3.3 Qualifications of Testing Laboratory for Coatings

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that persons performing analyses are qualified.

1.4.3.4 Qualifications of Testing Laboratory for Abrasive

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of abrasive for compliance with specification requirements. Submit documentation that laboratory has experience in testing samples of abrasive for conformance with specifications, and that persons performing analyses are qualified.

1.4.3.5 Metallic Abrasive

Provide manufacturer's certification of conformance to contract requirements and provide copies of test results.

1.4.4 Protective Coating Specialist (PCS)

The PCS shall be considered a QC Specialist and shall report to the QC Manager, as specified in Section 01 45 00.00 20 QUALITY CONTROL. The PCS shall approve all submittals prior to submission to the QC Manager for approval or submission to the government for approval.

1.4.5 Pre-Application Meeting

After approval of submittals but prior to the initiation of coating work, Contractor representatives, including at a minimum, project superintendent and QC manager, paint foreman, coating inspector, and PCS shall have a pre-application coating preparatory meeting. This meeting shall be in addition to the pre-construction conference. Specific items addressed shall include: corrective action requirements and procedures, coating work plan, safety plan, coordination with other Sections, inspection standards, inspection requirements and tools, test procedures, environmental control system, safety plan, and test logs. Notify Contracting Officer at least ten days prior to meeting.

1.5 PRODUCT DATA

1.5.1 Joint Sealant Instructions

Submit manufacturer's printed instructions including detailed application procedures, minimum and maximum application temperatures, and curing procedures. Include Safety Data Sheets (SDS) for materials to be used at the job site in accordance with 29 CFR 1926.59.

PART 2 PRODUCTS

2.1 JOINT SEALANT

TT-S-00230, Type II, Class B

2.2 COATING SYSTEM

Alternate systems or products will not be considered. Provide a complete system (primer, intermediate coat, top coat) material from one supplier.

Prepare surface and apply the complete coating system in the **field for the 08 39 55 20 Navy Standard Magazine Doors. Remove all shop-applied primer prior to final field surface preparation and coating system application. Adjust all shop preparation to avoid conflicts with final surface preparation requirements**.

The Military specification epoxy and polyurethane products specified in this Section do not require approval for listing on the QPL prior to contract award, as indicated in paragraph 3.2 of MIL-DTL-24441 and paragraph 3.1 of MIL-PRF-85285. Testing of products by an independent laboratory to the QUALIFICATION INSPECTION requirements of MIL-DTL-24441 and MIL-PRF-85285prior to contract award is required. See specific submittal requirements in paragraph QUALITY ASSURANCE.

2.2.1 Zinc-Rich Epoxy Primer Coat

Epoxy polyamide, MIL-DTL-24441/19 (Formula 159, Type III).

2.2.2 Epoxy Intermediate Coat

Epoxy polyamide, MIL-DTL-24441/31 (Formula 152, Type IV, White (Tinted)). Tint to approximately SAE AMS-STD-595A color number 27778 parchment using pigment dispersions prepared for epoxy paint tinting. Manufacturer shall tint material and appropriately label. All other requirements of this Military Specification apply.

2.2.3 Polyurethane Topcoat

Polyurethane coating topcoat of MIL-PRF-85285, Type II, White SAE AMS-STD-595A color number 17925.

Modify paragraph 3.6.4 of MIL-PRF-85285, Viscosity and Pot Life, as follows:

> The viscosity of the admixed coating, when tested in accordance with ASTM D1200 through a No. 4 Ford cup, shall be as follows:

Time from mix (minimum)	Maximum time through a No. 4 Ford cup
Initially	30 seconds
2 hours	60 seconds
4 hours	No gel

Modify paragraph 3.7.1 of MIL-PRF-85285, Drying Time, as follows:

When applied by spray techniques and when tested in accordance with ASTM D1640/D1640M, the coating shall be set-to-touch within four hours and dry-hard within eight hours (see 4.6 and table I).

2.3 COATING SAMPLE COLLECTION AND SHIPPING KIT

Provide a kit that contains one quart can for the base of each coating material, an appropriately sized can for each activator, dipping cups for each component to be sampled, a shipping box sized for the samples to to be shipped, and packing material. Mark cans for the appropriate component. Provide shipping documents, including either pre-paid shipping or a shipper number that can be used by the QC Manager to arrange pickup, addressed to the approved coating testing laboratory.

2.4 ABRASIVE

The referenced abrasive specifications have maximum limits for soluble salts contamination, however, this maximum level of contamination does not guarantee that contamination will not be transferred to the steel surface during abrasive blasting. Other factors such as on-site handling and recycling can allow contamination of abrasive. Contractors are cautioned to verify that the chosen abrasive, along with work and storage processes, allow the final surface cleanliness requirements to be achieved. Successful testing of chlorides in abrasive does not negate the final acceptance testing of steel surfaces.

Interpret MIL-A-22262 to include the meaning that abrasive material contains a maximum one percent by weight of any toxic substance listed in either Table Z-1, Z-2, or Z-3 or 29 CFR 1910-SUBPART Z, with the exception of inert or nuisance dust materials, arsenic, beryllium, cadmium, cobalt, lead, mercury, rhodium, silver, tellurium, thallium, and uranium.

2.4.1 Non-metallic Abrasive

Conform to MIL-A-22262, Type I (Inorganic materials). Abrasive shall be approved by the Naval Sea Systems Command and listed on the appropriate Qualified Products List (QPL) for the specified materials. Use sampling procedures and testing frequencies as prescribed in MIL-A-22262. Use abrasive that is specifically selected and graded to provide a sharp, angular profile to the specified depth. Do not use ungraded abrasive. Make adjustments to processes or abrasive gradation to achieve specified surface profile. Recycled non-metallic abrasive shall meet all requirements of the specification each time that it is placed in the blast pot.

2.4.2 Metallic Abrasive

2.4.2.1 New and Remanufactured Steel Grit

Conform to the chemical and physical properties of SSPC AB 3 Class 1 (Steel) only. Class 2 (Iron) abrasive shall not be used.

To develop a suitable work mix from new steel abrasive, a minimum of 200 - 400 recycles is required, therefore, it is advantageous for a Contractor to use remanufactured steel grit or grit reclaimed from a previous project. Such grit shall be considered to conform if it can be traced to new grit conforming to SSPC AB 3 Class 1 and it meets all cleanliness requirements of SSPC AB 3 Class 1 when brought to the current jobsite.

Submit one representative sample of this work mix to the laboratory for testing, along with samples of new material. Acceptance and use of this work mix shall not be used to justify any deviation from surface preparation requirements.

2.4.2.2 Recycled Steel Grit

Conform to the chemical and physical properties of SSPC AB 2

2.5 WHITE ALUMINUM OXIDE NON-SKID GRIT

Size #60, dust free (washed and dry), minimum 99 percent pure, having the following sieve analysis when tested in accordance with ASTM E11 using a 2.2 pound sample:

Sieve #	Percent Retained
40	0
50	15-40
60	60-85

PART 3 EXECUTION

Perform all work, rework, and repair in accordance with approved procedures in the Coating Work Plan.

3.1 SURFACES TO BE COATED

Section 08 39 55.00 NAVY STANDARD EARTH-COVERED MAGAZINE DOORS references Section 09 97 13.27 and requires **field** application of these coatings.

3.2 SURFACE PREPARATION

3.2.1 Abrasive Blasting Equipment

Use abrasive blasting equipment of conventional air, force-feed, or pressure type. Maintain a minimum pressure of 95 psig at nozzle. Confirm that air supply for abrasive blasting is free of oil and moisture when tested in accordance with ASTM D4285. Test air quality at each startup, but in no case less often than every five operating hours.

3.2.2 Operational Evaluation of Abrasive

Test abrasive for salt contamination and oil contamination as required by the appropriate abrasive specification daily at startup and every five operating hours thereafter.

3.2.3 Surface Standard

Inspect surfaces to be coated, and select plate with similar properties and surface characteristics for use as a surface standard. Blast clean one or more one foot square steel panels as specified in paragraph SURFACE PREPARATION. Record blast nozzle type and size, air pressure at nozzle and compressor, distance of nozzle from panel, and angle of blast to establish procedures for blast cleaning. Measure surface profile in accordance with ASTM D7127. When the surface standard complies with all specified requirements, seal with a clearcoat protectant. Use the surface

standard for comparison to abrasive blasted surfaces throughout the course of work.

3.2.4 Pre-Preparation Testing for Surface Contamination

Perform testing, abrasive blasting, and testing in the prescribed order.

3.2.4.1 Pre-Preparation Testing for Oil and Grease Contamination

Inspect all surfaces for oil and/or grease contamination using two or more of the following inspection techniques: 1) Visual inspection, 2) WATER BREAK TEST, 3) CLOTH RUB TEST. Reject oil and/or grease contaminated surfaces, clean in accordance with SSPC SP 1, and recheck for contamination until surfaces are free of oil and grease.

WATER BREAK TEST - Spray atomized mist of distilled water onto surface, and observe for water beading. If water "wets" surface rather than beading up, surface can be considered free of oil or grease contamination. Beading of water (water forms droplets) is evidence of oil or grease contamination.

CLOTH RUB TEST - Rub a clean, white, lint free, cotton cloth onto surface and observe for discoloration. To confirm oil or grease contamination in lightly stained areas, a non-staining solvent may be used to aid in oil or grease extraction. Any visible discoloration is evidence of oil or grease contamination.

3.2.4.2 Pre-Preparation Testing for Soluble Salts Contamination

Test surfaces for soluble salts, and wash as required, prior to abrasive blasting. Soluble salt testing is also required in paragraph PRE-APPLICATION TESTING FOR SOLUBLE SALTS CONTAMINATION as a final acceptance test of prepared surfaces after abrasive blasting, and successful completion of this phase does not negate that requirement. This phase is recommended since pre-preparation testing and washing are generally more advantageous than attempting to remove soluble salt contamination after abrasive blasting. Effective removal of soluble salts will require removal of any barrier to the steel surface, including rust. This procedure may necessitate combinations of wet abrasive blasting, high pressure water rinsing, and cleaning using a solution of water washing and soluble salts remover. The soluble salts remover shall be acidic, biodegradable, nontoxic, noncorrosive, and after application, will not interfere with primer adhesion. Delays between testing and preparation, or testing and coating application, may allow for the formation of new contamination. Use potable water, or potable water modified with soluble salt remover, for all washing or wet abrasive blasting. Test methods and equipment used in this phase are selected at the Contractor's discretion.

3.2.5 Abrasive Blasting

Abrasive blast steel surfaces to near-white metal in accordance with SSPC SP 10/NACE No. 2. Prepared surfaces shall conform to SSPC VIS 1 and shall match the prepared test-panels. Provide a 2 to 3 mil surface profile. Reject profile greater than 3 mils, discontinue abrasive blasting, and modify processes and materials to provide the specified profile. Measure surface profile in accordance with ASTM D7127, using Rmax as the measure of profile height. Record all measurements required in this standard. Measure profile at rate of three test areas for the first 1000 square feet plus one test area for each additional 1000 square

feet or part thereof. When surfaces are reblasted for any reason, retest profile as specified. Following abrasive blasting, remove dust and debris by vacuum cleaning. Do not attempt to wipe surface clean.

3.3 MIXING AND APPLICATION OF SEALANT AND COATING SYSTEM

3.3.1 Preparation of Sealant and Coating Materials for Application

Each of the sealant, primer, intermediate, and topcoat materials is a two-component material supplied in separate containers.

3.3.1.1 Mixing Sealant, Primer and Intermediate Coat Materials

Mix in accordance with manufacturer's instructions, which may differ for each product. Do not mix partial kits, or alter mix ratios. Mix materials in same temperature and humidity conditions specified in paragraph DELIVERY AND STORAGE. Allow mixed material to stand for the required induction time based on its temperature.

3.3.1.2 Mixing Topcoat Material

Do not mix partial kits, or alter mix ratios. Mix polyurethane coating materials in same temperature conditions specified in paragraph DELIVERY AND STORAGE. The polyurethane coating material is moisture sensitive and any introduction of moisture or water into the material during mixing or application will shorten usable pot life. Use a mixer that does not create a vortex. Do not add solvent without specific written recommendation from the manufacturer. No induction time is required, only thorough agitation of the mixed material.

3.3.1.3 Pot Life

Apply mixed products within stated pot life for each product. Stop applying when material becomes difficult to apply in a smooth, uniform wet film. Add all required solvent at time of mixing. Do not add solvent to extend pot life. Pot life is based on standard conditions at 70 degrees F and 50 percent relative humidity. For every 18 degrees F rise in temperature, pot life is reduced by approximately half, and for every 18 degrees F drop it is approximately doubled. Usable pot life depends on the temperature of the material at the time of mixing and the sustained temperature at the time of application. Other factors such as the shape of the container and volume of mixed material may also affect pot life. Precooling or exterior icing of components for at least 24 hours to a minimum of 50 degrees F in hot climates will extend pot life. High humidity at time of mixing and application shortens pot life of the Polyurethane topcoat material. Following are approximate pot life times:

Sealant	As specified by manufacturer
Epoxy primer and intermediate materials	4 hours
Polyurethane topcoat materials	2 hours.

3.3.1.4 Application Conditions and Recoat Windows

The application condition requirements for the coating system are very time and temperature sensitive, and are intended to avoid the delamination problems frequently found on industrial structures. Plan coating application to ensure that specified temperature, humidity, and condensation conditions are met. If conditions do not allow for orderly application of sealant, primer, stripe coat, intermediate coat and

topcoat, use appropriate means of controlling air and surface temperatures, as required. Partial or total enclosures, insulation, heating or cooling, or other appropriate measures may be required to control conditions to allow for orderly application of all required coats.

Maintain air and steel surface temperature between 60 and 100 degrees F during application and the first four hours of cure for epoxy coats and the first eight hours of cure for polyurethane coats. Maintain steel surface temperature more than 5 degrees F above the dew-point of the ambient air for the same period.

Use Table entitled "RECOAT WINDOWS" to determine appropriate recoat windows for each coat after the initial coat. Apply each coat during appropriate RECOAT WINDOW of preceding coat. If a RECOAT WINDOW is missed, the minimum and maximum primer and intermediate coat thickness may be adjusted to accommodate a FILL COAT, however, requirements for total epoxy coating thickness and total coating thickness will not be modified. Missing more than one RECOAT WINDOW may require complete removal of coating if maximum total coating thickness requirements cannot be achieved.

If coating is not applied during RECOAT WINDOW, or if surface temperature exceeds 120 degrees F between applications, provide GLOSS REMOVAL, apply next coat within 24 hours. If next planned coat is topcoat, apply FILL COAT if required to fill sanding marks. Sanding marks from GLOSS REMOVAL of intermediate coat reflecting through topcoat will be considered as noncompliant. Apply FILL COAT within 24 hours of GLOSS REMOVAL, then apply topcoat within RECOAT WINDOW of FILL COAT.

RECOAT WINDOWS						
EPOXY OVER EPOXY						
Temperature degrees F	60-70	71-80	12-36	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	24-72	18-60	16-48	12-36	8-18	4-6
POLYURETHANE OVER EPOXY						
Temperature degrees F	60-70	71-80	12-36	91-100	101-110	111-120

RECOAT WINDOWS						
RECOAT WINDOW (Hrs.)	24-96	24-72	16-48	12-36	10-24	8-16
POLYURETHANE OVER POLYURETHANE						
Temperature degrees F	60-70	71-80	12-36	91-100	101-110	111-120
RECOAT WINDOW (Hrs.)	8-48	6-48	4-36	3-24	2-12	1-2

The temperature ranges shown in the table above are for determining recoat windows. Choose recoat window based on the highest surface temperature that was sustained for one or more hours between coats. This applies to the entire time between coats. Measure and record air and surface temperatures on hourly basis to determine appropriate recoat windows. If surface temperature goes above 100 degrees F, measure and record temperatures every half hour.

FILL COAT - Where indicated, apply coat of intermediate coat epoxy, at 2 to 3 mils DFT, then apply next specified full coat within recoat window of FILL COAT. A FILL COAT may be used to adjust coating thickness to comply with requirements or to fill sanding marks in intermediate coat.

GLOSS REMOVAL - Where required, hand sand in a linear fashion to remove gloss using 120-200 grit wet/dry sandpaper, followed by solvent wiping with a clean rag soaked with denatured alcohol to remove all dust. GLOSS REMOVAL of primer coat is to scarify surface and shall consist of removal of approximately 1 mil of coating. If steel is exposed during GLOSS REMOVAL, repair in accordance with paragraph PROCEDURE FOR HOLIDAY AND SPOT REPAIRS OF NEWLY APPLIED COATING. GLOSS REMOVAL of intermediate coat may include removal of up to 3 mils of coating to avoid excess thickness, prior to application of FILL COAT.

3.3.2 Amine Blush Testing of Epoxy Coat Prior to Overcoating

Test epoxy surfaces prior to application of roof joint sealant, epoxy coat, or polyurethane topcoat for amine blush contamination using the Test Kit described in paragraph TEST KIT FOR IDENTIFYING AMINE BLUSH ON EPOXY SURFACES. Test all surfaces at rate of three tests for the first 1000 square feet plus one test for each additional 2000 square feet or part thereof. Remove any identified contamination using an approved procedure.

3.3.3 Application of Coating System and Joint Sealant

Apply coatings in accordance with SSPC PA 1 and as specified herein. Apply coatings to surfaces that meet all stated surface preparation requirements.

After application of primer coat and prior to application of each subsequent coat, perform testing prescribed in paragraph PRE-APPLICATION TESTING FOR SURFACE CONTAMINATION, as necessary, to ensure minimal intercoat contamination. This testing may be reduced to one half of the prescribed rate for bare steel if the testing indicates no contamination when sampling is evenly distributed over surfaces being tested. If contamination is found between coats, revert to the specified testing rate. Generally, oil and grease contamination and soluble salts contamination are not encountered if subsequent coats are applied within specified recoat windows and unusual atmospheric events do not occur. Such atmospheric events as a coastal storm blowing onshore can bring unusual chloride contamination. Concern for intercoat contamination should be continually prevalent, and spot testing should be accomplished to verify satisfactory conditions. Where visual examination or spot testing indicates contamination, perform sufficient testing to verify non-contamination, or to define extent of contamination for appropriate treatment.

Apply coatings at the following specified thickness:

Coat	Minimum DFT (Mils)	Maximum DFT (Mils)
Primer	5	5
Intermediate	5	5
Top	2	3
Total system	12	13

3.3.3.1 Application of Primer

Apply primer coat, maintaining paint supply container height within 3 feet of the paint nozzle for applying zinc primer. Maintain constant agitation of paint pot to ensure that zinc does not settle in container.

3.3.3.2 Application of Stripe Coat

Apply a stripe coat of intermediate coat epoxy material within RECOAT WINDOW of primer, allowing sufficient dry time to allow application of intermediate coat within RECOAT WINDOW of primer. Apply by brush, working material into corners, crevices, angles, and welds, and onto outside corners and angles.

3.3.3.3 Application of Intermediate Coat

Apply intermediate coat within RECOAT WINDOW of primer coat.

3.3.3.4 Non-skid for Stairs and Top

Where non-skid is required, apply a second intermediate coat, and immediately follow with application of non-skid grit, broadcast at the rate of 2 pounds per 100 square feet, and backroll. Apply topcoat as specified.

3.3.3.5 Application of Topcoat

Make all required repairs to primer and intermediate coats as specified in paragraph entitled "Procedure for Holiday and Spot Repairs of Newly Applied Coating" prior to applying topcoat. Apply topcoat within RECOAT WINDOW of intermediate coat. The polyurethane topcoat may require multiple passes to achieve desired aesthetics and required thickness. Consult manufacturer for thinning and application procedures for anticipated temperature, humidity, and wind conditions. Touch-up blemishes and defects within recoat window of polyurethane topcoat. Retain sample of polyurethane topcoat, from the same batch used to coat structure, to make touch-ups that might be required later.

3.3.3.6 Application of Joint Sealant

Apply joint sealant to back-to-back steel joints that are less that 3/8 inches wide and are not seal welded. Apply sealant to top and bottom, or each side, of narrow joints. Apply sealant within 48 hours of application of the topcoat, and touch-up with topcoat after appropriate cure of the sealant.

3.3.3.7 Procedure for Holiday and Spot Repairs of Newly Applied Coating

Repair coating film defects at the earliest practicable time, preferably before application of the succeeding coat. Observe all requirements for soluble salts contamination, cleanliness between coats, and application conditions. Prepare defective area in accordance with SSPC SP 10/NACE No. 2, and feather coating as required to leave 4 inches of each succeeding coat feathered and abraded. Protect adjacent areas from damage and overspray. Remove dust and solvent wipe the prepared area plus an additional 4 inches beyond the prepared area with clean denatured alcohol. Apply each coat within RECOAT WINDOW of preceeding coat. Within four hours of preparation, apply zinc-rich primer to prepared steel and feather onto prepared primer. Apply intermediate coat to primed area and feather to prepared intermediate area. Apply topcoat to intermediate coat and feather to prepared topcoat. Apply each repair coat to approximate thickness of surrounding coating system.

3.3.3.8 Structure Occupancy After Coating Application

Use clean canvas or other approved shoe covers when walking on coated surfaces, regardless of curing time allowed. For heavily trafficked areas, provide cushioned mats for additional protection.

3.4 FIELD QUALITY CONTROL

3.4.1 Coating Inspector

The coating inspector shall be considered a QC Specialist and shall report to the QC Manager, as specified in Section 01 45 00.00 20 QUALITY CONTROL. The Coating Inspector shall be present during all pre-preparation testing, surface preparation, coating application, initial cure of the coating system, during all coating repair work, and during completion activities as specified in Section 01 45 00.00 20 QUALITY CONTROL. The Coating Inspector shall provide complete documentation of conditions and occurrences on the job site, and be aware of conditions and occurrences that are potentially detrimental to the coating system. The requirements for inspection listed in this Section are in addition to the QC inspection and reporting requirements specified in Section

01 45 00.00 20 QUALITY CONTROL.

3.5 FINAL CLEANUP

Following completion of the work, remove debris, equipment, and materials from the site. Remove temporary connections to Government or Contractor furnished water and electrical services. Restore existing facilities in and around the work areas to their original condition.

-- End of Section --

SECTION 31 11 00

CLEARING AND GRUBBING
11/18

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Tree Wound Paint

1.2 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Tree Wound Paint

Use bituminous based paint from standard manufacture specially formulated for tree wounds.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

3.1.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.1.2 Trees, Shrubs, and Existing Facilities

Provide protection in accordance with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS. Protect trees and vegetation to be left standing from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

3.1.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor is responsible for the repair of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing

operations. When utility lines which are to be removed are encountered within the area of operations, notify the Contracting Officer in ample time to minimize interruption of the service. Refer to Section 01 30 00 ADMINISTRATIVE REQUIREMENTS and Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS for additional utility protection.

3.2 CLEARING

Clearing consists of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Clearing also includes the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work. Cut off flush with or below the original ground surface trees, stumps, roots, brush, and other vegetation in areas to be cleared, except such trees and vegetation as may be indicated or directed to be left standing. Trim dead branches 1-1/2 inches or more in diameter on trees designated to be left standing within the cleared areas and trim all branches to the heights indicated or directed. Neatly cut close to the bole of the tree or main branches, limbs, and branches to be trimmed. Paint, with an approved tree-wound paint, cuts more than 1-1/2 inches in diameter.

3.2.1 Tree Removal

Where indicated or directed, remove trees and stumps that are designated as trees from areas outside those areas designated for clearing and grubbing. This work includes the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Dispose of trees as specified in paragraph DISPOSAL OF MATERIALS.

3.2.2 Grubbing

Grubbing consists of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Remove material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Fill depressions made by grubbing with suitable material and compact to make the surface conform with the original adjacent surface of the ground.

3.3 DISPOSAL OF MATERIALS

Dispose of excess materials in accordance with the approved solid waste management permit and include those materials in the solid waste management report.

All wood or wood like materials, except for salable timber, remaining from clearing and grubbing such as limbs, treetops, roots, stumps, logs, rotten wood, and other similar materials is the property of the Contractor and dispose of as specified. All non-saleable timber and wood or wood like materials remaining from timber harvesting such as limbs, treetops, roots, stumps, logs, rotten wood, and other similar materials is the property of the Contractor and dispose of as specified.

3.3.1 Saleable Timber

All timber removed from the project site is the property of the Contractor. Reimburse the Government for the fair market value of the timber which the Government has appraised at **$760**. Submit payment to the Contracting Officer by cashier's or certified check in the amount of the appraised value, made payable to the U.S. Treasury for deposit into the Navy Forestry account. Make payment within 30 days of the Notice to Proceed or no less than 5 days prior to the start of land clearing operations.

-- End of Section --

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SECTION 31 66 13

RIGID INCLUSIONS
02/19

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM C109/C109M	(2016a) Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens)
ASTM C150/C150M	(2021) Standard Specification for Portland Cement
ASTM C39/C39M	(2018) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C618	(2019) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C937	(2016) Grout Fluidifier for Preplaced-Aggregate Concrete
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D1143/D1143M	(2007; R 2013) Piles Under Static Axial Compressive Load

1.2 DESCRIPTION OF WORK

Work shall consist of a design sealed by the Installer's Geotechnical Professional Engineer, furnishing and installing ground improvement using Rigid Inclusions and a Load Transfer Platform to the lines and grades designated on the Rigid Inclusions Plan for the structures as well as specified herein. The Rigid Inclusions shall be constructed by displacement drilling and casting columns in place with a concrete or grout mix delivered through the center of the hollow tool to the bottom of the hole such that each Rigid Inclusion element is adequate to meet the Design Requirements. The tooling is retracted at a constant rate under low pressure and positive concrete head to construct the grout column in a manner that achieves full contact with the surrounding soil along the entire column length. The Rigid Inclusion elements shall be in a columnar type configuration and shall be used to produce an intermediate foundation system for support of foundation loads. The Load Transfer Platform is

placed above the Rigid Inclusions and is composed of layers of biaxial geogrid reinforcement and compacted dense graded aggregate. The purpose of the Load Transfer Platform is to provide essentially uniform support for the mat foundation / spread footings / slab on grade above and to transfer loads from the concrete mat / footings / slabs to the Rigid Inclusions.

1.2.1 Subsurface Data

The soil boring logs, included in the Project Drawings, shall be considered representative of the in-situ sub-surface conditions likely to be encountered on the project site.

1.3 DEFINITIONS

a. "Rigid Inclusions" are grout or cemented aggregate vertical elements used to reinforce soft soils, providing an increased bearing capacity and reduced settlement for the support of shallow foundations.

b. "Load Transfer Platform" (LTP) is constructed over the rigid inclusions. The LTP is constructed using layers of biaxial geogrid reinforcement and compacted dense graded aggregate which transfers the foundation loads to the rigid inclusions, providing support above the rigid inclusions.

c. "Design Load": The design load shall be the required design axial capacity of an individual rigid inclusion element. As a minimum, the design load shall be the greater of the largest load calculated in any individual rigid inclusion from the analysis of the system, or approximately 95 percent of the largest load on an individual rigid inclusion calculated from the combination of the load on the rigid inclusion and the load from the tributary area of the surrounding soil.

1.4 MEASUREMENT AND PAYMENT

Measurement and payment will be on a lump sum basis. Include the cost of all design, engineering and testing/inspection services, and all necessary plant, equipment, tools, material, labor, and supervision required to meet the contract requirements. Include provisions for pre-drilling. The Contractor and Installer are responsible for clearly defining their respective roles and responsibilities for compliance with this section and related contract drawings and specifications. No additional payment will be made for rejected or misplaced elements; withdrawn and reinstalled elements; any portion of element remaining above the planned top elevation; buildups of elements installed below planned top elevation; or other excesses for which the Contractor is responsible. The lump sum price includes obstruction mitigation at 2 percent of the total rigid inclusion installation locations to bypass boulders and artificial obstructions encountered at depths up to 15 feet below rigid inclusion cutoff elevation.

1.5 SUBMITTALS

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

SD-01 Preconstruction Submittals

Designer And Installer Qualifications; G

Independent Geotechnical Engineering And Testing Agency (IGETA) Documentation; G

Professional Liability Insurance; G

Load Test Program; G

Work Plan; G

Obstruction Mitigation Plan; G

Preconstruction Meeting Agenda

SD-02 Shop Drawings

Rigid Inclusion/Load Transfer Platform; G

SD-03 Product Data

Installation Equipment

Engineered Fill

Geogrid Reinforcement

Grout

Cementitious Materials

Grout Fluidifier

SD-05 Design Data

Design Calculations; G

SD-06 Test Reports

Modulus Test or Load test; G

Compressive Strength Tests; G

IGETA Inspection Summary Report; G

SD-07 Certificates

Installation Equipment

Load Test Equipment

SD-11 Closeout Submittals

As-Built Drawings; G

Daily Rigid Inclusion Progress Reports and Final Reports; G

1.6 QUALITY CONTROL

The Installer shall provide full-time Quality Control monitoring of the Rigid Inclusion elements and load transfer platform construction activities. Sampling, testing, recording of the data, monitoring of subgrade preparation and installation of the rigid inclusions and the load transfer platform shall be performed under the direct supervision of a geotechnical Professional Engineer.

1.6.1 Designer and Installer Qualifications

Designers and Installers of Rigid Inclusion foundation systems shall have a minimum of 5 years of experience with the design and installation of Rigid Inclusions in similar soil conditions as specified herein, and must have completed at least 20 similar projects of comparable size and type over the past 5 years. Submit evidence that Designers and Installers have worked on similar type of projects. Projects must demonstrate proficiency of the Designer as applicable to the intent of the project. Submit list of projects, including name and description of the project, relative size, and contact person with phone number and email address.

The Designer must be a Professional Engineer registered in the state of Connecticut and must have professional liability Errors and Omissions insurance for the work. The professional liability insurance policy must provide a minimum coverage of $2 million per occurrence.

1.6.2 Load Test Program

a. A load test program shall be developed by the Installers Geotechnical Professional Engineer to verify the design. As a minimum, test two rigid inclusions each in the areas of the CLWS Magazines and Type G Magazines and one in the area of the Gate/Sentry House Building. The load tests shall be performed on rigid inclusions in accordance with ASTM D1143/D1143M, Procedure A: Quick Test.

b. The locations of each sacrificial test rigid inclusion must be approved by the Contracting Officer. Provide all labor, apparatus, equipment, and materials required to install the test rigid inclusions and reaction piles, if necessary, to perform the static load tests as specified including the documentation of all required load and deflection readings, and to provide written report documenting the results of the static load tests to the Engineer within 3 working days of completing the static load testing.

c. Load test the rigid inclusion to 150 percent of the design load and evaluate acceptance per the Davisson Offset Limit, Brinch-Hansen 90-Percent Criterion, or the Butler-Hoy Criterion.

d. Continue the load test to 200 percent of the design load. Verify that the rigid inclusion has not reached the failure load criteria of ASTM D1143/D1143M at 200 percent of the design load.

e. All load test equipment calibration records shall be submitted 7 days prior to performing the load test. The load test results shall be approved by the government. Rigid inclusion installation shall typically not begin until completion of the load test program and final tip elevations and spacings have been issued by the Installer's Engineer. At the Installer's risk, the load test may be done during installation of the production rigid inclusions.

f. Rigid Inclusions tested as part of the verification test program shall be abandoned and not used as production rigid inclusions.

1.6.3 Work Plan

Submit details of the installation equipment, sequence, and method of installation. Include a detailed narrative of the Contractor's Quality Control Plan. The work plan shall also describe the procedures for site/civil work related to the Rigid Inclusions such as LTP construction and load test rigging.

1.6.4 Obstruction Mitigation Plan

Provide detailed procedures for removing and bypassing obstructions.

1.6.5 Rigid Inclusion/Load Transfer Platform Shop Drawings

Submit a minimum of 30 days prior to start of installation. Rigid inclusion/Load Transfer Platform shop drawings shall include a reference number, spacing, diameter, load transfer platform thickness and compaction requirements, installation procedure and sequence of construction with sufficient details including transitions areas, planned cut off, and tip elevations. All shop drawings shall be sealed by the Installer's Professional Engineer.

1.6.6 Daily Rigid Inclusion Progress Reports

Furnish complete and accurate records of Rigid Inclusion Installation. Indicate the element location, length, final elevations or depths of the base and top of the elements, and record relative amperage readings, volume of grout used and grout pressure at least every 2-foot intervals. The record shall indicate the type and size of the installation equipment used, and the type of grout used. Unusual conditions shall be immediately reported to the Contracting Officer.

1.6.7 Compressive Strength Tests

Conduct strength testing of the grout in accordance with ASTM C39/C39M. At a minimum, eight 4-inch diameter by 8-inch test cylinders for each 50 cubic yards of concrete or grout placed or a minimum of two sets of eight cylinders each per day (whichever is greater) shall be made and cured. Three cylinders from each set shall be tested for strength at 7 and 28 days. The additional two cylinders from each set shall be held in reserve.

1.6.8 Preconstruction Meeting

Hold a preconstruction meeting at the jobsite at least 5 business days prior to the start of ground improvement rigid inclusion installation. The purpose of this meeting is to review the requirements of this specification and the project plans. The following individuals as a minimum will attend this meeting: Contractor's Project Manager and Project Superintendent, Ground Improvement Designer, Ground Improvement Installer's Project Manager and Site Foreman, Contractor's IGETA, Government Geotechnical Engineer, and Government Construction Manager and Engineering Technician. The minutes of this meeting will be recorded by the Contractor and published via email within 48 hours to all attendees. Re-publish meeting minutes within 48 hours via email pending any subsequent comments from the attendees.

1.7 QUALITY ASSURANCE

An Independent Geotechnical Engineering and Testing Agency (IGETA) shall be engaged to perform the following monitoring, tests and inspections and provide independent quality control services as specified herein. The IGETA must employ a registered professional geotechnical engineer experienced in soil mechanics and foundation engineering. Submit qualifications package demonstrating IGETA has been engaged in successful inspection of aggregate piers or rigid inclusions for at least 5 years and inspected projects in similar size and scope utilizing the methods being performed for this project. The IGETA must meet the accreditation requirements and comply with the testing and reporting requirements of Section 01 45 00.00 20 QUALITY CONTROL. Responsibilities of the IGETA include, but are not limited to the following: The observations and data collected shall be included in the Daily Reports.

a. Monitor the installation of test elements and associated verification testing. The Installer must provide and install all necessary dial indicators, load cells, and other measuring devices. The Designer is responsible for directing and supervising the modulus test or load test.

b. Monitor the Rigid Inclusion procedures and execution of work and installation of Rigid Inclusion elements to verify the depth and locations of Rigid Inclusion elements.

c. Monitor the installation of ground improvement elements to verify the production installation practices meet the design requirements and are similar to those demonstrated during the testing program. Report any discrepancies to the Installer, General Contractor, and Special Inspector immediately. Document any corrective actions taken.

d. Provide testing of materials used for the installation of the Rigid Inclusions.

e. Maintain daily reports which include, at a minimum, the following information:

   (1) Installation equipment used.

   (2) Installation records including predrill depth (if applicable), element number, installation start/finish time, length, diameter, type and volume of material used, installed depth or elevation of element tip, and elevation of element top.

   (3) Load transfer platform or cushion construction details.

   (4) Any unusual activity noted during installation.

f. Observe excavations for foundations, including load transfer platform or cushion as applicable, and verify the bearing conditions are satisfactory and meet the requirements of this Specification.

g. Submit an IGETA Inspection Summary Report to Contractor and Contracting Officer upon completion of the specified quality control services. Inspection summary report will serve as final comprehensive report for record purposes.

h. Provide quality control/inspection for placement of the Load Transfer

Platform (LTP). The inspection reports shall be sealed by a Professional Engineer stating the LTP was installed in accordance with the requirements of the Rigid Inclusion Shop Drawings.

1.8 DESIGN DATA

1.8.1 Design Calculations

Submit a minimum of 30 days prior to start of installation. The Rigid Inclusion Installer shall submit detailed design calculations for subgrade modulus and predicted settlements for the foundation system. The calculations must be sealed by the Installer's Professional Engineer and should include design parameters, references and assumptions. The calculations should also include the design of individual rigid inclusion elements to document the design for the required load and settlement criteria have been achieved.

1.8.2 Rigid Inclusion Design Criteria

Design ground improvement rigid inclusions in accordance with generally accepted engineering practice and the methods described in these Specifications. Design to meet the following criteria:

a. Service loads and load cases as indicated on the design drawings

b. Minimum subgrade modulus as indicated on the design drawings.

c. Estimated total long term settlement for footings and slabs (after construction) as indicated on the design drawings, not more than **.75 inch**.

d. Estimated long term differential settlement of adjacent support elements as indicated on the design drawings, not more than 0.5-inches and angular distortion ratio less than or equal to 1/500 between adjacent support points.

e. Rigid Inclusion system shall be installed below the mat foundation / spread footings / slab-on-grade as indicated on the design drawings.

f. Load Transfer Platform as indicated on the design drawings.

g. Design shall be based on the information contained in the design drawings.

PART 2 PRODUCTS

2.1 LOAD TRANSFER PLATFORM

2.1.1 Engineered Fill

Provide naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand meeting the requirements of the Rigid Inclusion Design Engineer's calculations and indicated on the Shop Drawings.

2.1.2 Geogrid Reinforcement

Provide biaxial geogrid reinforcement consisting of BX 1500 (or similar) throughout the load transfer platform. Geogrid selection shall be on the

basis of meeting settlement and strength requirements outlined herein and in the design drawings.

2.2 GROUT

Provide grout consisting of a mixture of portland cement, approved pozzolanic material, grout fluidifier, sand and water proportioned and mixed to produce a grout capable of being pumped with an ultimate compressive strength at 28 days as indicated on the Shop Drawings, per ASTM C109/C109M.

2.3 CEMENTITIOUS MATERIALS

2.3.1 Portland Cement

ASTM C150/C150M, Type I or II

2.3.2 Pozzolanic Material

Fly ash or natural pozzolan conforming to ASTM C618 Class C or Class F.

2.4 GROUT FLUIDIFIER

ASTM C937; Expansion shall not exceed 4 percent.

2.5 WATER

Potable, fresh, clean, and free from sewage, oil, acid, alkali, salts, or organic matter. Access to water on site shall be provided to the Installer by the Contractor.

2.6 WORKING PLATFORM

Contractor is responsible for providing an adequate working platform for Installer to construct the ground improvement elements, and shall provide adequate and suitable laydown space and staging areas on the project site for Installer's storage of aggregate and equipment.

PART 3 EXECUTION

3.1 PRE-INSTALLATION

3.1.1 Site Layout

Prior to installation of the rigid inclusions, each rigid inclusion location shall be surveyed. Provide all survey layouts, maintain utility clearances, and provide coordination with the Contracting Officer and any other agencies having jurisdiction prior to the start of construction.

Locate and protect underground and above ground utilities and other structures from damage during installation of the Rigid Inclusion elements.

Coordinate all utility excavations made after Rigid Inclusion installation so that excavations do not encroach on the grout columns.

3.1.2 Load Test

Prior to the installation of the Rigid Inclusions, the test elements shall

be installed, and load test results shall be sealed by the Installer's Professional Engineer and submitted for approval. If, at the Installer's risk, the load tests are performed during installation of the production rigid inclusions, and the rigid inclusios fail to meet the load test requirements, a report must be prepared by the Installer's Professional Engineer which includes recommendations for remediation and submitted to the Contracting Officer for approval before any corrective work is accomplished.

The Engineer may request additional sacrificial load tests as necessary when subsurface conditions change.

3.2 LOAD TRANSFER PLATFORM (LTP)

Do not start construction of the load transfer platform before a minimum waiting period of 7 days after the successful installation of the underlying rigid inclusions.

Protect the geogrid reinforcement from damage and place according to the manufacturer's guidelines, Shop Drawings and as specified herein. Do not operate construction equipment directly on the geogrid reinforcement.

Construct the load transfer platform in accordance with the Shop Drawings. Place and compact LTP fill to 95 percent of ASTM D1557.

3.3 RIGID INCLUSION INSTALLATION

3.3.1 Placement

Specific equipment and procedures are determined by the Rigid Inclusion Installer performing the Work as specified. Prior to the installation of the Rigid Inclusions, the existing ground shall be excavated and stripped of topsoil and other unsuitable material to provide a level and stable work platform capable of supporting the Installer's equipment. The subgrade shall be proof-rolled, and approved by the Rigid Inclusion Installer.

Install columns using a displacement tool consisting of a hollow stem probe that is drilled into the ground to the required depth by equipment with high torque capacity and high static downward thrust. The tooling shall displace the soil laterally and produce virtually no spoil or vibration. The grout or concrete shall be delivered to the top of the tooling by a pump capable of furnishing a minimum output of 50 cy/hr and at a sufficient rate during tool withdrawal to ensure a continuous rigid inclusion column over the full design depth and cross-section if formed without discontinuities. The actual grout volume must be greater than or equal to 100 percent of the theoretical grout volume.

The machine used for installation of the Rigid Inclusions shall be outfitted with automated measuring equipment to record critical parameters (including grout volume and crowd pressure) throughout penetration and grouting. The measurements shall be reported in real-time.

Install the rigid inclusions as required to found the rigid inclusions in a suitable bearing stratum as determined by the Rigid Inclusion Design Engineer. Obstructions encountered which prevent the rigid inclusions to be installed to the required depth shall be reported to the Rigid Inclusion Design Engineer immediately for direction on how to proceed. If the construction of a replacement rigid inclusion is deemed necessary by

the Design Engineer, construct the replacement rigid inclusion no more than 18 inches away from locations shown on the Shop Drawings. Ensure the increase in design spacing between the relocated rigid inclusion and the adjacent rigid inclusion is 18 inches maximum. Submit a daily obstruction report including location, depth, type of obstruction, and replacement rigid inclusion log.

Cold joints are not allowed. Major delays in the grouting of a rigid inclusion will be cause for rejection of that rigid inclusion. Such rigid inclusions shall be drilled out and replaced or abandoned at no additional cost to the Government. Minor delays may be permitted as long as initial set of grout in the tooling, or the top of the element (bottom of tooling) does not occur.

Cut off the rigid inclusions to the top elevation as shown on the Shop Drawings. When cutting off and trimming the rigid inclusions to the specified cut off elevations, take care to avoid shattering or otherwise damaging the rest of the column. Cut away any latency, or contaminated, cracked or defective concrete and repair the column in an approved manner to provide a full and sound section up to the cut off elevation. The cut off elevation shall be established with an accuracy of +/- 3 inches.

Conduct strength testing of rigid inclusion grout or concrete in accordance with paragraph 1.6.7.

Spoils that are generated by augering and pre-augering must be disposed of by the Contractor as specified. The volume of anticipated spoils must be estimated by the Installer and provided to the Contractor at the time of bidding.

Tolerances

a. Plan Position: +/- 6 inches

b. Verticality: 2 percent deviation from the planned vertical axis

c. Diameter: 10 percent

3.3.2 Protection

Perform excavation in such a way to prevent damage to the rigid inclusions or disturbances of the soil matrix between the rigid inclusions.

The LTP shall be protected until concrete foundation placement with procedures and equipment best suited to avoid exposure to water, prevent softening of the LTP, and to achieve direct and firm contact between the LTP and the concrete mat foundation.

All equipment used for construction of the LTP, foundations, slab-on-grab and utility excavations shall avoid direct contact with rigid inclusions. If any equipment makes contact with a rigid inclusion, the contractor shall notify the Rigid Inclusion Design Engineer for evaluation of the integrity of the rigid inclusion.

3.4 CORRECTIVE WORK

A report documenting any installations which are out of tolerance or defected must be prepared which includes recommendations for repair,

removal or remediation and submitted to the Rigid Inclusion Design Engineer for approval before any corrective work is accomplished. Complete corrective work within 30 calendar days of approval of the report.

3.4.1 Rigid Inclusions Damaged, Mis-located, or Out of Alignment

Rigid inclusions improperly located or installed beyond the maximum allowable tolerances or reported to be defective, shall be abandoned and replaced with two new rigid inclusions located adjacent to the abandoned element, unless the Contracting Officer elects to approve other remedial measures proposed by Designer. All material and labor required to replace or correct rejected elements must be provided at no additional cost to the Government, unless the cause of the rejection is due to an obstruction that is not pre-identified.

Any required modifications to the Work Plan due to mitigation of disturbances to adjacent rigid inclusions during installation shall be communicated to the Contracting Officer and noted in the daily progress reports.

3.4.2 Damaged or Trenched Load Transfer Platform

If areas of the Load Transfer Platform are damaged, or excavated for utility installation after LTP final approval by the Rigid Inclusion Design Engineer, the LTP shall be repaired per the requirements of the Rigid Inclusion Design Engineer.

3.5 SPECIAL INSPECTION AND TESTING

Perform special inspections and testing in accordance with Section 01 45 35 SPECIAL INSPECTIONS.

3.6 RECORDS

a. Keep complete and accurate records of all rigid inclusion elements. Indicate the rigid inclusion location, length, cut-off elevation, date and time of construction, record relative amperage readings, grout volumes and grout pressure recorded at least every 2 feet, and other pertinent installation details.

b. Immediately report any unusual conditions encountered during installation. Any corrective measures shall also be recorded. A complete tabulation of all records pertaining to approved rigid inclusion installation shall be certified by the Installer's engineer and shall be delivered to the Contracting Officer no later than 14 days after the completion of the rigid inclusion work. All testing and inspection documents shall be reviewed and approved by the Installer's engineer certifying the rigid inclusions and load transfer platform are suitable for foundation support.

c. Submit as-built drawings for the installed rigid inclusions with the load transfer platform based on actual locations and tip elevations.

3.7 RESPONSIBILITIES OF GENERAL CONTRACTOR

3.7.1 Site Preparation

a. Locate the underground utilities. Protect underground and aboveground utilities and other structures from damage during installation of the

rigid inclusions.

b. Provide and maintain the aggregate surfaced working platform as specified to the lines and grades indicated.

c. Perform field layout of the rigid inclusions and provide surveys of the installed element locations, unless other surveying agreement is arranged between Contractor and Installer.

d. Remove spoils from site due to rigid inclusion installation, footing excavation and subgrade preparation as specified in Section 31 00 00 EARTHWORK.

-- End of Section --

SECTION 41 22 13.14

BRIDGE CRANES, OVERHEAD ELECTRIC, TOP RUNNING
11/19, CHG 1: 02/21

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 GEAR MANUFACTURERS ASSOCIATION (AGMA)

AGMA 908	(1989B; R 1999) Information Sheet: Geometry Factors for Determining the Pitting Resistance and Bending Strength of Spur, Helical and Herringbone Gear Teeth
ANSI/AGMA 2001	(2004D; R 2010) Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth
ANSI/AGMA 2015-1	(2001A; R 2014) Accuracy Classification System - Tangential Measurements for Cylindrical Gears
ANSI/AGMA 6013	(2006A; R 2016) Standard for Industrial Enclosed Gear Drives
ANSI/AGMA 6113	(2016B) Standard for Industrial Enclosed Gear Drives (Metric Edition)

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360	(2016) Specification for Structural Steel Buildings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B30.2	(2017) Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)
ASME B30.10	(2019) Hooks
ASME B30.16	(2022) Overhead Underhung and Stationary Hoists
ASME B30.30	(2023) Ropes
ASME HST-4	(2021) Performance Standard for Overhead Electric Wire Rope Hoists

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding

Code - Steel

AWS D14.1/D14.1M (2019) Specification for Welding of Industrial and Mill Cranes and Other Material Handling Equipment

ASTM INTERNATIONAL (ASTM)

ASTM A275/A275M (2018) Standard Practice for Magnetic Particle Examination of Steel Forgings

ASTM A668/A668M (2022) Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use

ASTM A1023/A1023M (2021) Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes

ASTM E543 (2021) Standard Specification for Agencies Performing Non-Destructive Testing

ASTM F3125/F3125M (2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

BRITISH STANDARDS INSTITUTION (BSI)

BS ISO 4309 (2017) Cranes - Wire Ropes - Care and Maintenance, Inspection and Discard

CRANE MANUFACTURERS ASSOCIATION OF AMERICA (CMAA)

CMAA 70 (2020) Specification for Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2020) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA ICS 5 (2017) Industrial Control and Systems: Control Circuit and Pilot Devices

NEMA ICS 6 (1993; R 2016) Industrial Control and Systems: Enclosures

NEMA ICS 8 (2011) Crane and Hoist Controllers

NEMA MG 1 (2021) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2023) National Electrical Code

RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC)

RCSC A348	(2020) RCSC Specification for Structural Joints Using High-strength Bolts

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-W-410	(2020; Rev J) Wire Rope and Strand

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

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.147	The Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1910.179	Overhead and Gantry Cranes
29 CFR 1910.306	Specific Purpose Equipment and Installations

U.S. NAVAL SEA SYSTEMS COMMAND (NAVSEA)

NAVSEA T9074-AS-GIB-010/271	(2014; Revision 1) Requirements for Nondestructive Testing Methods

UNDERWRITERS LABORATORIES (UL)

UL 50	(2015) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 489	(2016; Rev 2019) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 943	(2016; Reprint Feb 2018) UL Standard for Safety Ground-Fault Circuit-Interrupters
UL 1004-1	(2012; Reprint Nov 2020) UL Standard for Safety Rotating Electrical Machines - General Requirements
UL 1449	(2021) UL Standard for Safety Surge Protective Devices

1.2 DEFINITIONS

a. Bridge Crane: That part of an overhead crane system consisting of girder(s), end trucks, end ties, walkway, and drive mechanism which carries the trolley(s) and travels along the runway rails parallel to the runway.

b. Crane Runway: The track system along which the crane operates

horizontally, including track hangar rods, track connection devices, and runway structural supports.

c. Dead Loads: The loads on a structure which remain in a fixed position relative to the structure.

d. Girder: The principal horizontal beam of the crane bridge. It is supported by the crane end trucks.

e. Lifted Load: The load consisting of the rated load and the weight of lifting devices attached to the crane such as the load block, bucket, or other supplemental devices.

f. Pendant: A control for a hoist and a crane. The pendant hangs from the hoist or the crane by a cable at a height that is easy for the operator to reach.

g. Rated Load: The maximum working load suspended under the load hook.

h. Standard Commercial Cataloged Product: A product which is currently being sold, or previously has been sold, in substantial quantities to the general public, industry or Government in the course of normal business operations. Models, samples, prototypes or experimental units do not meet this definition. The term "cataloged" as specified in this section is defined as "appearing" on the manufacturer's published product data sheets. These data sheets must have been published or copyrighted prior to the issue date of this solicitation and have a document identification number or bulletin number.

i. Top Running Crane: An electric overhead traveling crane that runs on rails on top of support girders.

j. Trolley Load: Weight of the trolley and its associated equipment carried by the trolley wheels.

k. Operating Environments:

(1) General Purpose Service: This applies to most cranes and are, in large measure, the manufacturers' standard designs. Cranes should be classified as General Purpose Service if they are operating in routine environments.

(2) Ordnance/Explosives Handling: Cranes handling palletized or unpackaged ammunition, missiles, torpedoes, and other types of ordnance. Minimum requirement of CMAA service class D.

(3) Hazardous (Explosive) Environments: Cranes operating in hazardous environments as defined by the cognizant activity safety office must be equipped with electrical safety features that meet NEC Article 500. The activity safety office will identify the specific Class, Division, and Group, as well as the envelope that the hazard exists, to allow proper design and shall list these in this section. Choose materials for mechanical components to minimize the potential for sparking, typically bronze, stainless steel, or aluminum. Hazardous environments are split into two groups: minimum anti-spark protection and maximum anti-spark protection.

(a) Minimum Anti-Spark Protection is used when only the load block

enters the explosive area.

(b) Maximum Anti-Spark Protection is used when the hazardous area envelops the entire crane.

1.3 SYSTEM DESCRIPTION

The requirements for the crane runway system and rail supporting structures are **defined on CLWS S drawings and** specified in **Section 03 30 00 CAST-IN-PLACE CONCRETE and** Section 05 12 00 STRUCTURAL STEEL, and must conform to AISC 360. **Submit field survey of rail alignment per paragraph 1.4.3.2 of 05 12 00 STRUCTURAL STEEL.**

1.3.1 Crane Design Criteria

Cranes will operate in the given spaces and match the runway dimensions and rails indicated. Hook coverage, hook vertical travel, clear hook height, lifting capacity, and load test weight must not be less than that indicated.

1.3.1.1 General

Include the following: Number of cranes one crane in each of six buildings, located in building identified as CLWS Magazines CLWS-0001, CLWS-0002, CLWS-0003, CLWS-0004, CLWS-0005, and CLWS-0006, with the capacity expressed in pounds, for each overhead electric traveling (OET) crane. Also clearly locate and identify each multiple girder hoist and system components.

1.3.1.2 Classification

Provide top running overhead electric traveling (OET) multiple girder crane conforming to CMAA 70 service class D for operation in an indoor environment, ordnance handling service, meeting the requirements of ASME B30.2, with an ambient temperature range of 30 to 100 degrees Fahrenheit. The crane span must be 30 feet 4 inches with a vertical lift of 16 feet and as specified herein.

The crane must be pendant controlled and operate in the spaces and within the loading conditions indicated. The pendant controller must be mounted on a separate festooned cable system from the trolley power supply. The crane must operate on 480-volts AC, 60 Hz, three phase power source. Maximum crane wheel loads (without impact) due to dead, trolley, and lifted loads, with the trolley in any position, must not cause a more severe loading condition in the runway support structure than that produced by the design wheel loads and spacing indicated.

1.3.1.3 Rated Capacity and Speeds

Provide crane with rated capacity of 50,000pounds. Lower load block or assembly of hook, swivel bearing sheaves, pins, and frame suspended by the hoisting ropes are not considered part of the rated capacity.

Rated (maximum) speeds plus or minus 10 percent (feet/min) for the main hoist, bridge, and trolley at the rated load are specified in the table below. The minimum speed must not exceed the values listed. Values in the table are for a fully loaded crane.

Rated Speeds feet/min		
Description	Minimum	Maximum
Main Hoist	1.2	12
Trolley	5	35
Bridge	5	50

Provide slow speed selector switch for bridge and trolley to set creep speed of 1.5 fpm.

1.4 VERIFICATION OF DIMENSIONS

The Contractor is responsible for the coordination and proper relation of their work to the building structure and to the work of all trades. Verify all dimensions of the building that relate to fabrication of the crane and notify the Contracting Officer of any discrepancy before finalizing the crane order.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Overhead Electric Traveling Crane; G

Complete Schematic Wiring Diagram; G

Control System and Network Drawings; G

SD-03 Product Data

Gear Reducers; G

Hoist Brakes; G

Travel Brakes; G

Couplings; G

Load Blocks and Hooks; G

Wheels; G

Hoists; G

Sheaves; G

Commercial Hoist and Trolley Units; G

End Trucks; G

Bridge Rails; G

End Stops; G

Bumpers; G

Motors; G

Runway Conductor System; G

Bridge Conductor System; G

Limit Switches; G

Pendant Pushbutton Station; G

Pendant Conductor System; G

Controls; G

Control Parameter Settings; G

Capacity Overload Protective Device; G

Load Indicating Device; G

Painting System; G

Control System and Network; G

SD-05 Design Data

Load and Sizing Calculations; G

SD-06 Test Reports

Hook Non-destructive Test (NDT); G

Post-erection Inspection; G

Operational Tests; G

Hook Tram Measurement; G

Load Tests; G

SD-07 Certificates

Wire Ropes; G

Crane Runway System; G

Hazardous Material; G

Loss of Power Test; G

Coupling Alignment Verification Record; G

Overload Test; G

Brake Adjustment Record; G

Compliance with Listed Standards; G

Contractor Hazardous Environment; G

Public Domain Software; G

Software and Services; G

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G

SD-11 Closeout Submittals

Disabled Ports, Connectors, and Interfaces; G

Network-Capable Control Devices; G

Control System Access Control; G

Control System Account Management; G

Patch Management and Updates; G

Malware Detection and Protection; G

Wireless Technology Provisions; G

Control System Inventory; G

Evaluation Status of Hardware and Software; G

1.6 QUALITY ASSURANCE

1.6.1 Manufacturer Qualification

Overhead Electric Traveling Crane must be designed and manufactured by a company with a minimum of 10 years of specialized experience in designing and manufacturing the type of overhead crane required to meet requirements of the Contract Documents. Crane design shall be accomplished by, or directly supervised by, a registered professional engineer (PE). PE licensing must be by a board or agency authorized to license and register professional engineers. The PE may be a Contractor's regular employee or a consultant. The PE's review and attestation of specification compliance and professional responsibility must be signified by his or her PE original seal and dated signature on the final drawings. The professional engineers must only undertake and perform work under this contract in the branch(s) of engineering in which they are licensed.

1.6.2 Pre-Delivery Inspections

Contractor is responsible for performance of quality control inspections, testing, and documentation. Submit all crane test data recorded on appropriate test record forms suitable for retention for the life of the

crane.

1.6.2.1 Inspection of Steel Castings

Visually inspect load-carrying steel castings. All load bearing components, couplings, shafts, and gears, in the hoist drive train must be rolled or forged steel, except brake drums which may be ductile iron. Methods of repairing the discontinuities is subject to review by the Contracting Officer.

1.6.2.2 Inspection of Hook Assembly

Inspect hook by a magnetic-particle type inspection prior to delivery. Furnish documentation of hook inspection to Contracting Officer prior to field operational testing. As part of the acceptance standard, linear indications greater than 1/16 inch are not allowed. Welding repairs of hook are not permitted. A hook showing linear indications, damage or deformation is not acceptable and must be replaced immediately.

1.6.2.2.1 Hook Non-Destructive Test (NDT)

For hooks of ferromagnetic materials, magnetic-particle inspect the hook over the entire area in accordance with NAVSEA T9074-AS-GIB-010/271 or ASTM A275/A275M.

Inspect each hook and shank over the entire surface area. If NDT cannot be performed on surfaces inside small holes (e.g., hook/nut captivation roll pin holes), visually inspect those surfaces to the maximum extent practical.

a. Procedure for magnetic particle inspection: Conduct magnetic particle inspection in accordance with ASTM A275/A275M with the following restrictions: Do not use DC yokes (including switchable AC/DC yokes used in the DC mode) or permanent magnet yokes. Do not use automatic powder blowers or any other form of forced air other than from a hand-held bulb for the application or removal of dry magnetic particles. Remove arc strikes. Equipment ammeters must have an accuracy of plus or minus 5 percent of full scale (equipment ammeter accuracy other than that stated is acceptable provided the MT procedure states that a magnetic field indicator is used to establish and verify adequate field strength for all aspects of the inspection.)

b. Acceptance Criteria: Defects found on the hook will result in rejection of defective items for use on furnished hoist.

c. Test Report: Submit a test report of the inspection of each hook provided the Contracting Officer for approval prior to final acceptance of hoist installation. Certify test reports by the testing organization. The performing organization must provide a written statement of certification to ASTM E543, current within one year of the date the NDT was performed. The NDT procedures including technique sheets specific to the types, shapes, and size of the parts being examined must adequately describe the orientation of the hooks within the magnetizing equipment. The performing organization must have the NDT procedures and its technique sheet used for testing of the hook reviewed and approved by an independent Level III examiner. Submit the (Level III examiner) approved procedures, technique sheet, and certification to the Contracting Officer with the test report.

1.6.3 Certificates

All certifications must be dated and bear the original signature (above the printed name) of the authorized representative of the Contractor or the manufacturer of the items or equipment being certified. Each certification will clearly identify the crane, the drives, components, and location (as applicable) to which it applies:

a. Submit a Wire Ropes Certification with either the wire rope manufacturer's certification that the rope meets the published breaking strength or certification of the actual breaking force of a sample taken from the reel and tested. Show the published breaking force on the wire rope certificate; the actual wire rope breaking force must meet or exceed the published value. Certification is to be traceable to the hoist, crane, and reel.

b. Submit a Crane Runway System Certificate stating that the new crane will operate properly on the runway; if the crane(s) cannot operate without restriction, the Contractor must indicate crane limitations.

c. Submit a Hazardous Material Certificate that the crane does not contain hazardous material including asbestos, lead, cadmium, chromium, PCBs, or elemental mercury. Products required for the designing and manufacturing of cranes must not contain the prohibited materials.

d. Submit a Loss of Power Test Certificate stating that a test may be performed in which power is removed from the crane while the hoist, bridge, and trolley are in operation.

e. Submit a Certificate of the Coupling Alignment Verification Record.

f. Submit an Overload Test Certificate stating that the crane can be periodically load tested to 125 percent (plus 0 minus 5 percent) of rated load.

g. Submit a Certificate of the Brake Adjustment Record. Provide a brake adjustment record and installation/maintenance manuals for each brake on the crane. Each brake measurement must have a tolerance traceable to the associated brake manual or documentation provided by the brake manufacturer, location of measurements, and the actual brake setting. Changes made to settings of the brake, at any time, will void the record.

h. Submit a Certificate of Compliance with Listed Standards

i. Provide a Contractor Hazardous Environment Certificate stating that the new crane and all associated components excluding the hoist are designed for operation in the hazardous environment specified in the Classification section.

j. The Contractor shall provide a Public Domain Software Certificate declaring that public domain software (e.g., freeware, shareware) is not used in the system.

k. The Contractor shall provide a certificate stating that all Software and Services that are not required for operation and/or maintenance of the product have been removed. The software/services to be removed are identified in paragraph SOFTWARE AND SERVICES.

1.6.4 Drawings: Overhead Electric Traveling Crane

a. Submit drawings showing the general arrangement of all components in plan, elevation, and end views. Show all major features of the crane including: hook approaches on all four sides, clearances and principal dimensions, assemblies of hoist, trolley and bridge drives, motor nameplate data, overcurrent protective device ratings, and electrical schematic drawings. Include weights and centers of gravity of major components. Provide maximum wheel loads (without impact) and spacing imparted to the crane runway system track beams. Indicate the crane speeds along the runway, the trolley speeds along the bridge girder, and the hoist lifting speeds; all speeds indicated are speeds with hoist loaded with rated crane capacity load.

b. Submit shop drawings of all fabricated components. Shop drawing quality must be equivalent to the contract drawings accompanying this solicitation. Drawings must be reviewed, signed, and sealed by a registered professional engineer.

c. Provide integral schedule of crane components on each drawing. The schedule must provide a cross reference between manufacturer data and shop drawings. Components listed on the schedule of crane components must include total quantity, description, original manufacturer, and part number. Distributing agents will not be acceptable in lieu of the original manufacturer.

d. Provide control system and network drawings. Network diagram must show equipment locations, names, models, and IP addresses on network communications schematic for all Programmable Logic Controllers (PLCs), Remote Terminal Unit (RTU), Supervisory Controller, and Other Network-Capable Devices. In addition, the drawings shall consist of all software block, flow, and ladder diagrams.

1.6.5 Design Data: Load and Sizing Calculations

Submit complete list of equipment and materials, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions. Submit calculations reviewed, signed, and sealed by a registered professional engineer verifying the load cases, sizing of the bridge girders, end trucks, travel drives, brake selections, and overcurrent protection for motors, controllers, and branch circuits. Provide a list of all codes and standards, design assumptions, equations, specified efficiencies, limits, factors of safety, component ratings, and sources of values used. Include free body diagrams or sketches of each load case.

1.6.6 Welding Qualifications and Procedures

Welding must be in accordance with qualified procedures using AWS D14.1/D14.1M as modified. Written welding procedures must specify the Contractor's standard dimensional tolerances for deviation from camber and sweep and not exceed those specified in AWS D14.1/D14.1M and CMAA 70. Welders and welding operators must be qualified in accordance with AWS D1.1/D1.1M or AWS D14.1/D14.1M.

1.7 CRANE SAFETY

Comply with the mandatory and advisory safety requirements of ASME B30.10,

ASME B30.2, ASME HST-4, CMAA 70, 29 CFR 1910.147, 29 CFR 1910.179, 29 CFR 1910.306, and all applicable provisions of 29 CFR 1910 and NFPA 70.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 General

Provide materials and equipment which are standard products of manufacturers regularly engaged in the fabrication of complete and totally functional cranes including necessary ancillary equipment. Material will be free from defects and imperfections that might affect the serviceability and appearance of the finished product. All material must be new and unused.

2.1.2 Nameplates

Secure nameplates to each major component of equipment with the manufacturer's name, address, type or style, model or catalog number, and serial number. Provide two bridge identification plates, one for each side of the bridge. Provide noncorrosive metal identification plates with letters which are easily read from the floor, showing a separate number such as BC-1, BC-2, for each bridge crane.

2.1.3 Capacity Marking

Mark the rated capacity in pound units on each side of the crane on the bridge girders. Capacity marks must be large enough to be clearly visible from the floor. The markings must be positioned to be visible at the operator's position after the crane has been installed.

2.1.4 Safety Warnings

Affix labels in a readable position to each lift block or control station in accordance with ASME B30.2. Submit safety warnings, diagrams and other instructions suitably framed and protected for display as indicated by the Contracting Officer as follows:

Design and locate the word "WARNING" or other legend to bring the label to the attention of the operator. Provide durable type warning labels and display the following information concerning safe-operating procedures: Cautionary language against lifting more than the rated load; operating the hoist when the hook is not centered under the hoist; operating hoist with twisted, kinked or damaged rope; operating damaged or malfunctioning hoist; operating a rope hoist with a rope that is not properly seated in its hoist drum groove; lifting people; lifting loads over people; and removing or obscuring the warning label.

2.2 STRUCTURAL REQUIREMENTS

The structural design of each crane shall conform to CMAA No. 70, 29 CFR Part 1910.179, ASME B30.2, AISC 360 and other requirements specified herein.

Load Combinations:

The crane shall be designed to meet load cases 1, 2 and 3 of CMAA No. 70 and additional load cases specified herein.

Case 4: Test Loads (CMAA No. 70 Stress Level 3)

The crane will be periodically tested up to 125% of rated capacity. Combined stresses for the following load combination shall be calculated to ensure structural adequacy during testing using CMAA No. 70 stress level 3.
DL (DLFB) + TL (DLFT) + 1.25 LL (1 + HLF) + IFD + SK + WLO

Notes:

(1) Test and extraordinary loads need not be considered in the fatigue analysis.

(2) Formula abbreviations correspond to principal loads as defined in CMAA No. 70.

(3) The subscripts "T" and "B" refer to trolley and bridge, respectively.

Crane location is Seismic Design Category "B". Seismic analysis is not required.

2.2.1 Structural Connections

High-strength bolted structural connections must be designed and installed in accordance with RCSC A348. Bolts must be of ASTM F3125/F3125M Grade A325/A325M or Grade A490/A490M material. Galvanized bolts are not acceptable.

Welded connections must be performed in accordance with AWS D14.1/D14.1M. Allowable stress values must comply with CMAA 70.

2.2.2 Bridge Girder or Girders

Provide welded structural steel box section bridge girders. If the ends of bridge girders are notched to fit over the end trucks, the notches must be reinforced with vertical diaphragms and horizontal stiffeners.

2.2.3 Bridge Rails

Provide bridge rails, crane girders and other sections that are straight and true. Make all rail joints flush and true without misalignment of running tread and design to minimize vibration. The gap between adjacent rail ends and the vertical misalignment of running treads shall not exceed 1/32 inch. Solid stock (e.g. square bar, roundstock) is not permitted as bridge rail. Center bridge rail on top flange or position bridge rail over girder web for torsion box girders. Fasten rail to girder with welded clips. Position rail clips in pairs and at not more than 36 inches on center. Bolt bridge rail joints using standard joint bars. Stagger and position rail joints directly over girder diaphragms. Provide a positive stop at bridge rail ends to prevent creep.

2.2.4 End Ties and Bridge Girder End Connections

If equalizing end trucks are used, provide rigid end ties between girders to form a frame that is rigid about the vertical and horizontal axes. If compensating end trucks are used, provide end ties which are rigid about the vertical axis but relatively flexible about the horizontal axis to permit partial rocking motion for wheel load compensation. Provide full

depth diaphragms at girder connections and jacking points. Provide horizontal gusset plates at the elevation of top and bottom end tie flanges for connection to girder ends. Make end connections with high-strength bolts in accordance with the Structural Connections section of this specification. Use tapered alignment pins to maintain original shop alignment between bridge girders and end ties/trucks.

2.2.5 End Trucks

Provide fixed axle type end trucks fabricated from structural steel plate to provide a rigid box section structure. Center wheels between the webs of the box section. Configure bridge and trolley trucks with a feature that limits load movement to 1 inch in the event of wheel or shaft failure. Provide jacking pads for removal of wheel assemblies. Wheel axle bearing seats must be designed such that wheel and axle bearing assembly can be removed with not more than 3 inches of jacking.

2.2.6 Trolley Frame

Provide trolley frame as a one-piece structural steel weldment. Provide pads for the use of jacks or wedges when changing truck wheels. Make all trolley yokes and load bars of drop forged, cast or rolled steel.

2.2.7 End Stops and Bumpers

Fit bridge girders with structural steel end stops. Locate stops to permit maximum trolley travel. Fit bridge end trucks and trolley frames with shock-absorbing bumpers capable of decelerating and stopping the bridge and trolley within the limits stated by 29 CFR 1910 and CMAA 70. Bumpers must fully engage end stops. Mount bumpers so that there is no direct shear on mounting bolts (if any) upon impact. Bumpers must provide adequate clearance between the crane and surrounding structure when compressed to preclude damaging equipment. Ensure bridge and trolley bumper retention in accordance with ASME B30.2. When more than one crane is located and operated on the same runway, bumpers shall be provided on their adjacent ends or on one end of one crane. Fit the other end of the end-truck with a structural steel stop to engage the bumpers of the adjacent crane. Ensure bridge bumpers are properly aligned with runway end stops. Metal to metal contact at the bumper to end stop connection is not permitted.

2.3 MECHANICAL REQUIREMENTS

a. Provide steel shafts, gears, keys, and couplings. Cast iron and aluminum used to support components of the hoist power transmission train must be ductile. Drive components of custom designed (built-up) hoists - those that transmit the driving torque, braking torque, and their supports/housings including the wire rope drum and bearing housings/supports - shall be steel. Exceptions are permitted for speed reducer housings, brake wheels and discs, thruster housings, brake lining backing plates, shoes and shoe holders, which may be ductile or malleable cast iron; and electric motor housings, which may be ductile or malleable cast iron or cast aluminum. Provide hoist speed reducer housings that are steel or ductile/malleable cast iron and hoist electric motor housings that are steel or ductile/malleable cast iron or cast aluminum. For the purposes of this specification, "ductile" is defined as having a minimum elongation of 5 percent in 2.00 inches. Gray cast iron load bearing parts are prohibited.

b. All bearings, except those subject only to small rocker motion, must be anti-friction type. All connections subject only to small rocking motion are to be fitted with bushings or thrust washers in the pivot pin bore, as applicable. Bronze bushings must have provisions for grease lubrication.

c. All mechanical components must be accurately aligned and positively secured to maintain the alignment. Parts must not be forced into position to obtain apparent alignment.

2.3.1 Hoists

Provide hoist conforming to ASME B30.2 and CMAA 70 service class D or better, double reeved, except as modified and supplemented in this section. Standard commercial hoist and trolley units (packaged hoists), if used, must meet ASME HST-4 Duty Class H4 or better. For custom hoist shafts, the fatigue design factor must be a minimum of 1.5.

2.3.2 Drives

2.3.2.1 Bridge Drives

Provide A-4 bridge drive arrangement as specified in CMAA 70 consisting of a single electric motor mechanically connected through gear reduction and drive shafts to the drive wheels or separate drive motors at each end of bridge.

Acceleration and deceleration must meet the requirements specified in this section. Gears must conform to applicable AGMA standards. Provide oil tight fully enclosed gear reducers with pressure or splash type lubrication. Bridge travel limit switches are optional.

2.3.2.2 Trolley Drives

Provide complete trolley drive arrangement with a minimum of two wheels driven by an integral electric motor. Drive mechanism must run in totally enclosed oil bath. Limit switches are optional for drive mechanism. Acceleration and deceleration controls must meet requirements specified in this section.

2.3.3 Load Blocks and Hooks

The load block must be constructed of steel and designed to prevent steel-to-steel contact of moving parts. The block must be fully enclosed, concealing the sheaves and wire ropes, except for wire rope slots and drain holes. The block must be clearly marked with the capacity in pounds on both sides.Standard commercial blocks may be used at their published ratings when their published design factors are 5.0 or greater.

Provide an unpainted single barbed forged steel hook complying with ASTM A668/A668M. Hook dimensions must be as shown on the drawings. Hook must be sized to appropriately interface with Crosbey shackle G213/S213, nominal size 1 3/4 inch, working load limit 25 tons. Fit hook with a safety latch designed to preclude inadvertent displacement of slings from the hook saddle. The hook and hook nut must be removable without unreeving of the hoist. Provide hook nut with a removable type set screw or other similar fastener, installed in a plane parallel to the longitudinal axis of the hook shank. Do not weld hook nut. Uniquely mark the hook in a permanent fashion that is traceable to the NDT certification.

Hook must be free to rotate through 360 degrees when supporting the test load up to 125 percent of the rated capacity. Provide only hooks which are designed and commercially rated in accordance with CMAA and conforming to ASME B30.10 and CMAA 70.

2.3.4 Wire Ropes

a. Wire rope must comply with ASME B30.30 and FS RR-W-410, ASTM A1023/A1023M, or BS ISO 4309 and have a rope classification appropriate for the usage. Wire ropes must be handled and seized in accordance with ASME B30.30. The wire rope must be in a double reeved configuration equalized with a sheave. Select wire rope minimum design factor in accordance with ASME B30.16. Provide proof of Wire Rope breaking force.

b. Provide hoisting ropes with improved plow steel, extra improved plow steel, or extra-extra improved plow steel, regular lay, bright, and uncoated with an independent wire rope, wire strand, or otherwise, steel core. Hot-dipped galvanized wire rope is not permitted.

c. Maximum hoisting rope fleet angles must be 4 degrees for drums and 4.75 degrees for sheaves. Hoisting rope end connections, other than drum connections, must be speltered sockets with forged steel terminals or swaged fittings installed in a fashion that provides 100 percent of the breaking strength of the wire rope. Provide proof of Wire Rope breaking strength. Wedge sockets or aluminum swages are not permitted on wire rope end connections.

2.3.5 Sheaves

Provide steel sheaves. Minimum pitch diameters must be 20 times the rope diameter for running sheaves, and no less than 12 times the rope diameter for equalizer sheaves. Sheave surfaces which contact wire rope are not to be painted.

The sheaves must be heat treated to a minimum hardness of 320 Brinell Hardness Number (BHN) in the wire rope contact area, have a groove depth not less than 1.5 times the hoisting rope diameter, with a throat angle of 30 to 40 degrees.

2.3.6 Hoist Drum

Provide drum made of steel. Design the drum such that all hoisting rope is wound in a single layer and so that not less than two dead wraps of hoisting rope remain on each anchorage when the hook is in its extreme low position. Drum grooving must be machined right and left hand beginning at the ends and grooving toward the center of the drum. Minimum drum groove depth must be 0.375 times the rope diameter. Minimum drum groove pitch must be either 1.14 times the rope diameter or the rope diameter plus 1/8 inch, whichever is smaller. Minimum drum pitch diameter must be 20 times the rope diameter. Do not paint, coat, or galvanize the surface of the drum which comes in contact with wire rope.

For wire rope drums installed directly onto the output shaft of the hoist speed reducer without an intermediate flexible coupling, the drum to shaft connection must be a barrel coupling.

2.3.7 Gearing

Provide gearing of the enclosed gear reducers type. Provide steel spur, helical, or herringbone type gears and pinions only. Gearing must conform to ANSI/AGMA 2001 and AGMA 908. Internal and external gear dimensional tolerances must conform to the applicable AGMA standard for tooth geometry and tolerances. Open-type gearing is not acceptable, except for final drives.

2.3.7.1 Gear Reducers

Gear reducers must be standard items of manufacturers regularly engaged in the design and manufacture of gear reducers for Class D and E cranes. Gear reducers must be designed, manufactured, and rated in accordance with ANSI/AGMA 6113 (ANSI/AGMA 6013) (for trolley drives only), as applicable. Except for final reduction, the gear reduction units must be fully enclosed in oil-tight housing. Enclosed gearing must be selected for minimum 3.0 service factor. Gearing must be designed to AGMA standards and operate in an oil bath. Operation must be smooth and quiet.

2.3.7.2 Open Gearing

Provide all gears and pinions with adequate strength and durability for the crane service class and manufactured to ANSI/AGMA 2015-1 Accuracy Grade A8 or better. Open gears must be enclosed with safety guards provided with openings with covers for inspection and access for grease lubrication.

2.3.8 Wheels

Provide double flanged, straight tread trolley and bridge travel wheels of rolled-to-shape or roll-forged steel.The rim, flanges, and wheel tread must be hardened to not less than 320 Brinell Hardness Number (BHN). Wheel sizing and flange-to-rail head clearances must be in accordance with CMAA 70 recommendations.

2.3.9 Bridge and Trolley Travel Brakes

Provide bridge and trolley drives with electro-mechanical brakes or non-freecoasting mechanical drive capable of stopping the motion of the bridge or trolley within a distance in feet equal to 10 percent of the full load speed in feet per minute when traveling at full speed with a full load. The brakes must have a minimum torque rating per CMAA 70 according to the applicable environment, but not sized larger than 150 percent of the motor torque. Brakes must have an externally accessible means to manually release the brake. The brakes must be equipped with a manual self-return to ON brake release and designed to permit inspection and adjustment without disassembly of the brake.

2.3.10 Hoist Brakes

a. Equip hoist with a minimum of two electro-mechanical holding brakes, each with a minimum torque rating of 125 percent of the rated load hoisting torque. Alternatively, if the hoist is an open loop control, hoist brake configuration may be with one electro-mechanical or thruster brake and one mechanical load brake that stops and holds 125 percent of the hoist's rated load and the mechanical load brake does not require the load to be raised before being lowered. For cranes with two electro-mechanical or thruster brakes, designate each brake

as primary or secondary with the primary brake being the brake mounted closer to the motor. Provide the primary brake with a non-time delay setting and secondary brake with an adjustable setting time delay, set between one to three seconds after the primary brake in any stopping condition. Do not use an uninterruptible power supply (UPS) to create the secondary brake time delay.

b. Electro-mechanical or thruster brake must be adjustable to 50 percent of its rated capacity, and must have an externally accessible means of manual release. On drives where the brakes are utilized as holding brakes only, torque adjustment is not required. The brakes must be equipped with a manual self-return to ON brake release and designed to permit inspection and adjustment without disassembly of the brake.

2.3.11 Couplings

Chain and continuous sleeve type couplings must not be used. Spline couplings are acceptable as installed on c, d, or p-face assemblies. Conventional couplings must not be loaded in the radial direction. Brake wheel or brake disc couplings (if used) must be compatible with the required coupling type. Flexible couplings must not be relied upon to compensate for inaccurate alignment. Ends of coupled shafts must be aligned within the recommended installation criteria of the coupling manufacturer.

2.4 ELECTRICAL REQUIREMENTS

2.4.1 Motors

Drive mechanism motors shall conform to NEMA MG 1. The bridge and trolley drive motors shall be AC inverter duty, totally enclosed non-ventilated (TENV) or totally enclosed fan cooled (TEFC), squirrel cage induction type. All motors shall have a 60-minute duty rating minimum. Motor insulation shall be a minimum of Class F. Motors that operate the same function (e.g. trolley, bridge) shall be identical (i.e. nameplate ratings, mfg., etc.).

For open loop systems, hoist motor(s) shall be AC inverter duty, totally enclosed non ventilated (TENV) or totally enclosed fan cooled (TEFC), squirrel cage induction type.

For closed loop systems, hoist motor(s) shall be AC vector duty, totally enclosed non ventilated (TENV) or totally enclosed fan cooled (TEFC), squirrel cage induction type with a minimum 1024 PPR encoder. Provide motor overload protection utilizing a thermal sensitive device embedded in its windings.

2.4.2 Controls

a. "For open loop designs, static reversing, variable frequency controllers shall be provided for the hoist, bridge and trolley electric drives. The controllers shall, at a minimum, provide undervoltage protection, electronic instantaneous over current protection, DC bus over voltage protection, and be able to withstand output line to line shorts without component failure. Motors shall operate smoothly at all speeds without torque pulsations, and shall only be energized within the frequency range of 50-60 Hz at rated speed. Dynamic braking shall be provided for each electric drive and sized per variable frequency drive manufacturer's requirements. The

main hoist, trolley, and bridge brakes shall set after the associated controller decelerates the drive motor to a controlled stop. Hoist functions shall not produce any rollback and shall produce no more than 1/8" of roll-up. All drives shall have the latest software/firmware installed prior to final government acceptance and be provided from the same manufacturer. With respect to AC control wiring, no neutral wire shall pass through the contacts of a control relay or contactor, i.e., a device shall not be shut off or disengaged by breaking the device's neutral conductor. Bridge and trolley drives are required to be selected such that the continuous rating of the controller is not less than the calculated motor full load current based on CMAA No. 70 5.2.9.1.2 and NEC Table 430.250. Submit VFD Control Parameter Settings."

b. Provide speed control which is infinitely variable for each function, controlled via pendant pushbutton station. Provide controls designed such that the maximum speed of bridge and trolley will be limited to 1.75 fpm when a slow speed switch is actuated on the controller. Energize a yellow/amber light/indicator while in slow speed mode.

c. "For closed loop designs, a speed regulated, closed loop flux vector controller with encoder feedback shall be provided for the hoist. The hoist controller shall prove torque before release of the brakes and enable the drive motor to develop full torque continuously at zero speed. Hoist functions shall not produce any rollback and shall produce no more than 1/8 inch of roll-up. All hoist drives shall be equipped with a motor overtorque limit to lock out the hoist and prevent gross overload of the associated hoist. The overtorque limit shall be set at 150 percent of the motor torque required to hoist 100 percent load. This overtorque limit may be increased, if the 150 percent value produces overtorque faults while performing the overload portion of the field test."

d. The use of definite purpose contactors is prohibited. If IEC contactors are used, the application cannot exceed the contactor manufacturer's AC3 ratings for the contactor at a minimum.

e. On hoist function roll-up must be less than 1/8 inch measured at the hook block and roll-back must not occur over the entire load range.

f. Use of Uninterruptable Power Supplies (UPS) is prohibited. Feed control circuits from a single phase, air cooled, double wound transformer with a grounded metal screen between the primary and secondary windings of the transformer.

g. Provide a main line contactor. Energization of the main line contactor must be controlled by the POWER-OFF/POWER-ON switch/pushbutton on all controllers. Upon actuation of the POWER-OFF pushbutton; power to all drive motors, brakes, and controls must be removed. The mainline contactor must not be able to be energize while the POWER-OFF pushbutton is actuated. The POWER-OFF pushbutton circuitry must be independent of all controls or any other electronic devices.

2.4.3 Protection

Protection must not be less than that required by NEMA ICS 8, CMAA 70, NFPA 70,UL 1004-1, UL 1449, UL 489, UL 50, UL 943, 29 CFR 1910.147, 29 CFR 1910.179, 29 CFR 1910.306 and all applicable provisions of

29 CFR 1910. Provide enclosed type circuit breaker readily accessible to the crane operator for crane disconnect. Provide an On/Off button that removes power from the motors, brakes and control circuit on all operator control stations. Provide for lockout/tagout of all hazardous energy sources.

2.4.4 Resistors

Provide resistors with natural convection cooling sized as recommended by the VFD OEM and fabricated of corrosion resistant metal; the use of "wire wound" type resistors is prohibited for segments of 8 ohms or less. Mount resistors in substantial, ventilated enclosures constructed entirely of non-combustible materials. Provide resistors with terminals fitted in the coolest position in the enclosure.

2.4.5 Transients and Harmonics Protection

a. Provide contactors and relays with appropriate Metal Oxide Varistors (MOV) or resistor-capacitor (R-C) surge absorbers installed across the respective coil.

b. Provide transient protection for electronic drive controllers that is either internal to the drive or via an MOV connected line-to-ground close to the line terminals of the drive.

c. Provide line reactors rated for continuous duty operation based upon the motor nameplate amperes. With motors of 50 horsepower or greater, harmonics protection must be provided by an isolations transformer or as recommended by the VFD OEM. For a drive motor branch circuit that exceeds 150 feet in length, a reactor must also be connected in series with the controller load (output) terminals to provide standing wave protection or as otherwise recommended by the VFD or motor OEM.

2.4.6 Limit Switches

a. Provide primary upper and lower geared limit switches. Geared limits must allow reversing direction to back out of the limit without resetting. The lower limit switch must be set such that there are a minimum of two wraps of rope on the hoist drum.

b. Provide a backup mechanical hook block activated upper limit switch wired independent of the directional controllers and the primary upper limit switch that removes power from the hoist motor, hoist brake and hoist controls conforming to NEMA ICS 5. The backup limit must require hoist resetting prior to operation of the hoist in any direction.

2.4.7 Operator Controls

a. Provide crane equipped with a pendant pushbutton station.

2.4.7.1 Pendant Pushbutton Station

The cranes must be controlled from a pendant pushbutton station suspended from an independent festooned messenger track system, operating the length of the bridge. Provide multiconductor flexible cords for pendant pushbutton stations with No. 16 AWG minimum conductors. Provide a method of strain relief to protect the electrical conductors from damage. Locate the pendant pushbutton station 4 feet above the finished floor.

Pushbutton pendant station must have its elements legibly marked and arranged vertically, in order, in accordance with CMAA 70. Provide 2-step infinitely variable pendant pushbuttons for control of the hoist, bridge, and trolley. Provide pendant pushbuttons for control that spring return to the OFF position. Voltage in the pendant pushbutton station must not exceed 150 Volts AC or 300 Volts DC. Provide a maintained two-position selector switch for slow speed selection. Provide spring loaded single position push button for warning bell.

Pendants must have indicator lights for power on, low speed activated, and overload warning.

Pendants must be detachable. Provide a spare pendant for each crane.

2.4.7.1.1 Pendant Conductor System

Provide a festoon type pendant conductor system. The festoon cables must be flat cables suspended from carriers riding on an I-beam or C-track. The pendant controller must be capable of traveling the entire length of the bridge and move independently of the trolley. Festoon loops must not extend below the high hook position.

2.4.8 Electrification Systems

2.4.8.1 Runway Conductor System

a. Provide a rigid Conductor Bar System for the runway conductor system, including all necessary cables and hardware to the crane from a wall or column mounted disconnect switch. Provide electrification system with three power conductors and an equipment grounding conductor. Conductors must be fabricated from copper. Steel (non-stainless) conductor bars are prohibited. The crane must be grounded through this conductor system. Provide conductors sized for simultaneous motions of the hoist, bridge, trolley mechanisms and any ancillary loads. If there is any way the hook block or wire rope can swing into runway electrification, provide a guard installed to prevent contact.

2.4.8.2 Bridge Conductor System

a. Provide Festoon System for the bridge conductor system utilizing cables suspended from carriers riding on an I-beam or C-track. Conductors must be fabricated from copper. A minimum of 20 percent of the festoon control circuit conductors for each electrification system must be spares at the time of crane acceptance. The trolley is required to be grounded through this conductor system. Festooned cable loops must not extend low enough to come into contact with any obstructions.

2.4.9 Capacity Overload Protective Device and Load Indicating Device

a. Provide a capacity overload protective device for all hoist systems using the load indicating device (LID) described in the next paragraph. Set hoist capacity overload protection at 80 percent for yellow overload indicator light and 100 percent for red indicator light and lockout. Hoist capacity overload protection must be adjustable between 80 and 150 percent of hoist capacity. Provide a keyed override or other means to disable the hoist capacity overload protection when performing a load test.

b. Provide an LID for the hoist. Provide displays installed on the underside of the bridge of each crane to provide load information from the load indicating system, to be displayed in pounds, for hoist. The load indicating system capacity is to be compatible with the maximum test load for each hoist. The accuracy of the load indicating system is to be such that the indicated load is not less than 100 percent of the actual load, and not more than 110 percent of the actual load. The load indicating system must be configured with a set point for an overload limit. Provide Tare (zero) functionality at each operator's station for the load indicating system. Any load bearing components used in the LID system must be steel, have a minimum design factor of 5 to 1 based on ultimate tensile strength and a hardness not to exceed HRC 40. Precipitation hardened stainless steel load bearing elements must be aged hardened at a minimum temperature of 1025 degrees F.

c. Initially, set the torque limiting capability of the VFD (that is separate from the capacity overload protective device) to 150 percent of the motor torque (amperage) necessary to hoist 100 percent load. It may be adjusted up only to avoid nuisance trips and adjusted down if possible while still avoiding nuisance trips.

2.4.10 Enclosures

a. Provide enclosures for control panels, controls, and brakes in accordance with NEMA 250 and NEMA ICS 6, Classification Type 1 indoor, general purpose. There must not be any condensation inside the control panels. If anti-condensation heaters are provided, these heaters must remain energized when the main line contactor is deenergized.

b. Provide a non-resettable hour meter, connected across the main line contactor, readable from the exterior of the main control panel, to indicate the elapsed number of hours the crane is energized. Provide a non-resttable hour meter, readable from exterior of main control panel, to indicate eleapsed number of hours each motion is energized.

c. Gaskets of enclosures and fixtures, and joints and contact surfaces of hazardous/explosive enclosures must be kept free of any paint to prevent damage during removal and reinstallation of gaskets of enclosures.

2.4.11 Warning Devices

Provide a warning bell that is operable from a push button at the pendant pushbutton station. Provide a warning strobe light that is illuminated at all times during movement of the hoist, trolley, or bridge function.

2.4.12 Indicator Lights

Provide Indicator Lights mounted in an enclosure on the bottom of the bridge with lights sized and positioned to be visible from the ground. The lights must be the dual-lamp type. Provide a white light to indicate that power is available on the load side of the crane disconnect and a blue light to indicate that the main contactor is energized. Provide an amber light to indicate slow speed selector is activated. Light voltage must be 115 VAC. Provide nameplates that are legible from ground level. The nameplates must read, in their respective order, "POWER AVAILABLE" and "CRANE ENERGIZED". "SLOW SPEED", and "OVERLOAD/DRIVE FAULT"The POWER AVAILABLE light must be supplied by a separate, fused transformer for its

energization. Provide red light for overload warning, or if a drive fault is detected.

2.4.13 Cyber Security of Control Systems

a. Provide the following for PLC, RTU, Supervisory Controller, or other network-capable (whether networked or not upon delivery) control devices as applicable:

(1) Hardware list (Hardware list must include the following for each device):
(a) Manufacturer
(b) Model
(c) Location
(d) Key technical ratings (e.g. memory)
(e) Serial number
(f) MAC addresses
(g) IP addresses

(2) Software List (Software list must include the following for each device):
(a) Manufacturer
(b) Version/subversion
(c) Location/device
(d) Used network ports/protocols/services

(3) List and discussion of all security features of Contractor hardware and software.

b. For every PLC, RTU, Supervisory Controller, or other network-capable control devices (whether networked or not upon delivery), deliver the following on CD/DVD:

(1) Original firmware
(2) Original firmware hash
(3) SOP for application of firmware updates/patches
(4) POC or website for firmware updates/patches
(5) Count of interfaces and types
(6) Protocols in use, per interface
(7) Configuration file
(8) SOP for configuration

2.4.13.1 Control System and Network

a. The Contractor must provide all equipment, including software and hardware, necessary for testing, installation, and communicating/troubleshooting all systems provided with the crane (e.g. engine/generator, control system, LID, etc.). The Contractor must provide all crane specific operational software files (e.g. ladder logic, functional block programming, etc.) for their associated systems (e.g. control systems, LID, engine generator, etc.).

b. A single common networked design must not be used for the control systems. A network for an individual function may be used as long as a failure of the network does not affect any other function/network except as defined for specific safety interlocks (e.g. LMI system). A common crane network may be used in a monitoring mode for recording faults and trending and is encouraged. Failure of the monitoring system must not affect crane functions.

c. All provided hardware and software must be currently marketed products, not currently scheduled for end of life or obsolescence, to ensure system sustainability.

d. Ensure there is no remote access capability enabled as remote access capabilities are prohibited. Physically disable or remove all modem/network devices not required for operational purposes.

2.4.13.2 Software and Services

a. Remove all Software and Services not required for operation and/or maintenance of the product. If removal is not technically feasible, then disable software not required for the operation and/or maintenance of the product. Configure the product to allow the ability to re-enable ports and/or services if they are disabled by software. The removal of software or services may not impede the primary function of the product. If software that is not required cannot be removed or disabled, document a specific explanation and provide risk mitigating recommendations and/or specific technical justification. The software/service to be removed and/or disabled includes, but is not limited to:

(1) Cameras

(2) Games

(3) Device drivers for product components not procured/delivered

(4) Messaging services (e.g., email, instant messenger, peer-to-peer file sharing)

(5) Source code

(6) Software compilers in user workstations and servers

(7) Software compilers for programming languages that are not used in the control system

(8) Unused networking and communications protocols

(9) Unused administrative utilities, diagnostics, network management, and system management functions

(10) Backups of files, databases, and programs used only during system development

(11) All unused data and configuration files

(12) Remove and/or disable, through software, physical disconnection, or engineered barriers, all services and/or ports in the procured product not required for normal operation, emergency operations, or troubleshooting. This includes communication ports and physical input/output ports (e.g., USB docking ports, video ports, and serial ports).

b. Provide documentation showing all disabled ports, connectors, and interfaces for all network-capable devices. In addition, the documentation shall provide summary documentation of the procured

product's security features and security-focused instructions on product maintenance, support, and reconfiguration of default settings.

c. For the evaluation status of hardware and software, the Contractor must provide information on Common Criteria or National Information Assurance Partnership (NIAP) or Federal Information Processing Standards (FIPS) evaluation status of hardware and software.

2.4.13.3 Access Control

a. The Contractor must configure each component of the procured product to operate using the principle of least privilege. This includes operating system permissions, file access, user accounts, application-to-application communications, and energy delivery system services.

b. Provide user accounts with configurable access and permissions associated with one or more organizationally defined user role(s), where roles are used.

c. Provide a system administration mechanism for changing user(s') role (e.g., group) associations.

d. The Contractor must document control system access control options by defining access and security permissions, user accounts, and applications with associated roles.

e. Provide recommended methods for the Acquirer to prevent unauthorized changes to the Basic Input/Output System (BIOS) and other firmware. If it is not technically feasible to protect the BIOS to reduce the risk of unauthorized changes, the Contractor must document this case and provide mitigation recommendations.

2.4.13.4 Control System Account Management

The Contractor must document all accounts (including, but not limited to, generic and/or default) that need to be active for proper operation of the procured product.

Remove or disable any accounts that are not needed for normal or maintenance operations, emergency, or troubleshooting of the energy delivery system.

2.4.13.5 Session Management

The Contractor may not allow multiple concurrent logins using the same authentication credentials, allow applications to retain login information between sessions, provide any auto-fill functionality during login, or allow anonymous logins.

Provide account-based and group-based configurable session-based logout and timeout settings (e.g., alarms and human-machine interfaces).

2.4.13.6 Authentication/Password Policy and Management

Provide a configurable account password management system that allows for, but is not limited to, the following:

a. Changes to passwords (including default passwords)

b. Selection of password length

c. Frequency of change

d. Setting of required password complexity

e. Number of login attempts prior to lockout

f. Inactive session logout

g. Screen lock by application

h. Comparison to a library of forbidden strings

i. Derivative use of the user name

j. Denial of repeated or recycled use of the same password

The Contractor must time stamp log files.

2.4.13.7 Logging and Auditing

Provide logging capabilities that cover the following events, at a minimum (as appropriate to their function):

a. Information requests and server responses

b. Successful and unsuccessful authentication and access attempts

c. Account changes

d. Privileged use

e. Application start-up and shutdown

f. Application failures

g. Major application configuration changes

2.4.13.8 Heartbeat Signals

The Contractor must identify heartbeat signals or protocols and recommend which should be included in network monitoring. At a minimum, a last gasp report from a dying component or equivalent shall be included in network monitoring.

The Supplier must provide packet definitions of the heartbeat signals and examples of the heartbeat traffic if the signals are included in network monitoring.

2.4.13.9 Patch Management and Updates

The Contractor must verify that procured products (including third-party hardware, software, firmware, and services) have appropriate updates and patches installed prior to delivery.

Provide documentation of the patch management program and update process (including third-party hardware, software, and firmware). This

documentation must include resources and technical capabilities to sustain this program and process. Provide the Contractor's method or a recommendation for how the integrity of the patch is validated by the Acquirer as well as the Supplier's approach and capability to remediate newly reported zero-day vulnerabilities.

2.4.13.10 Malware Detection and Protection

a. The Contractor is required to implement at least one of the following:

(1) Provide a host-based malware detection capability that quarantines (instead of automatically deleting) suspected infected files. Provide an updating scheme for malware signatures. The Contractor must test and confirm compatibility of malware detection application patches and upgrades.

(2) If the Contractor is not providing the host-based malware detection capability, the Contractor must suggest malware detection products to be used and provide guidance on malware detection and configuration settings that will work with Contractor products.

b. The Contractor must validate that cybersecurity services running on the procured product (e.g., virus checking and malware detection) do not conflict with other such services running on the procured product.

c. For malware detection and protection, the Contractor must provide, or specify how to implement, the capability to automatically scan any removable media that is introduced to the product being acquired.

2.4.13.11 Physical Security

Provide lockable or locking enclosures or rooms for energy delivery systems and system components (e.g., servers, clients, and networking hardware) and for the systems used to manage and control physical access (e.g., servers, lock controllers, and alarm control panels). Provide a method for tamper detection on lockable or locking enclosures. If a physical security and monitoring system is used, tamper detection must be compatible. The Contractor must ensure that physical security features do not hamper the crane system operations. Provide the tools and instructions for making changes to locks, locking codes, keycards, and any other keyed entrances.

2.4.13.12 Wireless Technology

For wireless technology provisions, the Contractor must document:

a. Specific protocols and other detailed information required for wireless devices to communicate with the control network, including other wireless equipment that can communicate with the Contractor-supplied devices.

b. Use, capabilities, and limits for the wireless devices.

c. Power and frequency requirements of the wireless devices (e.g., microwave devices meet the frequency requirements of Generic Requirements GR-63 Network Equipment Building System NEBS and GR-1089).

d. Range of the wireless devices and verify that the range of

communications is minimized to both meet the needs of the Acquirer's proposed deployment and reduce the possibility of signal interception from outside the designated security perimeter.

e. Wireless technology and associated devices compliance with standard operational and security requirements specified in applicable wireless standard(s) or specification(s) (e.g., applicable IEEE standards, such as 802.11).

f. Configuration control options that enable varying of the security level of the devices.

2.4.13.13 Control System Inventory

Provide the complete control system inventory. The Control System Inventory must include the following attributes, in tabular format, as applicable:

General Information	Location Information	Hardware Details	Operating System and Platform	Network Information (Actual Function, not potential function)
Unique ID	Facility Name	Device Type	Embedded OS (Yes/No)	MAC Address(es)
Barcode or Identifier	NFAID	Device Sub-Type	OS Contractor	IP Address(es)
Region	Commodity	Device Function	Operating System (O/S)	Upstream Device
Installation	Floor	Manufacturer	O/S Version	Protocols In Use
Special Area (Option DNA1)	Room	Product Line	Platform Contractor	Host Name
	Location	Model No.	Platform Product Line	
	System Type	Serial No.	Platform	
	Functional System or Equipment Control	Remote Connectivity: (Wired / Wireless / None)	Platform Version	
		Network Type Used: (Serial / Ethernet / Both / None)		

2.5 PAINTING SYSTEM

a. Remove all grease, oil, and surface debris by solvent wiping or detergent/water scrubbing, prior to blast cleaning. Prepare surfaces to be coated by abrasive blasting to SSPC SP 6/NACE No.3, Commercial Blast Cleaning, or in accordance with the coating manufacturer's requirements, whichever is more stringent.

b. Use a painting system appropriate for the conditions provided in the Crane Design Criteria section. Paint exposed portions of the crane using a three-coat system as follows: zinc-rich primer consisting of a minimum of 85 percent zinc by weight in the dry film, an anticorrosive epoxy intermediate coat, and an aliphatic polyurethane top coat. All paint products must be supplied by a single manufacturer and free of chromates, lead, and mercury. Apply each coat in accordance with manufacturer's instructions and requirements. Ensure each coat is smooth, even, and free of runs, sags, orange peel, and other defects. Desired color of finish coat is brilliant yellow. Submit product data for painting system.

c. Coat faying surfaces of bolted connections per RCSC A348, but do not apply finish paint.

d. Paint the load block brilliant yellow with black diagonal striping. Paint, coatings, or galvanizing on the following items or areas is not acceptable: hoist wire ropes, hooks, hook nuts, running bearing surfaces (including sheaves and wheel treads), grease fittings, or other items not normally painted.

e. Factory paint electrical and mechanical equipment in accordance with the manufacturer's best standard practice (for the specified environment), except that electrical equipment doors, which expose current-carrying electrical conductors when opened, must be orange.

2.6 IDENTIFICATION PLATES

Furnish and install identification plates. Provide non-corrosive metal identification plates with clearly legible permanent lettering giving the manufacturer's name, model number, serial number, capacity in both kilogram and pound units printed in different colors, and other essential information or identification.

2.6.1 Markings on Crane, Trolley, and Hook

To avoid operation of the crane in the wrong direction, affix the appropriate directions (NORTH, SOUTH, EAST, and WEST) with arrows on the bottom of the girder where they can be easily seen by the operator and from the loading point. Provide labels on the controls with corresponding directional (NORTH, SOUTH, EAST, and WEST) markings. Markings shall agree with the markings on controller. Do not indicate directional arrows on controller.

Mark the hook rated capacity in pounds on both sides of the hoist load block.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, and before performing any work, verify all dimensions in the field. The Contractor is responsible for the coordination and proper relation of the contracted work to the building structure and to the work of all trades. Verify all dimensions of the building that relate to fabrication of the crane and notify the Contracting Officer of any discrepancy before finalizing the crane order.

3.2 SHOP ASSEMBLY AND TESTS

Shop assemble major components as completely as possible, except for reeving of drums and sheaves. Functionally test the crane system at the construction facility prior to shipment. The Government reserves the right to inspect the crane for compliance with this specification and to witness the functionality tests. Notify the Contracting Officer 14 days prior to starting testing operations.

3.3 ERECTION AND INSTALLATION

Perform the entire crane erection in accordance with manufacturer's instructions under the full-time supervision of the manufacturer's representative.

3.3.1 Mechanical Alignment

Align motors, couplings, brakes, gear boxes and drive components in accordance with manufacturer's instructions. Complete the Coupling Alignment Verification Record.

3.3.2 Electrical Adjustments

Adjust control system in accordance with manufacturer's instructions. Store a copy of all Control Parameter Settings (PLC, VFD). Provide the final alignment data on the Complete Schematic Wiring Diagram, including but not limited to, timer settings, resistor tap settings, potentiometer settings, test-point voltages, supply voltages, motor voltages, motor currents. Provide the test conditions such as ambient temperature, motor load, date performed and person performing the alignment as part of the Operational Tests report.

3.3.3 Field Welding

Perform welding indoors, where possible. Surface of parts to be welded must be free from rust, scale, paint, grease or other foreign matter. Minimum preheat and interpass temperatures must conform to the requirements of AWS D14.1/D14.1M. Perform welding of girders and beams conforming to AWS D14.1/D14.1M.

3.3.4 Field Painting

Perform painting indoors, where possible. Field painting (including touch-up) must conform to the requirements of the coating manufacturer and as specified in PAINTING SYSTEM.

3.4 FIELD QUALITY CONTROL

3.4.1 Post-Erection Inspection

After erection, the Contractor, the Activity Crane Inspector/Test Director, and the Contracting Officer must jointly inspect the crane bridge and hoist systems and components to determine compliance with specifications and approved submittals. Notify the Contracting Officer 14 days before the inspection. Provide a report of the inspection indicating the crane is considered ready for operational tests.

3.4.2 Operational Tests

Check the clearance envelope of the entire crane prior to picking or traversing any load to ensure there are no obstructions. Test the systems in service to determine that each component of the system operates as specified, is properly installed and adjusted, and is free from defects in material, manufacture, installation, and workmanship. Rectify all deficiencies disclosed by testing and retest the system or component to prove the crane is operational. The Contractor must furnish operating personnel, instruments, and other apparatus necessary to conduct field tests on each crane.

3.4.2.1 No-Load Test

Raise and lower each hook through the full range of normal travel at rated speed for three complete cycles. Raise and lower each hook, testing other speeds of the crane. Verify proper operation of hoist limit switches. Operate the bridge and trolley in each direction the full distance between end stops. Operate through the entire speed range and verify proper brake operation. Verify correct operation of all indication and ancillary devices.

3.4.3 Test Data

Record test data on appropriate test record forms suitable for retention for the life of the crane. Record operating and startup current measurements for hoist, trolley, and bridge motors using appropriate instrumentation (i.e., clamp-on ammeters). Compare recorded values with design specifications or manufacturer's recommended values; abnormal differences (i.e., greater than 10 percent from manufacturer's or design values) must be justified or appropriate adjustments performed. In addition, note, investigate, and correct any high temperatures or abnormal operation of any equipment or machinery. Record hoist, trolley, and bridge speeds during each test cycle.

3.4.4 Hook Tram Measurement

Establish a throat dimension base measurement by installing two tram points and measuring the distance between these tram points (plus or minus 1/64 inch). Record this base dimension. Measure the distance between tram points before and after load test. An increase in the throat opening from the base measurement is cause for rejection.

3.4.5 Load Tests

Perform the following tests for each hoist, as specified below.

Test loads used in this section are defined as the following:

Wire rope run-in load: 25 – 50 percent of rated load.

Rated load test: 100 percent (plus 0 minus 10) of rated load.

Overload test: 125 percent (plus 0 minus 5) of rated load.

3.4.5.1 Wire Rope Run-In

The primary purpose of this procedure is to exercise the newly installed wire rope.

Place the load on the hook. Start at ground level and hoist up to one foot below upper limit at slow speed. Hoist down to lower limit at slow speed. Repeat hoisting and lowering of the load for approximately 10 hoisting cycles, increasing the speed for each cycle. During this test, the capacity overload lockout should not activate.

3.4.5.2 Rated Load Test

3.4.5.2.1 Hoist

a. Static Load Test: With the trolley in the center of the bridge span, raise the test load approximately one foot. Hold the load for 10 minutes. Rotate the load and hook 360 degrees to check bearing operation with no binding. Observe lowering that may occur which indicates a weakness in the structure or malfunction of hoisting components or brakes. Verify that maximum beam and girder deflections do not exceed CMAA 70 design limits.

   For hoists with primary and secondary holding brakes, raise the test load and release the secondary holding brake while testing the primary holding brake. Hold for 10 minutes. Observe for lowering of the load, which may indicate malfunction of hoisting components or brakes. Re-engage secondary holding brake and release the primary holding brake. Hold for 10 minutes. Observe for lowering of the load, which may indicate malfunction of hoisting components or brakes. Re-engage the primary holding brake. Recheck proper operation of time delay and ensure smooth positive stopping.

b. Hoist Mechanical Load Brake (if present): Raise test load approximately 5 feet. With the hoist controller in the neutral position, release (by hand) the holding brake. Document the method used to release the holding brake. The load brake must hold the test load. Again with the holding brake in the released position start the test load down at slow speed and return the controller to the "off" position as the test load lowers. The load brake must stop and hold the test load.

c. Raise and lower test load through the full lift range and visually observe smooth control and acceleration between points. Completely stop the machinery at least once in each direction to ensure proper brake operation.

d. Hoist Loss of Power Test: Raise the test load to approximately 8 feet. While slowly lowering the test load, disconnect the crane's power source. Verify that the test load does not lower and that the brake is set.

3.4.5.2.2 Trolley

Operate the trolley (if space is available) the full distance of the bridge rails in each direction with a test load on the hook. Check proper functioning through the range of speeds. Verify proper brake action.

3.4.5.2.3 Bridge

With a test load on the hook, operate the bridge for the full length of the runway (if space is available) in one direction with the trolley at the far end of the bridge, and in the opposite direction with the trolley

at the opposite end of the bridge. Use extreme caution. Check proper functioning through the range of speeds. Check for any binding of the bridge end trucks and verify proper brake action. Record deficiencies. Secure from testing if deficiencies are found.

3.4.5.2.4 Trolley Loss of Power Test

With a test load of 100 percent of rated load, raise the test load approximately midway between the trolley and any permanent obstruction on the operating floor. Starting at a safe distance from walls or other obstructions, attain a slow speed of trolley travel. While maintaining a safe distance from obstructions, disconnect the main power source at the wall mounted safety switch (disconnect) to simulate a power failure. Verify that the trolley stops and that the brake sets properly. Measure the distance required for the trolley to stop.

3.4.5.2.5 Bridge Loss of Power Test

With a test load of 100 percent of rated load, raise the test load approximately midway between the trolley and any permanent obstruction on the operating floor. Starting at a safe distance from walls or other obstructions, attain a slow speed of bridge travel. While maintaining a safe distance from obstructions, disconnect the main power source at the wall mounted safety switch (disconnect) to simulate a power failure. Verify that the bridge stops and that the brake sets properly. Measure the distance required for the bridge to stop.

3.4.5.3 Overload Test

3.4.5.3.1 Hoist

Disconnect or adjust the overload limit device to allow the hoist to lift the test load. Verify proper operation of the overload limit device after it is reconnected.

a. Static Load Test: With the trolley in the center of the bridge span, raise the test load approximately one foot. Hold the load for 10 minutes. Rotate the load and hook 360 degrees to check bearing operation with no binding. Observe lowering that may occur which indicates a weakness in the structure or malfunction of hoisting components or brakes.

   For hoists with primary and secondary holding brakes, raise the test load and release the secondary holding brake while testing the primary holding brake. Hold for 10 minutes. Observe for lowering of the load, which may indicate malfunction of hoisting components or brakes. Re-engage secondary holding brake and release the primary holding brake. Hold for 10 minutes. Observe for lowering of the load, which may indicate malfunction of hoisting components or brakes. Re-engage the primary holding brake. Recheck proper operation of time delay and ensure smooth positive stopping.

b. Raise and lower test load and visually observe smooth control. Stop the load during raising and lowering to verify that the brakes holds the load.

c. Hoist Load Brake (if present): Raise test load approximately 5 feet. With the hoist controller in the neutral position, release (by hand) the holding brake. Document the method used to release the holding

brake. The load brake must hold the test load. Again with the holding brake in the released position start the test load down at slow speed and return the controller to the "off" position as the test load lowers. The load brake must stop and hold the test load.

d. Hoist Loss of Power Test: Raise the test load to approximately 8 feet. While slowly lowering the test load, disconnect the crane's power source. Verify that the test load does not lower and that the brake is set.

3.4.5.3.2 Trolley

Operate the trolley the full distance of the bridge rails in each direction with a test load on the hook (one cycle) through the range of speeds. Verify proper brake action.

3.4.5.3.3 Bridge

With a test load on the hook, operate the bridge for the full length of the runway in one direction with the trolley at the extreme end of the bridge, and in the opposite direction with the trolley at the opposite extreme end of the bridge (one cycle). Check proper functioning through the range of speeds. Check for any binding of the bridge end trucks and verify proper brake action. Record deficiencies. Secure from testing if deficiencies are found.

3.5 MANUFACTURER'S FIELD SERVICE REPRESENTATIVE

Furnish a qualified experienced manufacturer's field service representative to supervise the crane installation, assist in the performance of the on-site testing, and instruct personnel in the operational and maintenance features of the equipment.

3.6 OPERATION AND MAINTENANCE MANUALS

Provide three hard copies of operation and three hard copies of maintenance manuals for the equipment furnished along with three electronic copies (PDF) of each on a Compact Disc. Provide one complete set prior to performance testing and final copies upon acceptance. Provide operation manuals that detail the step-by-step procedures required for system startup, operation and shutdown. Include the manufacturer's name, model number, parts list, and brief description of all equipment and basic operating features. List in the maintenance manuals routine maintenance procedures, including weekly, monthly, semi-annual, and annual required maintenance items, possible breakdowns and repairs, and troubleshooting guides. Also include as-built drawings, piping and equipment layout, design calculations, Control Parameter Settings and printouts of any software, and simplified wiring and control diagrams of the system as installed. Secure approval of operation and maintenance manuals prior to the field training course.

3.7 FIELD TRAINING

Conduct a training course for 10 operating and maintenance staff and provide a copy of the training material to each participant. Provide a training period consisting of a total of 4 hours of normal working time and starting after the system is functionally completed but prior to final acceptance. Cover all pertinent points involved in operating, starting, stopping, and servicing the equipment, including all major elements of the

Operation and Maintenance Manuals. Demonstrate in course instructions all routine maintenance operations such as lubrication, general inspection, and safety.

3.8 FINAL ACCEPTANCE

Final acceptance of crane system will not be given until Contractor has successfully completed all testing operations, corrected all material and equipment defects, made all proper operation adjustments, and removed paint or overspray on wire rope and hook.

Warranty period must coincide with beneficial occupancy of **each CLWS magazine**. Rapid response, under 3 hours, is required for warranty issues the first year.

-- End of Section --

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SECTION 41 22 13.15

BRIDGE CRANES, OVERHEAD ELECTRIC, UNDER RUNNING TROLLEY
11/22

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 GEAR MANUFACTURERS ASSOCIATION (AGMA)

AGMA 908	(1989B; R 1999) Information Sheet: Geometry Factors for Determining the Pitting Resistance and Bending Strength of Spur, Helical and Herringbone Gear Teeth
ANSI/AGMA 2001	(2004D; R 2010) Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth
ANSI/AGMA 2015-1	(2001A; R 2014) Accuracy Classification System - Tangential Measurements for Cylindrical Gears
ANSI/AGMA 6013	(2006A; R 2016) Standard for Industrial Enclosed Gear Drives

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360	(2016) Specification for Structural Steel Buildings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.1	(2003; R 2018) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B30.2	(2017) Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)
ASME B30.10	(2019) Hooks
ASME B30.16	(2022) Overhead Underhung and Stationary Hoists
ASME B30.17	(2020) Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoists)
ASME B30.30	(2023) Ropes
ASME HST-4	(2021) Performance Standard for Overhead Electric Wire Rope Hoists

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel
AWS D14.1/D14.1M	(2019) Specification for Welding of Industrial and Mill Cranes and Other Material Handling Equipment

ASTM INTERNATIONAL (ASTM)

ASTM A275/A275M	(2018) Standard Practice for Magnetic Particle Examination of Steel Forgings
ASTM A1023/A1023M	(2021) Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes
ASTM E543	(2021) Standard Specification for Agencies Performing Non-Destructive Testing
ASTM F436/F436M	(2019) Standard Specification for Hardened Steel Washers Inch and Metric Dimensions
ASTM F3125/F3125M	(2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

BRITISH STANDARDS INSTITUTE (BSI)

BS ISO 4309	(2017) Cranes - Wire Ropes - Care and Maintenance, Inspection and Discard

CRANE MANUFACTURERS ASSOCIATION OF AMERICA (CMAA)

CMAA 70	(2020) Specification for Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes
CMAA 74	(2020) Specifications for Single Girder Cranes

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC ISO 15408	(2022) Information Technology-Security Techniques-Evaluation Criteria for IT Security

MATERIAL HANDLING INDUSTRY OF AMERICA (MHI)

MHI MH27.1	(2016) Specifications for Underhung Cranes and Monorail Systems

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)

NECA NEIS 1	(2015) Standard for Good Workmanship in Electrical Construction

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 3	(2005; R 2010) Medium-Voltage Controllers Rated 2001 to 7200 V AC
NEMA ICS 5	(2017) Industrial Control and Systems: Control Circuit and Pilot Devices
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA ICS 8	(2011) Crane and Hoist Controllers
NEMA MG 1	(2021) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023) National Electrical Code

RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC)

RCSC A348	(2020) RCSC Specification for Structural Joints Using High-strength Bolts

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J429	(2014) Mechanical and Material Requirements for Externally Threaded Fasteners
SAE J995	(2017) Mechanical and Material Requirements for Steel Nuts

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-W-410	(2020; Rev J) Wire Rope and Strand

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

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.147	The Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1910.179	Overhead and Gantry Cranes
29 CFR 1910.306	Specific Purpose Equipment and

Installations

U.S. NAVAL SEA SYSTEMS COMMAND (NAVSEA)

NAVSEA T9074-AS-GIB-010/271	(2014; Revision 1) Requirements for Nondestructive Testing Methods

UNDERWRITERS LABORATORIES (UL)

UL 943	(2016; Reprint Feb 2018) UL Standard for Safety Ground-Fault Circuit-Interrupters
UL 1004-1	(2012; Reprint Nov 2020) UL Standard for Safety Rotating Electrical Machines - General Requirements

1.2 DEFINITIONS

a. Crane Bridge: That part of an overhead crane system consisting of a girder, end trucks, walkway, and drive mechanism which carries the trolley(s) and travels along the runway rails parallel to the runway.

b. Crane Runway: The track system along which the crane operates horizontally, including track hangar rods, track connection devices, and runway structural supports.

c. Dead Loads: The weight of all effective parts of the bridge structure, the machinery parts, and the fixed equipment supported by the structure.

d. Crane Bridge Girder: The principal horizontal beam of the crane bridge structure. It is supported by the crane end trucks. Typically for single girder cranes the trolley mounted hoist is suspended from the girder below the crane. For double girder cranes, the trolley is typically run on top of the bridge girder and the hoist is mounted on top of the trolley.

e. Insulated Link: A component normally installed between the hook and the lifting wire rope or lower load block, or below the hook to prevent the flow of electrical energy. Insulated links are primarily used when there is the possibility radio frequency energy collecting on the weight handling equipment structure. Insulated links are used extensively in the handling of ordnance.

f. Lifted Load: The load consisting of the rated load and the weight of lifting devices attached to the crane such as the load block, bucket, or other supplemental devices.

g. Original Equipment Manufacturer (OEM): the Company that produced the part or original equipment.

h. Packaged Hoist: A commercially designed and mass produced hoist characterized by the motor, gearing, brake(s), and drum contained in a single package often connected by the use of c, d, or p-face flanges.

i. Patented Track: A generic term referring to track built in accordance with MHI MH27.1 utilizing a composite track section incorporating a proprietary bottom flange shape. For this crane system, it is provided for the crane bridge girder and also the crane runway track,

if under running.

j. Pendant: A control for a hoist and a crane. The pendant hangs from the hoist or the crane by a cable at a height that is easy for the operator to reach.

k. Rated Load: The maximum working load suspended under the load hook.

l. Standard Commercial Cataloged Product: A product which is currently being sold, or previously has been sold, in substantial quantities to the general public, industry or Government in the course of normal business operations. Models, samples, prototypes or experimental units do not meet this definition. The term "cataloged" as specified in this section is defined as "appearing on the manufacturer's published product data sheets. These data sheets must have been published or copyrighted prior to the issue date of this solicitation and have a document identification number or bulletin number.

m. Top Running Crane: An overhead electric traveling crane that is supported by end trucks which run on top of supporting rails.

n. Trolley Load: The weight of the trolley and its associated equipment carried by the trolley wheels.

o. Under running (Underhung) Crane: An electric overhead traveling crane that is supported by crane end trucks suspended below the crane runway. The load is supported by hanging from the lower flange of a beam or patented track.

1.3 SYSTEM DESCRIPTION

The requirements for the structures supporting the crane runway are specified in Section 05 12 00 STRUCTURAL STEEL, and must conform to AISC 360.

1.3.1 Crane Design Criteria

Cranes will operate in the given spaces and match the runway dimensions and rails indicated. Hook coverage, hook lift, clearances, lifting capacity, and load test weight must not be less than that indicated. Provide loaded hook coverage to the maximum extent possible.

1.3.1.1 General

Include the following: Number of cranes 11 total, three each building located in two buildings identified as Box G Magazines G-001 and G-002 and five located in building identified as Box H Magazine H-001, with the capacity of 10,000 pounds, and total required hook lift of 8 feet, 11 inches, for each crane. Also clearly locate and identify each hoist and system components.

1.3.1.2 Classification

Provide top running single girder electric bridge crane(s), with under running trolley mounted hoist, conforming to MHI MH27.1, and CMAA 74 service class D, as applicable. The crane(s) must be designed for operation in an indoor environment, ordnance handling service, meeting the requirements of ASME B30.16 and ASME B30.17, with an ambient temperature range of 0 to 100 degrees Fahrenheit. The crane spans depending on

location as indicated on drawings Vertical lift must be as specified on the drawings. Provide separate runways for each crane.

The cranes must be pendant controlled and operate in the spaces and within the loading conditions indicated. Provide a crane, including hooks and hoisting rope, that is able to clear permanent obstructions in all operating configurations. The pendant controller must be mounted on a separate festooned cable system from the trolley power supply. The cranes must operate on 480-volts AC, 60 Hz , three phase power source. Maximum loading on the facility (without impact) due to dead loads, trolley loads, and lifted loads, with the trolley in any position, must not exceed the allowable wheel loading and wheel spacing of the facility.

1.3.1.3 Rated Speeds

Provide the crane with rated (maximum) speeds within plus or minus 10 percent (in feet/min) for the main hoist, bridge, and trolley at the rated load as specified in the table below. The minimum speed must not exceed the values listed.

Rated Speeds feet/min		
Description	Minimum	Maximum
Main Hoist	1.5	15
Trolley	3	25
Bridge	5	50

Provide slow speed switch for trolley and bridge to operate at 1.5 fpm.

1.4 VERIFICATION OF DIMENSIONS

The Contractor is responsible for the coordination and proper relation of their work to the building structure and to the work of all trades. Coordinate with the crane support structure design, where applicable, to provide the desired crane operating envelope (i.e., hook envelope and hook height). Verify all dimensions of the building that relate to fabrication of the crane and notify the Contracting Officer of any discrepancy before finalizing the crane order.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Overhead Electric Crane System; G

Crane Support Structure; G

Complete Schematic Wiring Diagram; G

Control System and Network Drawings; G

SD-03 Product Data

Hoist Brakes; G

Travel Brakes; G

Load Block and Hook; G

Hoist and Trolley Units; G

Hoisting Rope; G

Wheels; G

Bridge End Trucks; G

Crane Bridge Girder; G

End Stops; G

Bumpers; G

Crane Runway System; G

Motors; G

Enclosures; G

Circuit Breakers; G

Disconnect Switch; G

Contactors and Relays; G

Fuses; G

Variable Frequency Drives; G

Limit Switches; G

Resistors; G

Pendant Push-Button Station; G

Pendant Conductor System; G

Crane Controllers; G

Control Parameter Settings; G

Pilot Devices; G

Load Indicating Device; G

Warning Devices; G

Runway Conductor System; G

Bridge Conductor System; G

Overload Protection; G

Painting System; G

Control System and Network; G

SD-05 Design Data

Load and Sizing Calculations - Cranes; G

Design Calculations for Crane Support Structures; G

SD-06 Test Reports

Hook Non-Destructive Test (NDT); G

Post-Erection Inspection; G

Operational Tests; G

Hook Tram Measurement; G

Load Tests; G

SD-07 Certificates

Wire Rope; G

Crane Runway; G

Hazardous Material; G

Loss of Power Test; G

Overload Test; G

Brake Adjustment Record; G

Contractor Hazardous Environment; G

Public Domain Software; G

Software and Services; G

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals, Data Package 3; G

SD-11 Closeout Submittals

Network-Capable Control Devices; G

Disabled Ports, Connectors, and Interfaces; G

Evaluation Status of Hardware and Software; G

Control System Access Control; G

Control System Account Management; G

Patch Management and Updates; G

Malware Detection and Protection; G

Wireless Technology Provisions; G

Control System Inventory; G

1.6 QUALITY ASSURANCE

1.6.1 Manufacturer Qualification

Overhead Electric Crane System, including sub-system components manufactured by vendors, must be designed by, or directly supervised by, a registered professional engineer (PE). PE licensing must be by a board or agency authorized to license and register professional engineers. The PE may be a Contractor's regular employee or a consultant. The PE's review and attestation of specification compliance and professional responsibility must be signified by their PE original seal and dated signature on the final drawings. The professional engineers must only undertake and perform work under this contract in the branch(s) of engineering in which they are licensed.

1.6.2 Pre-Delivery Inspections

Contractor is responsible for performance of quality control inspections, testing, and documentation.

1.6.2.1 Inspection of Hook Assembly

Inspect hook by a magnetic particle type inspection prior to delivery. Furnish documentation of hook inspection to Contracting Officer prior to field operational testing.

Acceptance standard is no defects. A defect is defined as a linear indication for which the largest dimension is greater than 1/16 inch long. Welding repairs of hooks are not permitted. A hook showing linear indications, damage, or deformation is not acceptable.

1.6.2.1.1 Hook Non-Destructive Test (NDT)

For hooks of ferromagnetic materials, magnetic-particle inspect the hook over the entire area in accordance with NAVSEA T9074-AS-GIB-010/271 or ASTM A275/A275M.

Inspect each hook and shank over the entire surface area. If NDT cannot be performed on surfaces inside small holes (e.g., hook/nut captivation roll pin holes), visually inspect those surfaces to the maximum extent practical.

a. Procedure for magnetic particle inspection: Conduct magnetic particle inspection in accordance with NAVSEA T9074-AS-GIB-010/271. ASTM A275/A275M may be used with the following restrictions: Do not use DC yokes (including switchable AC/DC yokes used in the DC mode) or permanent magnet yokes. Do not use automatic powder blowers or any

other form of forced air other than from a hand-held bulb for the application or removal of dry magnetic particles. Remove arc strikes. Equipment ammeters must have an accuracy of plus or minus 5 percent of full scale (equipment ammeter accuracy other than that stated is acceptable provided the MT procedure states that a magnetic field indicator is used to establish and verify adequate field strength for all aspects of the inspection.)

b. Acceptance Criteria: Defects found on the hook will result in rejection of defective items for use on furnished hoist.

c. Test Report: Submit a test report of the inspection of each hook to the Contracting Officer for approval prior to final acceptance of hoist installation. Certify test reports by the testing organization. The performing organization must provide a written statement of certification to ASTM E543, current within one year of the date the NDT was performed. The NDT procedures including technique sheets specific to the types, shapes, and size of the parts being examined must adequately describe the orientation of the hooks within the magnetizing equipment, as applicable. The performing organization must have the NDT procedures and its technique sheet used for testing of the hook reviewed and approved by an independent Level III examiner. Submit the (Level III examiner) approved procedures, technique sheets, and certification to the Contracting Officer with the test report.

1.6.3 Drawings: Overhead Electric Crane System and Support Structure

a. Submit drawings showing the general arrangement of all components in plan, elevation, and end views to demonstrate proper interface with the facility and relation to other cranes on the same rail system, if applicable. Show all major features of the crane including: hook approaches on all four sides, clearances and principal dimensions, hoist, trolley and bridge drives, motor nameplate data, overcurrent protective device ratings, and electrical schematic drawings. Include weights and centers of gravity of major components (e.g., bridge girder(s), trolley/hoist).

b. Submit shop drawings of all fabricated components including support structure. Shop drawing quality must be equivalent to the contract drawings accompanying this solicitation. Drawings must be reviewed, signed and sealed by a licensed professional engineer.

c. Provide Bill of Materials for crane components on each drawing. The schedule must provide a cross reference between manufacturer data and shop drawings. Components listed on the schedule of crane components must include total quantity, description, original manufacturer, and part number. Distributing agents will not be acceptable in lieu of the original manufacturer.

d. Provide control system and network drawings. Network diagram must show equipment locations, names, models, and IP addresses on network communications schematic for all Programmable Logic Controllers (PLCs), Remote Terminal Unit (RTU), Supervisory Controller, and Other Network-Capable Devices. In addition, the drawings must consist of all software block, flow, and ladder diagrams.

1.6.4 Design Data: Load and Sizing Calculations - Cranes

Submit complete list of equipment and materials, including manufacturer's descriptive data, technical literature, and performance charts and curves. Submit calculations reviewed, signed, and sealed by a registered professional engineer verifying the load cases, sizing of the bridge girder(s), end trucks, travel drives, motors, overcurrent protection, and conduit. Provide a list of all codes and standards, design assumptions, equations, specified efficiencies, limits, factors of safety, component ratings, and sources of values used. Include free body diagrams or sketches of each load case. Include seismic analysis of crane.

Submit complete design calculations for crane support structures.

1.6.5 Certificates

All certifications must be dated and bear the original signature (above the printed name) of the authorized representative of the Contractor or the manufacturer of the items or equipment being certified. Submit certifications that clearly identify the crane, the drives, components, and location (as applicable) to which it applies:

a. Wire Rope Certification with either the wire rope manufacturer's certification that the rope meets the published breaking force, or certification of the actual breaking force of a sample taken from the reel and tested. Show the published breaking force on the wire rope certificate; the actual wire rope breaking force must meet or exceed the published value. Certification must be traceable to the hoist, crane, and reel.

b. Crane Runway Certificate stating that the new crane will operate properly on the runway. For runways provided by Contractor, include statement certifying runway has been aligned in accordance with CMAA 74 or MHI MH27.1, as applicable.

c. Hazardous Material Certificate that the crane does not contain hazardous material including asbestos, lead, cadmium, chromium, PCBs, or elemental mercury. Products required for the designing and manufacturing of cranes must not contain the prohibited materials.

d. Loss of Power Test Certificate stating that a test may be performed in which power is removed during operation without any detrimental effects to the crane.

e. Overload Test Certificate stating that the crane can be periodically load tested to 125 percent (plus 0 minus 5 percent) of rated load. Overload Test Certificate stating that the crane can be periodically load tested to 125 percent (plus 0 minus 5 percent) of rated load.

f. Certificate of the Brake Adjustment Record. Provide a brake adjustment record and installation/maintenance manuals for each brake on the crane. Each brake measurement must have a tolerance traceable to the associated brake manual or documentation provided by the brake manufacturer, location of measurements, and the actual brake setting. Changes made to settings of the brake, at any time, will void the record.

g. Contractor Hazardous Environment Certificate stating that the new

crane and all associated components including the hoist are designed for operation in the hazardous environment specified in the paragraph CLASSIFICATION.

h. Public Domain Software Certificate declaring that public domain software (e.g., freeware, shareware) is not used in the system.

i. Certificate stating that all Software and Services that are not required for operation and/or maintenance of the product have been removed. The software/services to be removed are identified in paragraph SOFTWARE AND SERVICES.

1.6.6 Welding Qualifications and Procedure

Welding must be in accordance with qualified procedures using AWS D14.1/D14.1M as modified. Written welding procedures must specify the Contractor's standard dimensional tolerances for deviation from camber and sweep and not exceed those specified in AWS D14.1/D14.1M, MHI MH27.1 and CMAA 74. Welders and welding operators must be qualified in accordance with AWS D1.1/D1.1M or AWS D14.1/D14.1M.

1.7 CRANE SAFETY

Comply with the mandatory and advisory safety requirements of ASME B30.10, ASME B30.16, ASME B30.17, ASME HST-4, 29 CFR 1910.147, 29 CFR 1910.179, 29 CFR 1910.306, and all applicable provisions of 29 CFR 1910 and NFPA 70.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 General

Provide materials and equipment which are standard products of manufacturers regularly engaged in the fabrication of complete and totally functional cranes including necessary ancillary equipment. Material will be free from defects and imperfections that might affect the serviceability and appearance of the finished product. All material must be new and unused.

2.1.2 Nameplates

Secure nameplates to each major component of equipment with the manufacturer's name, address, type or style, model or catalog number, and serial number. Provide two bridge identification plates, one for each side of the bridge. Provide noncorrosive metal identification plates with letters which are easily read from the floor, showing a separate number such as BC-1, BC-2, for each bridge crane.

2.1.3 Capacity Marking

Mark the rated capacity in pound units on each side of the crane on the bridge girder. Capacity marks must be large enough to be clearly visible from the floor. Individual hoist units must have their rated capacity clearly marked on their lower block, and additionally labeled on the hoist body.

2.1.4 Safety Warnings

Affix labels in a readable position to each lift block or control station in accordance with ASME B30.16 and ASME B30.17. Submit safety warnings, diagrams and other instructions suitably framed and protected for display as indicated by the Contracting Officer as follows:

Design and locate the word "WARNING" or other legend to bring the label to the attention of the operator. Provide durable type warning labels and display the following information concerning safe-operating procedures: Cautionary language against lifting more than the rated load; operating the hoist when the hook is not centered under the hoist; operating hoist with twisted, kinked or damaged rope; operating damaged or malfunctioning hoist; operating a rope hoist with a rope that is not properly seated in its hoist drum groove; lifting people; lifting loads over people; and removing or obscuring the warning label.

2.2 STRUCTURAL REQUIREMENTS

T he structural design of each crane shall conform to CMAA No. 70, 29 CFR Part 1910.179, ASME B30.2, AISC 360 and other requirements specified herein.

Load Combinations:

The crane shall be designed to meet load cases 1, 2 and 3 of CMAA No. 70 and additional load cases specified herein.

Case 4: Test Loads (CMAA No. 70 Stress Level 3)

The crane will be periodically tested up to 125 percent of rated capacity. Combined stresses for the following load combination shall be calculated to ensure structural adequacy during testing using CMAA No. 70 stress level 3.
DL (DLFB) + TL (DLFT) + 1.25 LL (1 + HLF) + IFD + SK + WLO

Notes:

(1) Test and extraordinary loads need not be considered in the fatigue analysis.

(2) Formula abbreviations correspond to principal loads as defined in CMAA No. 70.

(3) The subscripts "T" and "B" refer to trolley and bridge, respectively.

Crane location is Seismic Design Category "B". Seismic analysis is not required.

2.2.1 Structural Connections

High-strength bolted structural connections must be designed and installed in accordance with RCSC A348. Bolts must be of ASTM F3125/F3125M Grade A325/A325M or Grade A490/A490M material. Galvanized bolts are not acceptable.

Welded connections for the crane must be performed in accordance with AWS D14.1/D14.1M. Welded connections to the building must be performed in accordance with AWS D1.1/D1.1M. Allowable stress values must comply with

CMAA 74 or MHI MH27.1, as applicable.

2.2.2 Crane Bridge Girder

a. Provide crane bridge girder(s) of patented track conforming to MHI MH27.1. For ordnance handling cranes, provide crane bridge girders of patented track. Intermittent ("skip") welds on bridge girder elements (e.g., web and flange interfaces) are prohibited. If the girder is notched to fit over the end trucks, reinforce the girder ends with vertical and horizontal stiffeners. Splices in the unsupported length of the girder are prohibited.

b. For patented track girder(s), submit manufacturer's standard published tables that verify the crane bridge girder is sized in compliance with all specification requirements. When standard published tables are not available, provide calculations for the strength design and deflection of the bridge. Patented track girder must be of welded steel construction and fabricated by a manufacturer regularly engaged in the production of this type of beam.

c. Splices in the bridge girder(s) are not permitted.

2.2.3 Bridge End Trucks

Provide bridge end trucks conforming to ASME B30.17 and CMAA 74 or MHI MH27.1, as applicable. Configure end trucks with a feature that limits end truck movement to one inch in the event of wheel or shaft failure.

2.2.4 End Stops

Fit the crane bridge girder(s) with structural steel end stops. Locate stops to permit maximum trolley travel. Design end stops in accordance with MHI MH27.1 and ASME B30.17. Provide a system in which the travel wheels do not contact the end stops. End stops must be designed to absorb the maximum kinetic energy and impact force developed by the bumper contact. Provide end stops compatible with trolley bumpers and designed to bolt to the crane bridge girder.

2.2.5 Bumpers

Fit bridge end trucks and trolley frames with shock-absorbing bumpers capable of decelerating and stopping the bridge and trolley within the limits stated by ASME B30.17. Ensure bumpers conform to ASME B30.17. Bumpers must fully engage end stops. Mount bumpers so that there is no direct shear on mounting bolts (if any) upon impact. Bumpers must provide adequate clearance between the crane and surrounding structure when compressed to preclude damaging equipment (clearance requirements are defined in MHI MH27.1 or CMAA 74, as applicable, and ASME B30.17). Ensure bridge bumpers are properly aligned with runway end stops. Metal to metal contact at the bumper to end stop connection is not permitted.

2.2.6 Crane Runway System

a. Provide the complete runway track support system that is required to support the crane runway track at its indicated location from the floor slab. Rails must be ASCE 30.

b. For rolled steel shapes, locate splices under structural support

members.

c. Runway support structure must be designed, fabricated, and installed such that runway rails meet the alignment tolerances of CMAA 74 or MHI MH27.1, as applicable. Provide means to allow for vertical adjustment of the runway track both before and after the system has been put in operation so that track can be erected and maintained level. Brace runway to restrain the track against damaging lateral and longitudinal movements.

d. Design, fabricate, and install new runway end stops in accordance with ASME B30.17 and CMAA 74 or MHI MH27.1, as applicable. End stops must be designed to absorb the maximum kinetic energy and impact force developed by the bumper contact. Provide end stops compatible with end truck bumpers, designed to bolt to the runway support girders, and maximize bridge travel.

2.2.7 Seismic Forces

Crane location is Seismic Design Category "B", Seismic analysis is not required.

2.3 MECHANICAL REQUIREMENTS

a. Provide steel shafts, gears, and keys, with the exception of worm gears which may be bronze. No three or more bearing shaft configurations are allowed.

b. Cast iron and aluminum used to support components of the hoist power transmission train must be ductile. For the purposes of this specification, "ductile" is defined as having a minimum elongation of 5 percent in 2.00 inches. Gray cast iron load bearing parts are prohibited. Provide hoist speed reducer housings that are steel or ductile/malleable cast iron and hoist electric motor housings that are steel or ductile/malleable cast iron or cast aluminum.

c. Provide steel or ductile/malleable cast iron brake housings of motor mounted disc brakes, brake lining backing plates, shoes and shoe holders. Provide spring-set brake shoe or pad linings of a non-asbestos material.

d. All mechanical components must be accurately aligned and positively secured to maintain the alignment. Parts must not be forced into position to obtain apparent alignment.

e. Provide minimum bearing life in accordance with ASME hoist performance standards and MHI MH27.1 or CMAA 74, as applicable.

f. All "should" statements in CMAA 74, MHI MH27.1, and ASME B30 are considered to be "shall" statements.

2.3.1 Threaded Fasteners

Fasten mechanical connections that are not part of a commercial packaged assembly with SAE J429 Grade 5 fasteners, ASTM F436/F436M washers, and SAE J995 Grade 5 nuts. Lubricate all mechanical fasteners unless otherwise specified by the original component manufacturer.

2.3.2 Hoist

Provide hoist conforming to ASME B30.16, except as modified and supplemented in this section. Packaged hoist and trolley units (packaged hoists) must be double reeved electric wire rope hoist conforming to ASME HST-4 Duty Class H4 or better and be rated for the operating environment.

Configure trolley such that the trolley frame contacts the trolley stops and prevents the trolley from dropping more than one inch in the event of an axle or wheel failure.

2.3.2.1 Hoist Brakes

a. Provide a brake configuration with one electro-mechanical spring set brake and one mechanical load brake that stops and holds 125 percent of the hoist's rated load and does not require the load to be raised before being lowered.

b. Electro-mechanical brakes must have an externally accessible means of manual release. Provide manual-adjusting brakes designed to permit inspection and adjustment without disassembly of the brake. The brakes must be equipped with a manual self-return to ON brake release; maintained brake releases must reset when power is applied. Double face-mounted brakes are not permitted.

2.3.2.2 Load Block and Hook

a. Provide a load block constructed of steel. The load block must be designed to prevent metal-to-metal contact of moving parts. The block must be fully enclosed, concealing the sheaves and wire ropes, except for wire rope slots and drain holes. The design must preclude the wire rope from being cut, pinched, crushed, or chafed in case of two-blocking. Standard commercial blocks may be used at their published ratings when their published design factors are 5.0 or greater.

b. Provide an unpainted and unplated forged carbon steel single barbed hook with a minimum material longitudinal elongation of 16 percent in 2 inches. Hooks must conform to the requirements of ASME B30.10. The hook must be a standard commercial product with a published design factor of 5.0 or greater. Fit hook with a safety latch designed to preclude inadvertent displacement of slings from the hook saddle. The hook and hook nut must be removable without unreeving of the hoist or disassembly of the block. Provide hook nut secured to the hook with a commercial standard removable and reusable means. Do not weld hook nut. When provided, provide shank and nut threads with a Class 1 or 2 fit, per ASME B1.1. Uniquely mark the hook in a permanent fashion that is traceable to the NDT certification. The nut must be marked to match the hook. Hook must be free to rotate through 360 degrees when supporting the test load up to 125 percent of the rated capacity.

2.3.2.3 Hoisting Rope

a. Wire rope must comply with ASME B30.30 and FS RR-W-410, ASTM A1023/A1023M, or BS ISO 4309 and have a rope classification appropriate for the usage. Wire ropes must be handled and seized in accordance with ASME B30.30. The wire rope must be in a double reeved configuration equalized with a sheave. Select wire rope minimum design

factor in accordance with ASME B30.16. Provide proof of Wire Rope breaking force.

b. Provide hoist wire ropes with improved, extra-improved, or extra-extra-improved plow steel (or appropriate ISO grades), pre-formed, regular lay, bright, and uncoated, with an independent wire rope, wire strand, or otherwise, steel core. Hot-dipped galvanized wire rope is not permitted.

2.3.2.4 Drum

Provide grooved drum made of steel. Design drum in accordance with ASME B30.16. All hoisting rope is to be wound in a single layer and provided with no less than two dead wraps of hoisting rope remaining at each anchorage when the hook is in its extreme low position.

2.3.2.5 Sheaves

Provide steel sheaves. Size sheaves in accordance with ASME B30.16 for the minimum pitch diameters of running and equalizer sheaves.

2.3.3 Travel Drives

Provide under running travel assemblies with a minimum of one driven wheel on each side of the web and at least one quarter of all wheels driven.

The travel drive arrangement must consist of motor(s) driving through self-contained gear reduction units located at each driven wheel assembly. Gear reducers must be fully enclosed in an oil-tight housing and provided with a convenient means of lubricant level indication and draining. Open-type gearing is not acceptable, except for final drives.

2.3.3.1 Trolley Drives

Provide a motor-driven trolley arrangement. Acceleration and deceleration must meet the requirements specified in CMAA 70. Provide trolley travel limit switches.

2.3.3.2 Bridge Drives

Provide a motor-driven bridge arrangement. Acceleration and deceleration must meet the requirements specified in CMAA 74. Provide bridge travel limit switches.

2.3.3.2.1 Bridge Travel Gearing

Gearing must conform to ANSI/AGMA 2001 and AGMA 908, with internal and external gear dimensional tolerances conforming to the applicable AGMA standard for tooth geometry and tolerances.

2.3.3.2.1.1 Bridge Travel Reducer

Gear reducers must be standard commercial products designed, manufactured, and rated in accordance with ANSI/AGMA 6013. Provide cranes with a CMAA service class "C" or higher with the corresponding "Industrial Duty" service factors. The speed reducer input (high speed) gear set must use helical (including double helical and herringbone), spiral bevel, or worm gear tooth forms. Provide torque arms that are not of the threaded rod type. Operation must be smooth and quiet.

2.3.3.2.1.2 Bridge Open Gearing

Provide all gears and pinions with adequate strength and durability for the crane service class and manufactured to ANSI/AGMA 2015-1 Accuracy Grade A8 or better. Wherever feasible, open gears must be enclosed with safety guards provided with openings with covers for inspection and access for grease lubrication.

2.3.4 Travel Brakes

Provide travel drives with an end-mounted electro-mechanical spring set brake conforming to the requirements of CMAA 74 or non-freecoasting mechanical drive capable of stopping the motion of the travel function within a distance in feet equal to 10 percent of the full load speed in feet per minute when traveling at full speed with a full load.

Spring set brakes must be provided with an externally accessible means to manually release the brake. Provide manual-adjusting brakes designed to permit inspection and adjustment without disassembly of the brake. The brakes must be equipped with a manual self-return to ON brake release; maintained brake releases must reset when power is applied. Double face-mounted brakes are not permitted.

2.3.4.1 Trolley Brake

Provide brakes for underrunning trolleys/carriers sized in accordance with ASME B30.17, but not sized larger than 150 percent of the drive motor rated torque.

2.3.4.2 Bridge Brake

Provide brakes with a minimum torque rating per CMAA 74 according to the applicable environment, but not sized larger than 150 percent of the drive motor rated torque.

2.3.5 Wheels

a. Top running wheels are to be straight tread, double flanged, and sized in accordance with CMAA 74 recommendations for wheel sizing and flange to rail head clearances. Wheel material must be forged steel. Hollow stamped and gray cast iron wheels may not be used; the use of plate steel is prohibited. Provide steel wheels with a minimum tread hardness of 320 BHN.

b. Provide under running wheel sizing and flange-to-rail head clearances in accordance with MHI MH27.1 and CMAA 74 recommendations, as applicable. The wheels must be compatible with their respective runway profile. Wheels are to be made of forged steel. Hollow stamped and gray cast iron wheels may not be used; the use of plate steel is prohibited. Minimum tread hardness for underhung wheels that run on patented track is 375 BHN. Minimum tread hardness for wheels running on structural shapes is 320 BHN.

2.4 ELECTRICAL REQUIREMENTS

a. The design, selection, rating, and installation of the electrical portions of the crane and its accessories must conform to the requirements of NEMA ICS 3,NEMA ICS 8, the applicable ASME HST

standard, and NFPA 70, and other requirements specified herein.

b. All electrical components must be industrial grade, commercially available and comply with established national or internationally recognized approving organizations such as Underwriters Laboratories (UL) and Canadian Standards Association (CSA).

c. All electrical components must be located so they are easily accessible for inspection and maintenance without removing other parts, doors, or door center posts. Electrical equipment and panel wiring must be installed in a neat and workmanlike manner in accordance with Electrical Construction Standard NECA NEIS 1. Each motion of the crane must be provided with a separate control system or drive. The loss of any one function must not prevent the operation of other unaffected functions. Two independent relays, contactors, drive inputs, or other equivalent components/logic must be utilized for each function to provide directional control such that the failure of a single relay/contactor/component cannot result in motion in an unintended direction.

d. Disconnecting means for cranes must be in accordance with NFPA 70 Article 610.32. A permanent placard must be installed on the face of the main line disconnect that states "WARNING – THIS DOES NOT ISOLATE POWER TO LIGHTING, RECEPTACLES, AND ANCILLARY EQUIPMENT". Additionally, a lighting (ancillary equipment) disconnect must be provided, with lockout feature, as the isolation means for the lighting transformer and lighting circuit breaker panel, which must power the crane's ancillary equipment. It must feed 480 VAC to the primary side of the transformer directly from the runway conductors via tapping the line side of the main power disconnect. Provide individual disconnects, with lockout feature, capable of being locked in the open position for bridge lights and receptacles.

e. Unless otherwise specified, interconnecting wiring must be of copper stranded construction complying with Table 310.104(A) of NFPA 70. Interconnecting wiring containing asbestos in the insulation or outer covering are prohibited. Aluminum conductors must not be used. Aluminum connectors are allowed if they are rated for use with copper conductors (marked "AL/CU"). All conductors connected to or routed above resistors must have insulation shown in NFPA 70 Table 610.14(a) for 257 degrees F. For packaged hoists and hoist/trolleys, provide wiring sizes in accordance with NFPA 70 Table 610.14(a). Motor branch circuit conductors not part of a packaged hoist and hoist/trolley must be sized as to have an ampacity not less than 150 percent of the motor full load current rating and to be no smaller than 12 AWG. Conductors must be selected and de-rated based on maximum ambient temperature. Continuous loads such as utility, heating, lighting, and air conditioning must be multiplied by 2.25 to determine ampacity in order to permit application of NFPA 70 610.14 (A) for crane supply conductors. Wire-nuts are not permitted on splices. However, connections for lighting ballasts may be made using wire-nuts (if applicable).

f. Excluding conduit directly connected to dynamic breaking resistors, raceways must maintain a 12-inch clearance between the raceway and dynamic braking resistors. A separate grounding wire, sized in accordance with Section 250.122 of NFPA 70, must be routed with all ungrounded conductors. Only one equipment grounding conductor must be run in each conduit and be the largest size required for any circuit

routed in that conduit. All wiring must be numbered or tagged at all connection points. Power conductors which are shielded such that their wire size cannot be easily determined must be labeled as to the conductor size. All unused conduit openings must be plugged.

g. When fiber optic cable is utilized, inspections and performance checks must be accomplished upon completion of on-site installation to ensure cable cleanliness and proper signal integrity. Testing and verification must be conducted by a knowledgeable fiber optics technician using specialized, calibrated equipment. Cables must be tested for signal loss/attenuation. The fiber optic system must also be tested using an Optical Time Domain Reflectometer (OTDR). Final attenuation and OTDR readings from each fiber optic cable run, including spares, must be documented as a baseline for future reference. All spare fiber optic cables must have protective covers over their ends to maintain cleanliness while not in use. When fiber optic cable is utilized the drive OEM's recommendations for encoders and optical to digital converters must be followed. All system components utilized for this purpose must have known compatibility prior to integration.

h. Power cables and low voltage signal cables may not be mixed in the same conduit.

i. The crane manufacturer must furnish and install all electrical equipment on the crane conforming to NEMA ICS 6, including motors, conforming to NEMA MG 1, electrically released brakes, switches, crane controllers, panels, operating station, wiring system, cables, and crane electrification.

2.4.1 Motors

Motors must meet all applicable requirements of NEMA MG 1 and UL 1004-1. CMAA 70 calculations for motor horsepower shall be used in selecting bridge, trolley, and hoist drive motors. All motors must have a minimum of a 60 minute duty rating and be Totally Enclosed Non Ventilated (TENV), Totally Enclosed Fan Cooled (TEFC), or Totally Enclosed Blower Cooled (TEBC). Provide inverter duty motors for Open Loop Variable Frequency Drives (VFD). Provide motors with a minimum of Class F insulation. Provide motor overload protection utilizing a thermal sensitive device embedded in its windings.

2.4.2 Controls

a. Provide static reversing, variable frequency drives (VFD) for the bridge, trolley and hoist electric controls. VFD controllers must meet NEMA ICS 8, Part 8 and at a minimum, provide under-voltage protection, electronic instantaneous over current protection, DC bus over voltage protection, and be able to withstand output line to line shorts without component failure. Select bridge and trolley drives such that the continuous rating of the controller is not less than the calculated motor full load current based on CMAA 70 paragraph 5.2.9.1.1.1 and NFPA 70 Table 430.250. Select hoist drives such that the continuous rating of the controller is not less than 125 percent of the calculated motor full load current based on CMAA 70 paragraph 5.2.9.1.1.1 and NFPA 70 Table 430.250. All hoist drives must have a motor over-torque limit to lock out the hoist and prevent gross overload of the associated hoist. Provide dynamic braking for each electric drive that is sized per VFD manufacturer's requirements.

Submit VFD Control Parameter Settings.

b. Provide speed control which is infinitely variable for each function, controlled via pendant pushbutton station. Provide controls designed such that the maximum speed of bridge and trolley function will be limited to 1.5 fpm when a slow speed switch is actuated on the controller. Energize a yellow/amber light/indicator while in slow speed mode.

c. The hoist, trolley, and bridge brakes must set after the associated controller decelerates the drive motor to a controlled stop. The hoist, trolley, and bridge, controllers must be sized to provide sufficient starting torque to initiate motion of that crane drive mechanism from standstill with 0 to 125 percent of rated load on the hook. Motors must operate smoothly at all speeds without torque pulsations and must only be energized within the frequency range of 50-60 Hz at rated speed.

d. The use of definite purpose contactors is prohibited. If IEC contactors are used, the application cannot exceed the contactor manufacturer's AC3 ratings for the contactor at a minimum.

e. On hoist function roll-up must be less than 1/8 inch measured at the hook block and roll-back must not occur over the entire load range.

f. Use of Uninterruptible Power Supplies (UPS) is prohibited. Feed control circuits from a single phase, air cooled, double wound transformer with a grounded metal screen between the primary and secondary windings of the transformer.

g. Provide a main line contactor. Energization of the main line contactor must be controlled by the POWER-OFF/POWER-ON switch/pushbutton on all controllers. Upon actuation of the POWER-OFF pushbutton; power to all drive motors, brakes, and controls must be removed. The mainline contactor must not be able to be energize while the POWER-OFF pushbutton is actuated. The POWER-OFF pushbutton circuitry must be independent of all controls or any other electronic devices.

h. Provide a spring returned brake bypass keyswitch for each hoist. The switch allows for actuation of the electro-mechanical brake for independent testing of the mechanical load brake. The normal position allows both brakes to work in their normal operating configuration. Label the keyswitch positions as "NORMAL" and "LOAD BRAKE TEST".

2.4.3 Protection

Protection must not be less than that required by NEMA ICS 3, NEMA ICS 8, CMAA 74, NFPA 70, UL 1004-1, UL 943, 29 CFR 1910.147, 29 CFR 1910.179, 29 CFR 1910.306 and all applicable provisions of 29 CFR 1910. All protection must be by circuit breakers or fuses. Provide a disconnect switch or enclosed type circuit breaker readily accessible to the crane operator for the crane disconnect. Motor branch circuits must be individually protected by inverse time circuit breakers capable of being locked in the open position. The means for locking must remain in place with or without the lock installed. Motor full load current from NFPA 70 Article 430, Part XIV (Tables) must be used to calculate the circuit breaker size.

Provide disconnecting means on the crane in accordance with NFPA 70 Article 610.32. Provide for lockout/tagout of all hazardous energy sources. Provide product data for all circuit breakers and fuses.

2.4.3.1 Conductors

a. The crane contractor is responsible for ensuring that all conductors from the load side of the existing floor level disconnect to the motor branch circuits have adequate overcurrent protection complying with one of the following:

(1) Not be greater than the largest rating or setting of any branch circuit protective device plus the sum of the nameplate rating of all other loads per NFPA 70 Article 610.41(A).

(2) Not be greater than the ampacity of all feeder conductors after all ampacity correction factors have been applied.

b. Conductors for brake coils must be protected by fuses or other protective devices. The device must be chosen to protect the brake circuit conductors from ground faults or short circuits.

2.4.4 Resistors

Provide resistors with natural convection cooling sized as recommended by the VFD OEM and fabricated of corrosion resistant metal; the use of "wire wound" type resistors is prohibited for segments of 8 ohms or less. Mount resistors in substantial, ventilated enclosures constructed entirely of non-combustible materials. Provide resistors with terminals fitted in the coolest position in the enclosure.

2.4.5 Transients and Harmonics Protection

a. Provide contactors and relays with appropriate Metal Oxide Varistors (MOV) or resistor-capacitor (R-C) surge absorbers installed across the respective coil.

b. Provide transient protection for electronic drive controllers that is either internal to the drive or via an MOV connected line-to-ground close to the line terminals of the drive.

c. Provide line reactors rated for continuous duty operation based upon the motor nameplate amperes. With motors of 50 horsepower or greater, harmonics protection must be provided by an isolations transformer or as recommended by the VFD OEM. For a drive motor branch circuit that exceeds 150 feet in length, a reactor must also be connected in series with the controller load (output) terminals to provide standing wave protection or as otherwise recommended by the VFD or motor OEM.

2.4.6 Limit Switches

a. Provide primary upper and lower geared limit switches. Geared limits must allow reversing direction to back out of the limit without resetting. The lower limit switch must be set such that there are a minimum of two wraps of rope on the hoist drum.

b. Provide a backup mechanical hook block activated upper limit switch wired independent of the directional controllers and the primary upper limit switch that removes power from the hoist motor, hoist brake and

hoist controls conforming to NEMA ICS 5. The backup limit must require hoist resetting prior to operation of the hoist in any direction.

2.4.7 Operator Controls

a. Provide crane equipped with a pendant pushbutton station.

2.4.7.1 Pendant Pushbutton Station

The cranes must be controlled from a pendant pushbutton station suspended from an independent festooned messenger track system, operating the length of the bridge. Provide multiconductor flexible cords for pendant pushbutton stations with No. 16 AWG minimum conductors. Provide a method of strain relief to protect the electrical conductors from damage. Locate the pendant pushbutton station 4 feet above the finished floor. Pushbutton pendant station must have its elements legibly marked and arranged vertically, in order, in accordance with CMAA 74. Provide 2-step infinitely variable pendant pushbuttons for control of the hoist, trolley, and bridge. Provide pendant pushbuttons for control that spring return to the OFF position. Voltage in the pendant pushbutton station must not exceed 150 Volts AC or 300 Volts DC. Provide a maintained two-position selector switch for slow speed selection. Provide spring loaded push button for warning bell.

Provide indicator lights for power on, slow speed activated, overload warning.

Pendants must be detachable. Provide one spare pendant for each crane.

2.4.7.1.1 Pendant Conductor System

Provide a festoon type pendant conductor system. The festoon cables must be flat cables suspended from carriers riding on an I-beam or C-track. The pendant controller must be capable of traveling the entire length of the bridge and move independently of the trolley. Festoon loops must not extend below the high hook position.

2.4.8 Electrification Systems

2.4.8.1 Runway Conductor System

a. Provide a Festoon System for the runway conductor system utilizing cables suspended from carriers riding on an I-beam or C-track for the crane, including all necessary cables and hardware to the crane from a wall or column mounted disconnect switch. Provide electrification system with three power conductors and an equipment grounding conductor. Conductors must be fabricated from copper. The crane is required to be grounded through this conductor system. Provide conductors sized for simultaneous motions of the hoist, bridge, trolley mechanisms and any ancillary loads. Festooned cable loops must not extend low enough to come into contact with any obstructions.

2.4.8.2 Bridge Conductor System

a. Provide Festoon System for the bridge conductor system utilizing cables suspended from carriers riding on an I-beam or C-track. Conductors must be fabricated from copper. A minimum of 20 percent of the festoon control circuit conductors for each electrification system

must be spares at the time of crane acceptance. The trolley is required to be grounded through this conductor system. Festooned cable loops must not extend low enough to come into contact with any obstructions.

2.4.9 Overload Protection and Load Indicating Device

a. Provide a capacity overload protective device for all hoist systems using VFD drive capacity overload protection (separate from torque limiting feature of the VFD) using the load indicating device (LID) described in the next paragraph. Provide overload warning at 80% of rated load. Set hoist capacity overload protection at 100 percent of rated capacity. Hoist capacity overload protection must be adjustable between 80 and 150 percent of hoist capacity. Provide a keyed override or other means to disable the hoist capacity overload protection when performing a load test. If a slip clutch is used as the overload limiting device, it must comply with all ASME B30.16 requirements. Provide adjustable slip clutches set at or less than the cranes maximum test load.

b. Initially, set the torque limiting capability of the VFD (that is separate from the capacity overload protective device) to 150 percent of the motor torque (amperage) necessary to hoist 100 percent load. It may be adjusted up only to avoid nuisance trips and adjusted down if possible while still avoiding nuisance trips.

c. Provide an LID for the hoist with display mounted on the underside of the bridge displayed in pounds. The LID capacity must be compatible with the maximum test load for the hoist. The accuracy of the LID must be such that the indicated load is not less than 100% of the actual load and not more than 110% of the actual load. The lid must be configured with set points for an overload limit. Provide TAE (zero) functionality at the operator's station. Any load bearing components in the LID system must be steel, have a minimum design factor of 5 t0 1 based on ultimate tensile strength and a hardness not to exceed HRC 40. Precipitation hardened stainless steel load bearing elements must be age hardened at a minimum temperature of 1025 degrees F.

2.4.10 Enclosures

a. Provide enclosures for control panels, controls, and brakes in accordance with NEMA 250 and NEMA ICS 6, Classification Type 2 indoor, drip-proof. There must not be any condensation inside the control panels. If anti-condensation heaters are provided, these heaters must remain energized when the main line contactor is deenergized.

b. Provide a non-resettable hour meter, connected across the main line contactor, readable from the exterior of the main control panel, to indicate the elapsed number of hours the crane is energized. Provide a non-resettable hour meter, readable from exterior of main control panel, to indicate elapsed number of hour each motion is energized.

c. Gaskets of enclosures and fixtures, and joints and contact surfaces of hazardous/explosive enclosures must be kept free of any paint to prevent damage during removal and reinstallation of gaskets of enclosures.

2.4.11 Warning Devices

Provide a warning bell that is operable from a push button at the pendant pushbutton station. Provide a warning rotating beacon that is illuminated at all times during movement of the hoist, trolley, or bridge function, but may be deactivated on the operator control station.

2.4.12 Pilot Devices

Provide Indicator Lights mounted in an enclosure on the bottom of the bridge with lights sized and positioned to be visible from the ground. The lights must be the dual-lamp type. Provide a white light to indicate that power is available to the crane, a blue light to indicate that the main contactor is energized, an amber light to indicate slow speed mode, and a red light to indicate overload warning. Light voltage must be 115 VAC. Provide nameplates that are legible from ground level. The nameplates must read, in their respective order, "POWER AVAILABLE", "CRANE ENERGIZED", "SLOW SPEED", and "OVERLOAD". The POWER AVAILABLE light must be supplied by a separate, fused transformer for its energization.

2.4.13 Cyber Security of Control Systems

a. Provide the following for PLC, RTU, Supervisory Controller, or other network-capable (whether networked or not upon delivery) control devices as applicable:

(1) Hardware list (Hardware list must include the following for each device):

(a) Manufacturer

(b) Model

(c) Location

(d) Key technical ratings (e.g., memory)

(e) Serial number

(f) MAC addresses

(g) IP addresses

(2) Software List (Software list must include the following for each device):

(a) Manufacturer

(b) Version/subversion

(c) Location/device

(d) Used network ports/protocols/services

(3) List and discussion of all security features of Contractor hardware and software.

b. For every PLC, RTU, Supervisory Controller, or other network-capable control devices (whether networked or not upon delivery), deliver the

following on CD/DVD:

(1) Original firmware

(2) Original firmware hash

(3) SOP for application of firmware updates/patches

(4) POC or website for firmware updates/patches

(5) Count of interfaces and types

(6) Protocols in use, per interface

(7) Configuration file

(8) SOP for configuration

2.4.13.1 Control System and Network

a. The Contractor must provide all equipment, including software and hardware, necessary for testing, installation, and communicating/troubleshooting all systems provided with the crane (e.g., engine/generator, control system, LID, etc.). The Contractor must provide all crane specific operational software files (e.g., ladder logic, functional block programming, etc.) for their associated systems (e.g., control systems, LID, engine generator, etc.).

b. A single common networked design must not be used for the control systems. A network for an individual function may be used as long as a failure of the network does not affect any other function/network except as defined for specific safety interlocks (e.g., LMI system). A common crane network may be used in a monitoring mode for recording faults and trending and is encouraged. Failure of the monitoring system must not affect crane functions.

c. All provided hardware and software must be currently marketed products, not currently scheduled for end of life or obsolescence, to ensure system sustainability.

d. The control system engineering workstation hardware and operating system must be in conformance to the Common Criteria for IT Security Evaluation (IEC ISO 15408, visit https://www.niap-ccevs.org for more information).

e. Ensure there is no remote access capability enabled as remote access capabilities are prohibited. Physically disable or remove all modem/network devices not required for operational purposes.

2.4.13.2 Software and Services

a. Remove all Software and Services not required for operation and/or maintenance of the product. If removal is not technically feasible, then disable software not required for the operation and/or maintenance of the product. Configure the product to allow the ability to re-enable ports and/or services if they are disabled by software. The removal of software or services may not impede the primary function of the product. If software that is not required cannot be removed or disabled, document a specific explanation and

provide risk mitigating recommendations and/or specific technical justification. The software/service to be removed and/or disabled includes, but is not limited to:

(1) Cameras

(2) Games

(3) Device drivers for product components not procured/delivered

(4) Messaging services (e.g., email, instant messenger, peer-to-peer file sharing)

(5) Source code

(6) Software compilers in user workstations and servers

(7) Software compilers for programming languages that are not used in the control system

(8) Unused networking and communications protocols

(9) Unused administrative utilities, diagnostics, network management, and system management functions

(10) Backups of files, databases, and programs used only during system development

(11) All unused data and configuration files

(12) Remove and/or disable, through software, physical disconnection, or engineered barriers, all services and/or ports in the procured product not required for normal operation, emergency operations, or troubleshooting. This includes communication ports and physical input/output ports (e.g., USB docking ports, video ports, and serial ports).

b. Provide documentation showing all disabled ports, connectors, and interfaces for all network-capable devices. In addition, provide summary documentation of the procured product's security features and security-focused instructions on product maintenance, support, and reconfiguration of default settings.

c. For the evaluation status of hardware and software, the Contractor must provide information on Common Criteria (IEC ISO 15408) or National Information Assurance Partnership (NIAP) or Federal Information Processing Standards (FIPS) evaluation status of hardware and software.

2.4.13.3 Access Control

a. The Contractor must configure each component of the procured product to operate using the principle of least privilege. This includes operating system permissions, file access, user accounts, application-to-application communications, and energy delivery system services.

b. Provide user accounts with configurable access and permissions associated with one or more organizationally defined user role(s),

where roles are used.

c. Provide a system administration mechanism for changing user(s') role (e.g., group) associations.

d. The Contractor must document control system access control options by defining access and security permissions, user accounts, and applications with associated roles.

e. Provide recommended methods for the Acquirer to prevent unauthorized changes to the Basic Input/Output System (BIOS) and other firmware. If it is not technically feasible to protect the BIOS to reduce the risk of unauthorized changes, the Contractor must document this case and provide mitigation recommendations.

2.4.13.4 Control System Account Management

The Contractor must document all accounts (including, but not limited to, generic and/or default) that need to be active for proper operation of the procured product.

Remove or disable any accounts that are not needed for normal or maintenance operations, emergency, or troubleshooting of the energy delivery system.

2.4.13.5 Session Management

The Contractor may not allow multiple concurrent logins using the same authentication credentials, allow applications to retain login information between sessions, provide any auto-fill functionality during login, or allow anonymous logins.

Provide account-based and group-based configurable session-based logout and timeout settings (e.g., alarms and human-machine interfaces).

2.4.13.6 Authentication/Password Policy and Management

Provide a configurable account password management system that allows for, but is not limited to, the following:

a. Changes to passwords (including default passwords)

b. Selection of password length

c. Frequency of change

d. Setting of required password complexity

e. Number of login attempts prior to lockout

f. Inactive session logout

g. Screen lock by application

h. Comparison to a library of forbidden strings

i. Derivative use of the user name

j. Denial of repeated or recycled use of the same password

The Contractor must time stamp log files.

2.4.13.7 Logging and Auditing

Provide logging capabilities that cover the following events, at a minimum (as appropriate to their function):

a. Information requests and server responses

b. Successful and unsuccessful authentication and access attempts

c. Account changes

d. Privileged use

e. Application start-up and shutdown

f. Application failures

g. Major application configuration changes

2.4.13.8 Heartbeat Signals

The Contractor must identify heartbeat signals or protocols and recommend which should be included in network monitoring. At a minimum, include a last gasp report from a dying component or equivalent.

The Supplier must provide packet definitions of the heartbeat signals and examples of the heartbeat traffic if the signals are included in network monitoring.

2.4.13.9 Patch Management and Updates

The Contractor must verify that procured products (including third-party hardware, software, firmware, and services) have appropriate updates and patches installed prior to delivery.

Provide documentation of the patch management program and update process (including third-party hardware, software, and firmware). This documentation must include resources and technical capabilities to sustain this program and process. Provide the Contractor's method or a recommendation for how the integrity of the patch is validated by the Acquirer as well as the Supplier's approach and capability to remediate newly reported zero-day vulnerabilities.

2.4.13.10 Malware Detection and Protection

a. The Contractor is required to implement at least one of the following:

(1) Provide a host-based malware detection capability that quarantines (instead of automatically deleting) suspected infected files. Provide an updating scheme for malware signatures. The Contractor must test and confirm compatibility of malware detection application patches and upgrades.

(2) If the Contractor is not providing the host-based malware detection capability, the Contractor must suggest malware detection products to be used and provide guidance on malware

detection and configuration settings that will work with Contractor products.

b. The Contractor must validate that cybersecurity services running on the procured product (e.g., virus checking and malware detection) do not conflict with other such services running on the procured product.

c. For malware detection and protection, the Contractor must provide, or specify how to implement, the capability to automatically scan any removable media that is introduced to the product being acquired.

2.4.13.11 Physical Security

Provide lockable or locking enclosures or rooms for energy delivery systems and system components (e.g., servers, clients, and networking hardware) and for the systems used to manage and control physical access (e.g., servers, lock controllers, and alarm control panels). Provide a method for tamper detection on lockable or locking enclosures. If a physical security and monitoring system is used, tamper detection must be compatible. The Contractor must ensure that physical security features do not hamper the crane system operations. Provide the tools and instructions for making changes to locks, locking codes, keycards, and any other keyed entrances.

2.4.13.12 Wireless Technology

For wireless technology provisions, the Contractor must document:

a. Specific protocols and other detailed information required for wireless devices to communicate with the control network, including other wireless equipment that can communicate with the Contractor-supplied devices.

b. Use, capabilities, and limits for the wireless devices.

c. Power and frequency requirements of the wireless devices (e.g., microwave devices meet the frequency requirements of Generic Requirements GR-63 Network Equipment Building System NEBS and GR-1089).

d. Range of the wireless devices and verify that the range of communications is minimized to both meet the needs of the Acquirer's proposed deployment and reduce the possibility of signal interception from outside the designated security perimeter.

e. Wireless technology and associated devices compliance with standard operational and security requirements specified in applicable wireless standard(s) or specification(s) (e.g., applicable IEEE standards, such as 802.11).

f. Configuration control options that enable varying of the security level of the devices.

2.4.13.13 Control System Inventory

Provide the complete control system inventory. The Control System Inventory must include the following attributes, in tabular format, as applicable:

General Information	Location Information	Hardware Details	Operating System and Platform	Network Information (Actual Function, not potential function)
Unique ID	Facility Name	Device Type	Embedded OS (Yes/No)	MAC Address(es)
Barcode or Identifier	NFAID	Device Sub-Type	OS Contractor	IP Address(es)
Region	Commodity	Device Function	Operating System (O/S)	Upstream Device
Installation	Floor	Manufacturer	O/S Version	Protocols In Use
Special Area (Option DNA1)	Room	Product Line	Platform Contractor	Host Name
	Location	Model No.	Platform Product Line	
	System Type	Serial No.	Platform	
	Functional System or Equipment Control	Remote Connectivity: (Wired / Wireless / None)	Platform Version	
		Network Type Used: (Serial / Ethernet / Both / None)		

2.5 PAINTING SYSTEM

a. Remove all grease, oil, and surface debris by solvent wiping or detergent/water scrubbing, prior to blast cleaning. Prepare surfaces to be coated by abrasive blasting to SSPC SP 6/NACE No.3, Commercial Blast Cleaning, or in accordance with the coating manufacturer's requirements, whichever is more stringent.

b. Use a painting system appropriate for the conditions provided in the Crane Design Criteria section of this specification. Paint exposed portions of the crane using a three -coat system as follows: zinc-rich primer consisting of a minimum of 77 percent zinc by weight in the dry film, an anticorrosive epoxy intermediate coat, and an aliphatic polyurethane top coat. All paint products must be supplied by a single manufacturer and free of chromates, lead, and mercury. Apply each coat in accordance with manufacturer's instructions and requirements. Ensure each coat is smooth, even, and free of runs, sags, orange peel, and other defects. Desired color of finish coat is brilliant yellow. Submit product data for painting system.

c. Coat faying surfaces of bolted connections per RCSC A348, but do not apply finish paint.

d. Paint the load block brilliant yellow with black diagonal striping.

e. Paint, coatings, or galvanizing on the following items or areas is not acceptable: hoist wire rope or load chain, hooks, hook nuts, sheave and drum grooves, sprockets, wheel treads, lubrication fittings, nameplates, flange mounting faces, corrosion resistant steel, bronze, or other items not normally painted.

f. Factory paint electrical and mechanical equipment in accordance with the manufacturer's best standard practice for the specified environment.

2.6 IDENTIFICATION PLATES

Furnish and install identification plates. Provide non-corrosive metal identification plates with clearly legible permanent lettering giving the manufacturer's name, model number, serial number, capacity in pound units, and other essential information or identification.

2.6.1 Markings on Crane, Trolley, and Hook

To avoid operation of the crane in the wrong direction, affix the appropriate directions (NORTH, SOUTH, EAST, and WEST) with arrows on both sides of the bridge and both sides of trolley, as applicable. Markings must be visible by the operator and from the loading point. Labels on the controls must have corresponding directional (NORTH, SOUTH, EAST, and WEST) markings. Markings must agree with the markings on controller. Do not indicate directional arrows on controller.

Mark the hook rated capacity in pound units on both sides of the hoist load block.

2.7 ELECTRICAL ASSEMBLY

Installation of all electrical wiring, conduit, and components must be performed in accordance with the requirements of NFPA 70. As a minimum, items a. through g. below must be followed:

a. All electrical connections must be installed in accordance with NFPA 70 Articles 110.14 or 430.9, as applicable, or as recommended by the device manufacturer.

b. Crimped terminal lugs, if used, must be properly sized for the wire and installed using the device(s) – e.g., crimping tool and indenter – recommended by the terminal lug manufacturer.

c. All spare conductors must be identified as spare conductors, and must have their ends insulated to preclude accidental contact with energized equipment.

d. Bonding straps and equipment grounding conductors must be connected to engineered ground points, have all paint removed from their termination points, or have tooth lockwashers (star lockwashers) installed, to insure proper grounding of the equipment.

e. Rigid Polyvinyl Chloride conduit may be used to protect festoon cable from physical damage when the cable is run along the footwalk of the crane, provided that only sections of conduit are used.

f. Festoon cable must be installed with suitable strain relief and protected from physical damage in accordance NFPA 70 Article

610.11(E)(1). This includes damage from chafing against the crane structure and any other type of damage that may be incurred.

g. Fiber optic cable must be installed in accordance with the manufacturer's installation guidelines. However, at a minimum the following guidelines must be adhered to: no sharp bends (bend radii must be greater than 1 inch or as prescribed by the manufacturer), avoid tight loops, no zip ties, and no stretching of cable.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, and before performing any work, verify all dimensions in the field. The Contractor is responsible for the coordination and proper relation of the contracted work to the building structure and to the work of all trades. Verify all dimensions of the building that relate to fabrication of the crane and notify the Contracting Officer of any discrepancy before finalizing the crane order.

3.2 ERECTION AND INSTALLATION

Perform the entire crane system erection in accordance with manufacturer's instructions under the full-time supervision of the manufacturer's representative.

3.2.1 Mechanical Alignment

Align motors, couplings, brakes, gear boxes, and drive components in accordance with manufacturer's instructions.

3.2.2 Electrical Adjustments

Adjust control system in accordance with manufacturer's instructions. Store a copy of all Control Parameter Settings (PLC, VFD). Provide the final settings and configurations data on the Complete Schematic Wiring Diagram, including but not limited to, timer settings, resistor tap settings, potentiometer settings, test-point voltages, supply voltages, motor voltages, motor currents. Provide the test conditions such as ambient temperature, motor load, date performed and person performing the adjustments as part of the Operational Tests report.

3.2.3 Field Welding

Perform welding indoors, where possible. Surface of parts to be welded must be free from rust, scale, paint, grease, and other foreign matter. Minimum preheat and interpass temperatures must conform to the requirements of AWS D14.1/D14.1M.

3.2.4 Field Painting

Perform painting indoors, where possible. Field painting (including touch-up) must conform to the requirements of the coating manufacturer and as specified in paragraph PAINTING SYSTEM.

3.3 FIELD QUALITY CONTROL

3.3.1 Post-Erection Inspection

After erection, the Contractor, the Activity Crane Inspector/Test Director, and the Contracting Officer must jointly inspect the crane bridge and hoist systems and components to verify compliance with specifications and approved submittals. Notify the Contracting Officer 14 days before the inspection. Provide for approval a report of the inspection indicating the crane is considered ready for operational tests.

Document the results of this inspection and submit the post-erection inspection report to the Contracting Officer for approval.

3.3.2 Operational Tests

Check the clearance envelope of the entire crane prior to picking or traversing any load to ensure there are no obstructions. Test the systems in service to determine that each component of the system operates as specified, is properly installed and adjusted, and is free from defects in material, manufacture, installation, and workmanship. Rectify all deficiencies disclosed by testing and retest the system or component to prove the crane is operational. The Contractor must furnish operating personnel, instruments, and other apparatus necessary to conduct field tests on each crane.

3.3.2.1 No-Load Test

Raise and lower each hook through the full range of normal travel at rated speed for three complete cycles. Raise and lower each hook, testing other speeds of the crane. Verify proper operation of hoist limit switches. Operate the bridge and trolley in each direction the full distance between end stops and bring bumpers into contact with the end stops. Operate through the entire speed range and verify proper brake operation. Verify correct operation of all indication and ancillary devices.

3.3.3 Test Data

Submit all crane test data recorded on appropriate test record forms suitable for retention for the life of the crane. Record operating and startup current measurements for hoist, trolley, and bridge motors using appropriate instrumentation (i.e., clamp-on ammeters). Compare recorded values with design specifications or manufacturer's recommended values; abnormal differences (i.e., greater than 10 percent from manufacturer's or design values) must be justified or appropriate adjustments performed. In addition, note, investigate, and correct any high temperatures or abnormal operation of any equipment or machinery. Record hoist, trolley, and bridge speeds during each test cycle.

3.3.4 Hook Tram Measurement

Establish a throat dimension base measurement by installing two tram points and measuring the distance between these tram points (plus or minus 1/64 inch). Record this base dimension. Measure the distance between tram points before and after load test. An increase in the throat opening from the base measurement is cause for rejection.

3.3.5 Load Tests

a. Perform the following tests, as specified below.

b. Test loads used in this section are defined as the following:

Wire rope run-in load (when applicable): 25 - 50 percent of rated load.

Rated load test: 100 percent (plus 0 minus 10) of rated load.

Overload test:125 percent (plus 0 minus 5) of rated load.

c. Testing of cranes must be done with the use of test weights. The use of dynamometers in lieu of lifting test weights is not permitted. Each test weight for crane tests must be marked with a unique identification number and the weight in pounds. The weight marked must be the actual weight taken from the scale or other measuring device. Solid weights must be measured using calibrated equipment traceable to the National Institute of Standards and Technology (NIST), with a minimum accuracy of plus or minus two percent (i.e., indicated weight must be within plus or minus two percent of actual weight). A list of test weights, with identification numbers and weights, must be retained. The list must include the type and serial number (or other identifier) of the weighing device(s) used to weigh the test weights. Where a lifting attachment supports multiple test weights (e.g., stacked weights or multiple weights suspended from a padeye), the total capacity must be marked on the attachment. All rigging gear must meet OSHA and ASME requirements.

3.3.5.1 Wire Rope Run-In

The primary purpose of this procedure is to exercise the newly installed wire rope.

Place the load on the hook. Start at ground level and hoist up to one foot below upper limit at slow speed. Hoist down to lower limit at slow speed. Repeat hoisting and lowering of the load for approximately 10 hoisting cycles, increasing the speed for each cycle. During this test, the capacity overload lockout should not activate.

3.3.5.2 Rated Load Test

3.3.5.2.1 Hoist

a. Static Load Test: With the trolley in the center of the bridge span, raise the test load approximately one foot. Hold the load for 10 minutes. Rotate the load and hook 360 degrees clockwise and counterclockwise to check bearing operation with no binding. Observe for lowering of the load, which may indicate a malfunction of hoisting components or brakes. Verify that maximum beam and girder deflections do not exceed CMAA 74 and MHI MH27.1 design limits, as applicable.

b. Dynamic Load Test: Raise and lower test load through the full lift range and visually observe smooth control and acceleration between points. Completely stop the machinery at least once in each direction to ensure proper brake operation.

c. Hoist Mechanical Load Brake (or Self-locking Worm Gear): Raise test

load approximately 5 feet. With the hoist controller in the neutral position, release (by hand) the holding brake. Document the method used to release the holding brake. The load brake must hold the test load. Again, with the holding brake in the released position start the test load down at slow speed and return the controller to the "off" position as the test load lowers. The load brake must stop and hold the test load.

d. Hoist Loss of Power Test: Raise the test load to approximately 8 feet. While slowly lowering the test load, disconnect the crane's power source. Verify that the test load does not lower and that the brake is set.

3.3.5.2.2 Trolley

Operate the trolley (if space is available) the full distance of the bridge rails in each direction with a test load on the hook. Check proper functioning through the range of speeds. Verify proper brake action and stopping distance.

3.3.5.2.3 Bridge

With a test load on the hook, operate the bridge for the full length of the runway (if space is available) in one direction with the trolley at the far end of the bridge, and in the opposite direction with the trolley at the opposite end of the bridge. Use extreme caution. Check proper functioning through the range of speeds. Check for any binding of the bridge end trucks. Verify proper brake action and stopping distance. Record deficiencies. Secure from testing if deficiencies are found.

3.3.5.2.4 Trolley Loss of Power Test

Raise the test load approximately midway between the trolley and any permanent obstruction on the operating floor. Starting at a safe distance from walls or other obstructions, attain a slow speed of trolley travel. While maintaining a safe distance from obstructions, disconnect the main power source at the wall mounted safety switch (disconnect) to simulate a power failure. Verify that the trolley stops and that the brake sets properly. Measure the distance required for the trolley to stop.

3.3.5.2.5 Bridge Loss of Power Test

Raise the test load approximately midway between the trolley and any permanent obstruction on the operating floor. Starting at a safe distance from walls or other obstructions, attain a slow speed of bridge travel. While maintaining a safe distance from obstructions, disconnect the main power source at the wall mounted safety switch (disconnect) to simulate a power failure. Verify that the bridge stops and that the brake sets properly. Measure the distance required for the bridge to stop.

3.3.5.3 Overload Test

3.3.5.3.1 Hoist

Disconnect or adjust the overload limit device to allow the hoist to lift the test load. Verify proper operation of the overload limit device after it is reconnected.

a. Static Load Test: With the trolley in the center of the bridge span,

raise the test load approximately one foot. Hold the load for 10 minutes. Rotate the load and hook 360 degrees clockwise and counterclockwise to check bearing operation with no binding. Observe for lowering of the load, which may indicate a malfunction of hoisting components or brakes.

b. Dynamic Load Test: Raise and lower test load and visually observe smooth control. Stop the load during raising and lowering to verify that the brakes holds the load.

c. Hoist Mechanical Load Brake (or Self-locking Worm Gear): Raise test load approximately 5 feet. With the hoist controller in the neutral position, release (by hand) the holding brake. Document the method used to release the holding brake. The load brake must hold the test load. Again, with the holding brake in the released position start the test load down at slow speed and return the controller to the "off" position as the test load lowers. The load brake must stop and hold the test load.

d. Hoist Loss of Power Test: Raise the test load to approximately 8 feet. While slowly lowering the test load, disconnect the crane's power source. Verify that the test load does not lower and that the brake is set.

3.3.5.3.2 Trolley

Operate the trolley the full distance of the bridge rails in each direction with a test load on the hook (one cycle) through the range of speeds. Verify proper brake action.

3.3.5.3.3 Bridge

With a test load on the hook, operate the bridge for the full length of the runway in one direction with the trolley at the extreme end of the bridge, and in the opposite direction with the trolley at the opposite extreme end of the bridge (one cycle). Check proper functioning through the range of speeds. Check for any binding of the bridge end trucks and verify proper brake action. Record deficiencies. Secure from testing if deficiencies are found.

3.4 MANUFACTURER'S FIELD SERVICE REPRESENTATIVE

Furnish a qualified experienced manufacturer's field service representative to supervise the crane installation, assist in the performance of the on-site testing, and instruct personnel in the operational and maintenance features of the equipment.

3.5 OPERATION AND MAINTENANCE MANUALS

Provide three hard copies of operation and three hard copies of maintenance manuals for the equipment furnished along with three electronic copies (PDF) of each on a Compact Disc. Provide one complete set prior to performance testing and final copies upon acceptance. Provide operation manuals that detail the step-by-step procedures required for system startup, operation, and shutdown. Include the manufacturer's name, model number, parts list, and brief description of all equipment and basic operating features. List in the maintenance manuals routine maintenance procedures, including weekly, monthly, semi-annual, and annual required maintenance items, possible breakdowns and repairs, and

troubleshooting guides. Also include as-built drawings, piping and equipment layout, design calculations, Control Parameter Settings and printouts of any software, and simplified wiring and control diagrams of the system as installed. Secure approval of operation and maintenance manuals prior to the field training course (as applicable).

3.6 FIELD TRAINING

Conduct a training course for eight operating and maintenance staff and provide a copy of the training material to each participant. Provide a training period consisting of a total of eight hours of normal working time and starting after the system is functionally completed but prior to final acceptance. Cover all pertinent points involved in operating, starting, stopping, and servicing the equipment, including all major elements of the Operation and Maintenance Manuals. Demonstrate in course instructions all routine maintenance operations such as lubrication, general inspection, and basic troubleshooting, and safety.

Provide a minimum four hour training session on the Variable Frequency Drives (VFDs) discussing maintenance, troubleshooting of fault codes, theory of operation, and adjustment of crane parameters. This training session will be for an audience of approximately eight people.

3.7 FINAL ACCEPTANCE

Final acceptance of crane system will not be given until Contractor has successfully completed all testing operations, corrected all material and equipment defects, made all proper operation adjustments, and removed paint or overspray on wire rope, hook, and electrical collector bars.

Warranty period must coincide with actual beneficial occupancy of **each Type G or Type H magazine**. Rapid warranty response, within 3 hours is required for the first year.

-- End of Section --