DEPARTMENT OF HOMELAND SECURITY  
UNITED STATES COAST GUARD  
ENGINEERING SERVICES DIVISION   
  
  
  
  
  
SPECIFICATIONS

FOR

REBUILD KINKORA RANGE REAR LIGHT

U.S. COAST GUARD AIDS TO NAVIGATION TEAM

PHILADELPHIA

PHILADELPHIA, PENNSYLVANIA

OCTOBER 2018

COMMANDING OFFICER

UNITED STATES COAST GUARD

CIVIL ENGINEERING UNIT, RM 2179

1240 EAST NINTH STREET

CLEVELAND, OHIO 44199-2060

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DIVISION 1   
GENERAL REQUIREMENTS   
(January 2012 Version)

# SECTION 01 11 00 SCOPE OF WORK Scope of Work

Work Included: This project will entail the rebuilding of the Kinkora Upper Range Rear tower. Major items of work shall include the following:

1.1 Demolition: Remove all solar panels, optics and batteries with the stainless steel enclosure and deliver to ANT Philadelphia as salvaged equipment. Disassemble and remove the steel tower and equipment platform in its entirety. Anchor bolts shall be cut-off flush with the top of the existing concrete foundation. The concrete foundation shall remain.

1.2 Survey: Obtain the services of a State of New Jersey licensed marine surveyor to position and site the new tower. The tower shall be centered on the projected channel range line. Coordinate with the Army Corps of Engineers, North Atlantic Philadelphia District, to verify the channel coordinates.

1.3 Foundation: Place and drill the helical piles at the locations indicated and construct the new concrete foundation. Foundation work shall include excavation, rebar placement, formwork and placement to construct the foundation.

1.4 New Tower: Fabricate and install the new tower as shown on the structural drawings. Fabricate members to the dimensions indicated. Fabrication of optics stand, solar panel stand and railing on the upper platform shall be included. Erect and install tower using bolts, nuts and washers indicated.

1.5 Equipment Installation: Install solar panels, optics and the battery box with batteries on the tower platform. All wiring will be performed by Coast Guard personnel.

1.6 Lightning Protection: Provide and install lightning protection on the tower as shown. Lightning protection to include installation of air terminals, grounding cable, grounding rods and associated fittings for a complete lightning protection installation.

1.7 Work associated with these items is described in the following specification sections and/or is shown on the contract drawings. Incidental work items not listed above and necessary for completing the project shall be included.

2. DRAWINGS: Drawings and the accompanying specifications are the property of the Government and comprise legal documentation that pertains exclusively to this project. Drawings will be made available in a format determined by the solicitation method. CEU Cleveland will not provide hard copies of drawings.

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| --- | --- |
| 2.1 Construction Drawings: | 8505-D, sheets 1 through 10 of 10 |

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SECTION 01 11 16  
WORK BY OTHERS  
Work by Others

1. Work not included in the Contract: Non-contractor personnel will accomplish the following work items necessary for completion of the project. However, the contractor must coordinate accomplishment of these work items with the appropriate parties noted below in accordance with Section 01 14 16, “Coordination”.

1.1 Work by Coast Guard Personnel: Coast Guard personnel will test and assure aids to navigation (AtoN) equipment is working properly. The contractor shall set and secure equipment, battery boxes and solar panels on top of the tower and perform all electrical installations as indicated.

SECTION 01 14 00  
CONTRACTOR WORK HOURS  
Contractor Work Hours

1. WORK HOURS: Work hours will be limited to Monday through Friday, 0730 to 1700. Access will be limited by the operation hours of the Waste Management GROWS North Landfill, 1000 New Ford Mill Rd, Morrisville, PA 19067, (866) 909-4458.

2. SATURDAY, SUNDAY AND HOLIDAYS: The contractor shall provide the Contracting Officer's Representative at least forty-eight hours advance notice prior to working on weekends or Federal holidays. Access to the North Landfill outside of normal operating hours shall be coordinated directly with Waste Management. The Government may reject any such request without impacting the completion time of the contract.

3. CONTRACT COMPLETION: The contractor shall complete work within the time frame indicated upon issuance of the Notice to Proceed. Limitations imposed by these work hours will not entitle the Contractor additional time to complete the project. Refer to FAR Clause 52.211-10 "Commencement, Prosecution and Completion of Work".

SECTION 01 14 13  
PRE-BID SITE VISITS  
Pre-Bid Site Visits

1. GENERAL: Bidders are responsible for visiting the site to field verify existing conditions and determine actual dimensions and the nature of the work required. Failure to visit the site does not relinquish the bidder from determining the extent and scope of the work required and estimating the difficulty and cost to complete the project. Requests for equitable adjustments, in either time or money, arising from failing to field verify site conditions may be denied. Provisions regarding the site visit requirements are outlined in FAR Clause 52.236-3 “Site Investigation and Conditions Affecting the Work”

2. SITE VISIT: Arrange the pre-bid site visit to verify existing conditions with the Officer in Charge, U.S. Coast Guard ANT Philadelphia (215) 271-4962. The Officer in Charge may limit hours of access or levy certain restrictions regarding visits to the site.

SECTION 01 14 16  
COORDINATION  
Coordination

1. AIDS TO NAVIGATION EQUIPMENT

1.1 General: Coordinate any work affecting the tower or obstructing or blocking the optic from view with ANT Philadelphia at least one week prior to any work directly affecting the operation of ATON equipment.

1.2 Notify the Commander, Commander, Fifth Coast Guard District (dpw) at (757) 398-6486 or [CGD5waterways@uscg.mil](mailto:CGD5waterways@uscg.mil) for issuance of “Notice to Mariners” a minimum of 10 (ten) days in advance of taking any AtoN equipment out of service. The duration in which AtoN equipment is out of service shall be limited as indicated and/or dictated by (dpw). Installation and operation of temporary AtoN equipment will be required when the outage will exceed the duration prescribed.

SECTION 01 14 14  
PRE-CONSTRUCTION SITE CONDITIONS  
Pre-Construction Site Conditions

1. SITE CONDITION VERIFICATION: The Contractor shall verify the conditions of the existing site, equipment and facilities potentially affected by the work under this contract and photograph and/or videotape the conditions in order to document their pre-construction condition. Copies of the photos and videos shall be submitted to the Contracting Officer prior to starting work.

SECTION 01 14 19  
FIELD ADJUSTMENTS  
Field Adjustments

1. The Contracting Officer’s Representative may authorize field adjustments. Field adjustments are those alterations that do not affect time, price, or intent of the contract documents. All field adjustments shall be documented in the Daily Reports and on the As-Built Drawings.

SECTION 01 18 14  
BUILDING PERMITS  
Building Permits

1. NO BUILDING PERMITS from state or local governments are required for work performed on federal property. Courtesy permits may be obtained at the Contractor's option. No payment will be made to the Contractor for any permit cost. Design changes to obtain courtesy permits, even at no cost, will not be allowed without written approval of the Contracting Officer.

SECTION 01 18 17  
ENVIRONMENTAL PERMITS  
Environmental Permits

1. The required environmental permissions have been obtained for this project. The contractor will not be required to obtain permits.

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SECTION 01 26 13  
REQUESTS FOR INFORMATION  
Request for Information

1. SUMMARY: Section Includes: Administrative requirements for requests for information.

2. DEFINITIONS:

A. Request for Information: A document submitted by the Contractor requesting clarification of a portion of the contract documents, hereinafter referred to as RFI (Request for Information).

B. Proper RFI’s: A properly prepared request for information shall include a detailed written statement that indicates the specific Drawings or Specification in need of clarification and the nature of the clarification requested.

1. RFI’s shall be sequentially numbered.

2. Drawings shall be identified by drawing number and location on the drawing sheet.

3. Specifications shall be identified by Section number, page and paragraph.

C. Improper RFI’s: RFI’s that are not properly prepared.

1. Improperly prepared RFIs will not be processed by the Contracting Officer, but will be returned unprocessed.

D. Frivolous RFI’s: RFI’s that request information that is clearly shown on the Contract Documents.

1. Frivolous RFI’s may be returned unprocessed.

3. CONTRACTOR’S REQUESTS FOR INFORMATION:

A. When the Contractor is unable to determine from the Contract Documents, the material, process or system to be installed, the Contracting Officer shall be requested to make a clarification of the indeterminate item.

1. Wherever possible after contract award, such clarification shall be requested at the next site visit by the Contracting Officer’s Representative (COR), with the response entered on the daily reports. When clarification at the COR’s site visit is not possible either because of the urgency of the need, or the complexity of the item, Contractor shall prepare and submit an RFI to the Contracting Officer.

B. Contractor shall endeavor to minimize the number of RFIs. In the event that the process becomes unwieldy, in the opinion of the Contracting Officer because of the number and frequency of the RFIs submitted, the Contracting Officer may require the Contractor to abandon the process and submit future requests as either submittals, substitutions or requests for change.

C. RFIs shall be submitted on the form provided by the Contracting Officer. Forms completely filled in, and if prepared by hand, shall be fully legible after photocopying or fax transmission. Each page of the attachments to RFIs shall bear the RFI number in the upper right corner.

D. RFIs shall be originated by the Prime Contractor.

1. RFIs from subcontractors or material suppliers shall be submitted through, reviewed by, and signed by the Prime Contractor prior to submitting to the Contracting Officer.

2. The Contracting Officer will neither act on nor respond to RFIs received directly from subcontractors or suppliers.

E. Contractor shall carefully study the Contract Documents to assure that the requested information is not available therein. RFIs which request information available in the Contract Documents will be deemed either Improper or Frivolous as defined above.

F. In cases where RFIs are issued to request clarification of coordination issues, for example, pipe and duct routing, clearances, specific locations of work shown diagrammatically, and similar items when feasible, Contractor shall fully lay out a suggested solution using drawings or sketches drawn to scale, and submit with the RFI.

G. RFIs shall not be used for the following purposes:

1. To request approval of submittals.

2. To request approval of substitutions.

3. To request changes which entail additional cost or credit.

4. To request different methods of performing work than those drawn and specified.

H. In the event the Contractor believes that a clarification by the Contracting Officer results in additional cost or time, the Contractor shall not proceed with the work indicated by the RFI until a modification is prepared and approved. RFIs do not automatically justify a cost increase in the work or a change in the project schedule.

1. Answered RFIs shall not be construed as approval to perform extra work.

I. Contractor shall prepare and maintain a log of RFIs, and at any time requested by the Contracting Officer, Contractor shall furnish copies of the log showing outstanding RFIs. Contractor shall note unanswered RFIs in the log.

J. Contractor shall allow up to 14 days review and response time for RFIs, however, the Contracting Officer will endeavor to respond in a timely fashion to RFIs.

K. The Government reserves the right to issue a change order to expedite the work per FAR Clause 52.243-4, Changes.

4. CONTRACTING OFFICER’S RESPONSE TO RFIs:

A. Contracting Officer will respond to RFIs on one of the following forms:

1. Proper RFIs:

a. Change Order

b. Request for Proposal

2. Improper or Frivolous RFIs:

a. Unprocessed RFIs will be returned with a stamp or notation: Not

Reviewed.

3. Answers to properly prepared RFIs may be made directly upon the RFI form with supplementary instructions as necessary.

SECTION 01 31 19   
PROJECT MEETINGS  
Project Meetings

1. LOCATION: Project meetings will be conducted either on-site or with a conference call. The following meetings may be held:

1.1 Pre-Construction Conference: After award of a contract, the Coast Guard will arrange a conference with the contractor, and necessary Coast Guard personnel. The purpose of this conference is to orient the Contractor to Government procedures for wage rates, contractual and administrative matters, and to discuss specific issues regarding actual construction.

1.2 Progress and Technical Review Meetings: These meetings generally take place at the project site. Either party may request a meeting to review the progress of the project and/or review or clarify the technical requirements of the specifications.

SECTION 01 32 16  
CONSTRUCTION SCHEDULE, SCHEDULE OF VALUES,  
AND PROGRESS SCHEDULE  
Construction Schedule, Schedule of Values and Progress Schedule

1. **In accordance with the Notice to Proceed letter**, the Contractor shall submit the following:

a. Construction Schedule-This schedule shall be prepared using a horizontal bar graph with time scale. It shall be in an industry accepted Project Management format and shall accurately display:

1. All major categories of work to be performed within the required contract completion date broken out in sufficient detail to track progress throughout the life of the contract. Major work categories should include but are not limited to mobilization, carpentry, plumbing, mechanical, electrical, roofing, concrete, site work, and demobilization. In addition to construction activities, procurement times for critical items, submittal turnaround time, mobilization, final inspection, punchlist work, and demobilization shall be shown on the schedule.

2. The duration of each work category.

3. Any concurrent work categories.

b. Schedule of Values-This schedule shall be prepared as a **detailed** cost breakdown of the contract price and be submitted with the Construction Schedule. This schedule shall include but not be limited to costs of materials, equipment, and labor for all major work categories shown on the Construction Schedule. The Contractor shall adhere to the following guidelines when developing the Schedule of Values.

1. Format - The line items in the Schedule of Values **shall** be the same as that of the Construction Schedule.

2. Bonds - Bonding costs will only be paid in a lump sum if they are broken out separately and included with the schedule of values. The Contractor shall provide evidence that he has furnished full payment to the surety.

3. Materials - To request progress payments for materials delivered to the construction or fabrication site, the particular category of work associated with the materials must be broken down into separate material and labor costs.

2. UPDATES: **Each month and /or with each progress payment request**, the Contractor shall submit the following:

a. **Progress Schedule**-This schedule shall be an update of the Construction Schedule. It shall show the current schedule of all work.

1. Modifications - If modifications are made to the contract, the work added shall be tracked separately from the original Construction Schedule and shall maintain its individuality on the Progress Schedule throughout the life of the contract. Progress Payment requests shall not lump modification costs into the original contract price.

SECTION 01 32 26  
CONSTRUCTION DAILY REPORTS  
Construction Daily Reports

1. GENERAL: **The Contractor shall complete a Daily Report for each and every day after mobilization.** The importance of an accurate, fully detailed Daily Report, promptly delivered to the designated On-Site Representative cannot be overemphasized. The report shall provide an accurate cumulative summary of the history and performance of the work. The Daily Report shall document weather; work hours; work in-place; inspections and tests conducted, and their results; dimensional checks; equipment and material checks; data on workers by classification; the mobilization and demobilization of construction equipment; materials delivered to the site; and any other pertinent noteworthy event; e.g., personnel injury, site visit by Coast Guard personnel, etc.

2. RESPONSIBILITY: The Daily Reports play an important role in settling disputes and claims for both parties. For this reason the On-Site Representative and the Contractor's Superintendent, together, should review the report to ensure its completeness and accuracy. Each day's report shall be submitted to the On-Site Representative no later than 10:00 a.m. the following morning. The maximum allowable retainage will be enforced for late, sporadic or non-submission of Daily Reports. In the absence of an On-Site Representative the Contractor shall mail the Daily Reports directly to the Contracting Officer every Friday. Should the Daily Report indicate an accident, environmental issue, OSHA violation or any crisis the On-Site Representative deems important, the Report should be faxed immediately to the Contracting Officer at (216) 902-6278.

3. DESIGNATED ON-SITE REPRESENTATIVE RESPONSIBILITY: After a Notice to Proceed for site work has been issued the On-Site Representative shall complete a Daily Report for each day until the Contractor mobilizes. After the Contractor is at the site, the On-Site Representative shall ensure that the Contractor completes the Daily Report in accordance with Paragraphs 1 and 2 above. Any items of dispute or other notes the On-Site Representative feels appropriate shall be added to the Daily Report. The On-Site Representative is also responsible for informing the COR when the contractor fails to submit daily reports.

SECTION 01 33 00  
SUBMITTAL PROCEDURESSubmittal Procedures

1. GENERAL: The Contractor shall submit to the Contracting Officer (4) copies of submittals required by this specification and/or itemized on the **"List of Submittals"** found at the end of this division.

2. REQUEST: A **"CONTRACT ITEM ACCEPTANCE REQUEST"** shall accompany all submittals. All items shall be individually listed and clearly identified, referencing the applicable Section and Paragraph. A copy of this form is located at the end of this division and may be reproduced as needed.

2.1 Up to eight (8) items may be listed on an individual acceptance request. Number each Contract Item Acceptance Request consecutively *(Submittals # 1, 2, etc.)* and re-submittals with letters *(Submittal #1A is the first re-submittal of Submittal #1)*.

2.2 Submittals shall be forwarded to the Contracting Officer. The contractor **shall allow 14 calendar days**, excluding mailing time, for the review process in the Construction Schedule and all project planning. In instances where submittal review must be expedited, the Contractor may annotate the Contract Item Acceptance Request as "Urgent" and provide a FAX number for prompt return. The Coast Guard will make every effort to accelerate the review of each urgent submittal; however, the Contractor should not anticipate a reduced time schedule and shall plan project progress accordingly.

3. DEVIATIONS

3.1 Deviation from specification**:**

3.1.1 The Contracting Officer will consider requests for deviations/substitutions only if submitted within fifteen (15) calendar days after award.

3.1.2 Deviations may be considered when a product becomes unavailable through no fault of the Contractor.

3.1.3 The Contractor shall document each request with complete data substantiating compliance of proposed deviation with the Contract documents*. Request for deviation* ***shall not*** *be submitted on a Request for Information (RFI) form.*

3.1.4 A request constitutes a representation that the Contractor:

3.1.4.1 Has investigated proposed product and determined that it meets or exceeds quality level of specified product.

3.1.4.2 Will provide the same warranty for deviation as for specified product.

3.1.4.3 Will coordinate installation and make changes to other work which may be required for the work to be completed at no additional cost to the Government.

3.1.4.4 Waives claims for additional costs or time extension which may subsequently become apparent.

3.1.4.5 Will reimburse the Government for review or redesign services associated with re-approval by the Contracting Officer.

3.1.5 If the deviation has a lesser value than the product originally specified, the Contractor shall provide a credit to the Government.

3.1.6 Deviations will not be considered when they are indicated or implied on Shop Drawings or Product Data submittals, without a separate written request, or when acceptance will require revisions to the Contract documents.

3.2 Deviation submittal procedures:

3.2.1 The Contractor shall mark the “Deviation” block on the Contract Item Acceptance Request (CIAR) form and provide the information stated in Paragraph 3.1.

3.2.2 The Contractor shall submit shop drawings, product data, and certified test results attesting to proposed product equivalence. Burden of proof is on the Contractor.

3.2.3 The Contracting Officer will then review the “deviation” request and either accept or reject the deviation. The Contracting Officer’s acceptance of the deviation signifies that the Contractor has provided the information required in Paragraph 3.1. If a credit is due the government, the Contracting Officer will notify the Contract Specialist and the deviation will be processed utilizing the Change Request procedures for a modification to the contract/task order.

3.2.4 The Contracting Officerwill notify the Contractor of acceptance/rejection of the deviation via an accepted or rejected CIAR. The Contracting Officer will notify the Contractor, in writing, if a modification to the contract is required.

3.2.5 If a request for deviation is received without the documentation stated above, the Contracting Officer will return the submittal to the contractor for the required information.

4. ACCEPTANCE: Submittals will be stamped "Accepted," "Accepted with Comments," or "Resubmit". Acceptance, Acceptance with comments or Resubmit for each item will be indicated on the Contract Item Acceptance Request form and one copy returned to the Contractor.

4.1 **Prompt re-submittal of items is required.** The Contractor shall furnish a new Contract Item Acceptance Request numbered in accordance with the requirements of paragraph 2.1.

5. DEFECTIVE WORK: Acceptance of Submittals **does not** restrict the Government's right to reject departures from contract requirements, use of damaged or improperly installed items/materials, or latent defects, nor does it prejudice the Government's rights of rejecting any work found defective at Final Inspection and Acceptance.

5.1 Work started or completed prior to submittal acceptance is **solely** at Contractor's risk and may jeopardize contract performance.

SECTION 01 35 29  
SAFETY PROGRAM  
Safety Program

1. GENERAL: The Contractor is wholly responsible for work site safety. The Contractor shall implement a safety program that protects the lives and health of personnel in the construction area, prevents damage to property, and avoids work interruptions. The Contractor shall provide appropriate safety barricades, signs, signal lights, etc. (see Section 01 56 00, “Lights, Signs & Barricades”) as well as complying with the requirements of all applicable Federal, State and Local safety laws, rules and regulations.

2. COMPLIANCE: The Contractor is specifically required to comply with the requirements of the U. S. Army Corps of Engineers "Safety and Health Requirements Manual" (EM 385-1-1, *latest version available*) and the “Accident Prevention” clause (FAR 52.236-13). Once accepted, this safety plan shall become part of the contract requirements. ***Note: This review/acceptance does not in any way relinquish the Contractor from responsibility for work site safety nor the obligation to comply with the OSHA regulations found in 29 CFR 1910 & 1926 or any other State or Local safety law, rule or regulation applicable to the contract work.*** *The Coast Guard will cooperate fully with the Department of Labor (Occupational Safety and Health Administration) in their enforcement of OSHA regulations.*

3. SAFETY PLAN: The Contractor **shall submit a written safety plan.** At a minimum, this plan shall describe the Contractor's general safety program and identify specific safety provisions for hazards incidental to the contract work; e.g., elevated working surfaces, working over water, working from floating work platforms, overhead crane operations, etc.

SECTION 01 51 00  
TEMPORARY UTILITIES  
Temporary Utilities

1. GENERAL: There are no utilities available on site. The contractor shall provide portable generation, water, portable toilets and other services necessary to complete the project.

2. SANITARY FACILITIES: It shall be the Contractor's responsibility to furnish and maintain approved portable toilet facilities for all Contractor personnel.

SECTION 01 55 00  
ACCESS ROADS AND PARKING  
Access Roads and Parking

1. ACCESS: The site is located at the far end of the Waste Management North Landfill and access will have to be cleared by the gate at the main entrance and the scrap yard section of the landfill. The access roads are unimproved and the roads/access drives within the scrapyard have no base course material. During wet conditions, the site is only accessible with all-wheel drive vehicles with high ground clearance

2. PARKING: The contractor shall arrange all parking and access as required for their personnel. All vehicle operations and parking shall comply with all applicable local regulations.

3. VEHICLE AND VEHICLE OPERATION: All vehicles, owned by the Contractor or employees of the Contractor, and operators of these vehicles, shall meet all state regulations for safety, noise, loading and minimum liability insurance.

SECTION 01 55 29  
STAGING AREAS AND ACCESS  
Staging Areas and Access

1. LOCATION: The Contractor shall construct the access drive and lay-down within the limits shown on the drawings. Any deviation from the areas identified shall be approved by Waste Management personnel. **The contractor will assume all liability for the security of materials and equipment stored on site.**

2. COORDINATION: The contractor shall coordinate the staging and storage areas for equipment and materials directly with the facility or site owners. The Coast Guard will not coordinate the storage and staging areas.

3. ADJACENT AREAS: The Contractor shall ensure that all land and vegetation adjacent to the staging area remain undisturbed and undamaged; all damages shall be repaired at no cost to the Government.

SECTION 01 57 23  
POLLUTION CONTROL  
Pollution Control

1. Volatile Organic Compound (VOC) Regulations: Contractors are required to comply with local, state and federal VOC compliance laws and regulations in the foregoing order of precedence. In order to comply with the provisions of the Clean Air Act, each state must have a State Implementation Plan. Some contractors may be required to abide by the provisions of a Title V Permit. Some contractors may be required by state or local law to operate under the terms of a Compliance Plan to reduce VOC Emissions.

1.1 In accordance with the Notice to Proceed Letter, the contractor will submit copies of any local, state or federal implementation plans, permits or compliance plans required/applicable to the use/application of VOCs at contractor's facility or offsite work places.

1.2 If no local, state or federal implementation plans, permits or compliance plans are required/applicable to the use/application of VOCs, then the contractor shall submit to the designated Contracting Officer a letter, notarized under oath, that such documents are not required.

1.3 If the use of paint is required the contractor shall submit to the Contracting Officer and in accordance with the Notice to Proceed Letter, certificates, specifications or manufacturing data verifying the VOC rating.

2. SPILL RESPONSE PLAN: The Contractor shall submit a Spill Response Plan covering all regulated materials brought to the site for execution of work and all wastes generated as a result of the work to the Contracting Officer. The plan shall include, at a minimum, the following: types and quantity of all substances covered under this plan; the reportable quantity (RQ) for each substance; the onsite storage location of each substance; the Contractor's spill response equipment, if applicable; procedures to be followed for responding to a spill, including initial responses to be taken; procedures to be followed in reporting a spill, including the names and telephone numbers for all federal, state, and local agencies/authorities to be notified; and the name, address, and telephone number (work, home, cell and pager) of all Contractor response and media relations personnel.

2.1 In the event of a spill or release, the Contractor shall be responsible for immediate implementation of the spill response plan and restoration of the site to pre-spill condition at no cost to the Government. The Contractor shall also immediately notify the Contracting Officer to coordinate further notifications.

SECTION 01 65 00  
RECOVERED MATERIALS NOTICE  
Recovered Materials Notice

1. GENERAL: It is the intent of CEU Cleveland to comply with the requirements of Section 6002 of the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act (RCRA or the Act) as amended, 42 U.S.C. 6962 and Executive Order 12873 as they apply to the procurement of the materials designated in paragraph 2.

2. DESIGNATED RECOVERED MATERIALS: It is the purpose of this section to designate items that are or can be made with recovered materials. These designated items can be found at <http://www.epa.gov/epaoswer/non-hw/procure/products.htm>.

3. CONTRACTOR RESPONSBILITY: The contractor should provide recycled materials to the extent practical, provided the materials meet all other requirements of the applicable specification section.

SECTION 01 66 16  
SAFETY DATA SHEETS AND MATERIAL HANDLING PROCEDURES  
Safety Data Sheets and Material Handling Procedures

1. DATA SHEETS: Submit a Safety Data Sheet (SDS) for all materials containing hazardous substances required for contract execution. Information provided in SDS’s shall meet the requirements of 29 CFR 1910.1200. MSDS’s require Contracting Officer review and acceptance prior to bringing these materials on site.

2. MATERIAL STORAGE: Limit the quantity of these materials stored on site to the amount needed for execution of work. Storage of excess materials will not be permitted. Assure that the storage of these materials comply with all applicable federal, state, and local laws and regulations and provide additional storage facilities (paint lockers, etc.) as required for the storage of such materials. Coordinate the physical location of storage areas with the On-site Representative prior to bringing these materials on site.

3. PROTECTIVE MEASURES: The contractor shall take all protective measures outlined on the MSDS’s and as required by federal, state, and local regulations to protect all personnel in the vicinity of the work area from exposure to these materials. The Contractor shall include any required protective measures in the Safety Plan (See Section 01 35 29, “Safety Program”). The Contracting Officer's Representative shall review protective measures prior to allowing use of these materials.

4. DISPOSAL OF EXCESS MATERIAL: The Contractor shall dispose of all excess hazardous materials as required by the MSDS and all applicable federal, state, and local laws and regulations.

SECTION 01 74 00  
GENERAL CLEANUP AND SITE RESTORATION OF WORK AREAS  
General Cleanup and Site Restoration of Work Areas

1. GENERAL: The Contractor shall remove and properly dispose of all trash and debris incidental to the contract work from the limits of government property, as well as all adjacent affected areas. The area shall be cleaned and secured at the end of each work day. All trash and debris must be containerized immediately. No loose debris will be allowed.

2. WORK AREA CLEANUP: At the end of each day the entire work area and all adjacent affected areas shall be thoroughly cleaned by removing all trash, debris, dust, etc. caused by the contract work. Any floor, wall or ceiling surfaces that may have been stained or soiled by the contract work shall be restored to pre-construction condition.

3. SITE RESTORATION: If at any time while performing the contract the Contractor causes damage or destruction to any portion of any Government facility or grounds; e.g., bulkheads, pavement, lawns, shrubbery, etc., it shall be the Contractor's responsibility to replace and/or restore the damage as approved by the Contracting Officer’s Representative at no additional cost to the Government.

4. POST CONSTRUCTION CLEANUP: Upon completion of the job, the Contractor shall clean up the job site, returning it to a state of cleanliness equal to or exceeding that in which it was found. The Contractor shall properly dispose of any trash, extra materials, dirt, debris, or other litter that remains. If the job site appearance is not to the satisfaction of the Contracting Officer’s Representative, final acceptance will not be approved.

SECTION 01 78 00  
AS BUILT DRAWINGS  
As-Built Drawings

1. GENERAL: Maintain one full size set of contract drawings to record variations from the original design. **All deviations shall be neatly and clearly marked in** **RED** on these drawings to show work and/or materials actually provided. As Built drawings shall be **updated** as work progresses and kept at the work site for the duration of the contract. These drawings shall be available for Contracting Officer review upon request.

2. DISCOVERED UTILITIES: Indicate the exact location of any **underground utility lines** **discovered in the course of the work** on the As-Built drawings.

3. PERMITTED VARIATIONS: As Built drawings shall reflect the actual construction and materials provided when alternative materials or work methods are allowed in the specifications and/or drawings or if the scope is altered by award of bid items, subsequent changes or modifications.

4. STANDARDS: Variations shown on As Built drawings shall be neat, clear and conform with standard drafting practices. Mark-ups shall include supplementary notes, legends, and details necessary to convey the exact representation of construction actually provided**. To comply with Computer Assisted Design (CAD) practices, only full size AS BUILT drawings are acceptable.**

5. SUBMITTAL: Submit As Built drawings for Contracting Officer’s acceptance upon completion of the contract. **Final payment will not be until all required As-Built drawings are accepted.** Maximum retention shall be withheld for late or incomplete As Built drawings.

LIST OF SUBMITTALS  
List of Submittals

|  |  |  |  |
| --- | --- | --- | --- |
| SECT | PARA | ITEM | general use column |
| 01 14 14 | 1 | Pre-Con Site Conditions |  |
| 01 32 16 | 1.a | Construction Schedule |  |
|  | 1.b | Schedule of Values |  |
|  | 2.a | Progress Schedule |  |
| 01 35 29 | 3 | Safety Plan |  |
| 01 57 23 | 1.1 | State Implementation Documentation |  |
|  | 1.2 | Notarized Letter |  |
|  | 1.3 | VOC rating documentation |  |
|  | 2 | Spill Response Plan |  |
| 01 66 16 | 1 | MSDS |  |
|  | 3 | Protective Measures |  |
| 01 78 00 | 5 | As-Built Drawings |  |
| 02 21 13 | 1.2.1 | Survey Reports | SD-06 |
| 02 23 10 | 1.1.1 | Clearing and Grubbing Plan | SD-01 |
| 02 41 13 | 1.2.1 | Demolition Plan | SD-01 |
| 03 11 13 | 1.2.1 | Formwork/Form Removal Schedule | SD-02 |
|  | 1.2.2 | Form Materials | SD-03 |
|  | 1.2.3 | Calculations | SD-05 |
| 03 20 00 | 1.2.1 | Reinforcement Layout | SD-02 |
|  | 1.2.2 | Reinforcing Steel | SD-03 |
|  | 1.2.3 | Reinforcing Steel | SD-07 |
| 03 30 00 | 1.3.1 | Cementitious Material/Chemical Admixtures | SD-03 |
|  | 1.3.2 | Mixture Properties | SD-05 |
|  | 1.3.3 | Mixture Proportions, Fly ash, GGBF slag, Aggregates, Air content, Slump, Cement, Pozzolan, Compressive strength, Water, Sampling plan, Strength test | SD-06 |
|  | 1.3.4 | CQC Personnel, Ready Mix Plant | SD-07 |
| 05 12 40 | 1.2.1 | Tower Assembly Drawings | SD-01 |
|  | 1.2.2 | Tower Fabrication | SD-02 |
|  | 1.2.3 | Welding Electrodes and Rods | SD-03 |
|  | 1.2.4 | Bolts, Nuts, Washers | SD-06 |
|  | 1.2.5 | Steel, Bolts, Nuts, Washers, Galvanizing, AISC Plant Quality, Welding Procedures and Qualifications, Welding Electrodes and Rods | SD-07 |
| 05 50 13 | 1.2.1 | Fabrication and Installation Drawings | SD-02 |
| 05 51 33 | 1.2.1 | Ladders, Installation Drawings | SD-02 |
|  | 1.2.2 | Ladders, Safety Devices | SD-03 |
|  | 1.2.3 | Ladder Assembly, Fabricators | SD-07 |
|  |  |  |  |

# LIST OF SUBMITTALS (Cont.)

|  |  |  |  |
| --- | --- | --- | --- |
| SECT | PARA | ITEM | general use column |
| 06 73 01 | 1.2.1 | Installation Drawings, Template | SD-02 |
|  | 1.2.2 | FRP Grating Spec. Sheet, Load Tables, Clips, Anchorage | SD-03 |
|  | 1.2.3 | Bearing Strength Testing, Flexural Properties, Ultraviolet Testing, Shear Strength, toxicity Testing, Tensile Properties, Coefficient of Linear Thermal Expansion | SD-06 |
|  | 1.2.4 | Manufacturer’s Sample Warranty, Anchorage System | SD-07 |
|  | 1.2.5 | Shipping, Handling, Assembly Procedures | SD-08 |
|  | 1.2.6 | Certification of Installation | SD-09 |
|  | 1.2.7 | Manufacturer’s Warranty | SD-11 |
| 26 00 00 | 1.3.1 | Electrical Equipment and Materials | SD-03 |
|  | 1.3.2 | Test Results | SD-06 |
|  | 1.3.3 | Contractor Certifications | SD-07 |
| 26 41 13 | 1.1.1 | Terminals, Mounting Accessories, and Layout of Lightning Protection System | SD-02 |
|  | 1.1.2 | System Components | SD-03 |
|  | 1.1.3 | Field Quality Reports | SD-09 |
| 31 66 15 | 1.2.1 | Installation Certificates | SD-01 |
|  | 1.2.2 | Helix and Extension Sections, Equipment Data | SD-03 |
|  | 1.2.3 | Pile Load Capacity, Pile Assemblies, Torsional Resistance Criteria, Allowable Pile Torque, Embedment Lengths | SD-05 |
|  | 1.2.4 | Pile Installation Records | SD-06 |
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SD-01 Preconstruction Submittals

SD-02 Shop Drawings

SD-03 Product Data

SD-04 Samples

SD-05 Design Data

SD-06 Test Reports

SD-07 Certificates

SD-08 Manufacturer’s Instructions

SD-09 Manufacturer’s Field Reports

SD-10 Operation and Maintenance Data

SD-11 Closeout Submittals

# **CONTRACT ITEM ACCEPTANCE REQUEST** Contract Item Acceptance Request

|  |  |
| --- | --- |
| **Contract Number: HSCG83-** | **DO/TO: HSCG83-** |
| **Contract Specialist:** | **Project Number:** |
| **Contractor Name:** |  |

**URGENT YES NO (if yes) CONTRACTOR FAX #: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Submittal #**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **Job Location:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**NOTE**: **Contractor must mark Deviation column if submittal deviates from contract requirements**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Item**  **No.** | **Spec Section**  **and Paragraph** | **Description of Material**  **Include Type, Model #,**  **Manufacturer, Etc.** | **Deviation** | Status |
|  |  |  |  |  |
|  |  |  |  |  |
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STATUS ABBREVIATION GUIDE:

AC - Accepted

AC w/ CMT - Accepted with Comment

R-Resubmit

**Comments**:

|  |  |  |
| --- | --- | --- |
| Typed Name & Title | Signature | Date |

**NOTE:** Review and acceptance of submittals by the Government is intended to verify general conformance with the design intent as shown on the contract drawings and in the specifications. Acceptance by the Contracting Officer Technical Representative does not relieve the Contractor of responsibility for any errors and/or omissions in the submittals, nor from the responsibility for complying with the requirements of the contract, except with respect to variations described and approved in accordance with FAR 52.243-4 CHANGES.

1. Division 02 00 00 - sitework

SECTION 02 21 13  
SITE SURVEYS  
Site Surveys

#### PART-1 GENERAL

1.2 Submittals:

1.2.1 SD-06 Test Reports: Submit three copies of the survey report to the Contracting Officer’s Representative upon completion of the project as detailed in paragraph 3.3.

#### PART-2 PRODUCTS

Not Used

#### PART-3 EXECUTION

3.1 Surveying Services:   
  
The contractor shall employ the services of a licensed State of New Jersey professional marine surveyor to locate the exact center of the tower. All surveys shall be performed to third order accuracy. The contractor shall use the CG positioning standards as outlined in the CG Positioning Manual available on-line. Provide the Coast Guard representative five days’ notice prior to final survey work. Coordinates shall be expressed in U. S. Survey Feet and based upon the New Jersey 2900, NAD 83 projection state plane grid system. Provide latitude and longitude to the nearest one-one thousandth of a second of the final structure locations. Contact D5 (dpw) if assistance is required in obtaining the CG specifications in the CG Positioning Manual.

3.2 Locations:   
  
Survey shall be performed to determine the tower’s location prior to and after construction. The position of the center of the existing rear tower shall be determined prior to construction of the new foundation. Mark the center of the rear tower with a 5/8” diameter by 36” long rebar. The position shall be verified to be centered along the channel range line using the near and far channel coordinates shown on Sheet G-02 of the drawings.

Tower Position Coordinates (in US Survey Feet):

|  |  |  |
| --- | --- | --- |
| Y coordinate Northing: |  | 474650.9543 |
| X coordinate Easting: |  | 419918.7447 |

3.3 Survey Report:   
  
 Submit two copies of the survey report, including survey plats, detailing the position and orientation of the structure for acceptance. All data and processing records shall be contained in the report. Coordinates shall be expressed in NAD 83 Northing and Easting coordinates and Latitude/Longitude.

---End of Section 02 21 13---

SECTION 02 23 10  
CLEARING AND GRUBBING  
Clearing and Grubbing

#### PART 1 GENERAL

* 1. Submittals:

1.1.1 SD-01 Preconstruction Submittals: Provide a clearing and grubbing plan showing the extent of removals required for the construction of the access drive and work site.

#### PART 2 PRODUCTS

2.1 Tree Wound Paint:

Bituminous based paint of standard manufacture specially formulated for tree wounds

#### PART 3 EXECUTION

3.1 Clearing

Work shall encompass clearing and grubbing of the work site as required for excavation, construction and grading as shown on the drawings. Removal of trees and underbrush and trimming of tree branches that extend into the work site shall be included. Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Cut off flush with or below the original ground surface trees, stumps, roots, brush, and other vegetation in areas to be cleared, except for trees and vegetation that will not interfere with construction.

3.2 Pruning

Larger trees that don’t interfere with construction operations shall remain in place and be trimmed as necessary. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branches. Paint cuts more than 1 1/4 inches in diameter with an approved tree wound paint.

3.3 Grubbing

Remove and dispose of roots larger than 3 inches in diameter, matted roots, and designated stumps from the indicated grubbing areas. Excavate this material together with logs, organic and metallic debris, brush, and refuse and remove to a depth of not less than 18 inches below the original soil surface in areas within the construction site. Fill depressions made by grubbing with suitable material and compact in accordance with the requirements specified in Section 02301, "Earthwork” to make the new surface conform to the existing adjacent surface of the ground.

3.4 Disposal of Cleared and Grubbed Materials

Remove from the project site and dispose of off station at contractor expense. Dispose of by a timber, scrub, vegetation, and debris cleared by clearing and grubbing operations. Burning will not be permitted.

-- End of Section 02 23 10 --

SECTION 02 41 13  
selective site demolition

Selective Site Demolition

#### PART-1 GENERAL

1.1 References:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.6 Demolition Operations

1.2 Submittals:

1.2.1 SD-01 Preconstruction Submittals: Provide a demolition plan outlining the removal of the tower, submarine power cable, cable protection cover and electrical equipment to be removed.

1.3 General Requirements:   
  
Do not begin demolition until authorization is received from the Contracting Officer. Remove rubbish and debris from the project site; do not allow accumulations.

1.4 Regulatory And Safety Requirements: Comply with federal, state, and local hauling and disposal regulations. Safety requirements shall also conform to ANSI A10.6.

#### PART-2 PRODUCTS

Not used.

#### PART-3 EXECUTION

3.1 Electrical Removals: Disconnect and remove the electrical wiring and battery enclosure for the existing tower. Disconnect and remove all wiring. Remove aids to navigation equipment including optics, solar panels and the battery enclosure and deliver to ANT Philadelphia.

3.2 Tower:   
  
Disassemble and remove the existing tower in its entirety. Existing anchor bolts shall be cut off flush with the top of the concrete foundation.

3.3 Cleanup:

Remove and transport debris and rubbish in a manner that will prevent spillage. Debris hauled on trucks once it is landside shall not be allowed to spill onto streets or adjacent areas.

-- End of Section 02 41 13--

1. DIVISION 03 00 00   
   CONCRETE

SECTION 03 11 13  
STRUCTURAL cAST-IN-PLACE CONCRETE FORMING  
Structural Cast-in-Place Concrete Forming

#### PART 1 GENERAL

1.1 References:

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

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117 (2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary

ACI 301 (2010; Errata 2015) Specifications for Structural Concrete

ACI 347 (2004; Errata 2008; Errata 2012) Guide to Formwork for Concrete

ASTM INTERNATIONAL (ASTM)

ASTM D698 (2012) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

1.2 Submittals:

1.2.1 SD-02 Shop Drawings

Formwork

Form Removal Schedule

1.2.2 SD-03 Product Data

Form Materials

1.2.3 SD-05 Design Data

Calculations

1.3 DELIVERY, STORAGE, AND HANDLING

Store fiber voids above ground level in a dry location. Keep fiber voids dry until installed and overlaid with concrete.

#### PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

The design, engineering, and construction of the formwork is the responsibility of the Contractor. Design formwork in accordance with methodology of ACI 347 for anticipated loads, lateral pressures, and stresses, and capable of withstanding the pressures resulting from placement and vibration of concrete. Comply with the tolerances specified in Section 03 30 00 CAST-IN-PLACE CONCRETE, paragraph CONSTRUCTION TOLERANCES. However, for surfaces with an ACI Class A surface designation, limit the allowable deflection for facing material between studs, for studs between walers and walers between bracing to 0.0025 times the span. Design the formwork as a complete system with consideration given to the effects of cementitious materials and mixture additives such as fly ash, cement type, plasticizers, accelerators, retarders, air entrainment, and others. Monitor the adequacy of formwork design and construction prior to and during concrete placement. Submit design analysis and calculations for form design and methodology used in the design.

2.2 FORM MATERIALS

Submit manufacturer's data, including literature describing form materials, accessories, and form releasing agents.

2.2.1 Formwork

Comply with ACI 301 Section 2. Provide for surfaces not exposed to public view a surface finish SF-1.0. Provide for surfaces exposed to public view a surface finish SF-3.0. Patch holes and defects in accordance with ACI 301. Submit form removal schedule indicating element and minimum length of time for form removal.

#### PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Formwork

Comply with ACI 301 Section 2 with surface tolerances in accordance with ACI 117. Stabilize and compact all grade below concrete to the greater of 90 percent ASTM D698 or to match the density of surrounding in-situ material.

3.2 INSPECTION

Inspect forms and embedded items in sufficient time prior to each concrete placement to certify to the Contracting Officer that they are ready to receive concrete. Report the results of each inspection in writing. Submit field inspection reports for concrete forms and embedded items.

-- End of Section 03 11 13 --

SECTION 03 20 00  
CONCRETE REINFORCING  
Concrete Reinforcing

#### PART 1 GENERAL

1.1 References:

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117 (2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary

ACI 301 Structural Concrete for Buildings

ACI 315 Details and Detailing of Concrete Reinforcement

ACI 318 (2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016) Building Code Requirements for Structural Concrete and Commentary

ACI SP-66 (2004) ACI Detailing Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4/D1.4M (2011) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 307 Carbon Steel Bolts, Studs, and Threaded Rod

ASTM A1035/A1035M (2016) Standard Specification for Deformed and Plain, Low-carbon, Chromium, Steel Bars for Concrete Reinforcement

ASTM A615/A615M (2015a; E 2015) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM A706/A706M (2014) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM A934/A934M (2013) Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars

1.2 Submittals:

1.2.1 SD-02 Shop Drawings: Reinforcement Layout

1.2.2 SD-03 Product Data: Reinforcing Steel

1.2.3 SD-07 Certificates: Provide certificates showing reinforcing steel complies with all requirement as outlined in the applicable references. Scrap metal content shall also be certified.

1.3 Delivery, Storage and Handling

Store reinforcement and accessories off the ground on platforms, skids, or other supports. Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

#### PART 2 PRODUCTS

2.1 Reinforcing Steel:

Reinforcing steel of deformed bars conforming to ASTM A615/A615M, ASTM A706/A706M, or ASTM A1035/A1035M grades and sizes as indicated. Reinforcing steel furnished shall contain no less than 25 percent recycled scrap steel.

2.1.1 Epoxy-Coated Bars: All bars shall be epoxy coated unless noted otherwise. Epoxy-coated steel bars complying with the requirements of ASTM A934/A934M.

2.2 Wire Ties:

Use wire ties that are 16 gauge or heavier black annealed steel wire. Ties for epoxy-coated bars must be vinyl-coated or epoxy-coated.

2.3 Supports:

Provide bar supports complying with the requirements of ACI SP-66. Provide plastic-coated wire, stainless steel or precast concrete supports for bars in concrete with formed surfaces exposed to view or to be painted. Use wedge-shaped precast concrete supports, not larger than 3-1/2 by 3-1/2 inches, of thickness equal to that indicated for concrete cover and with an embedded hooked tie-wire for anchorage. Bar supports used in precast concrete with formed surfaces exposed to view must be the same quality, texture and color as the finish surfaces.

#### PART 3 EXECUTION

3.1 Reinforcement:

All reinforcing shall be epoxy coated unless noted otherwise. Fabricate and place reinforcement steel and accessories as specified, as indicated, and as shown on approved shop drawings. Fabrication and placement details of steel and accessories not specified or shown must be in accordance with ACI SP-66 and ACI 318. Cold bend reinforcement unless otherwise authorized. Bending may be accomplished in the field or at the mill. Mill bend zinc-coated and epoxy-coated bars prior to coating. Bend all steel cold unless authorized. Do not bend bars after embedment in concrete. Place safety caps on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Face wire tie ends away from the forms. Submit detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Show support details including types, sizes and spacing. Reinforcement shall not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond.

3.1.1 Placement: Reinforcement must be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Place reinforcement in accordance with ACI 318 at locations indicated plus or minus one bar diameter. Cover with concrete coverage as indicated or as required by ACI 318. If bars are moved more than one bar diameter to avoid interference with other reinforcement, or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, requires approval before concrete is placed. ACI 301 for minimum coverage, unless otherwise indicated.

3.1.2 Placing Tolerances: Conform bar spacing and concrete cover to ACI 117.

3.1.3 Splicing: Conform splices of reinforcement to ACI 318 and make only as required or indicated. Bars may be spliced at alternate or additional locations at no additional cost to the Government subject to approval. Splicing must be by lapping or by mechanical or welded butt connection; except that lap splices must not be used for bars larger than No. 11 unless otherwise indicated.

3.1.3.1 Lap Splices: Place lapped bars in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Do not space lapped bars farther apart than 1/5 of the required length of lap or less than 6 inches.

3.1.3.2 Mechanical Reinforcing Bar Connectors: ACI 301. Provide 125 percent minimum yield strength of the reinforcement bar.

-- End of Section 03 20 00 --

SECTION 03 30 00  
CAST-IN-PLACE CONCRETE  
Cast-in-Place Concrete

PART-1 GENERAL

1.1 References:

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117 (2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary

ACI 211.1 (1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete

ACI 214R (2011) Evaluation of Strength Test Results of Concrete

ACI 301 (2010; Errata 2015) Specifications for Structural Concrete

ACI 304.2R (1996; R 2008) Placing Concrete by Pumping Methods

ACI 304R (2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete

ACI 305.1 (2014) Specification for Hot Weather Concreting

ACI 306.1 (1990; R 2002) Standard Specification for Cold Weather Concreting

ACI 309R (2005) Guide for Consolidation of Concrete

ASTM INTERNATIONAL (ASTM)

ASTM C1017/C1017M (2013; E 2015) Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete

ASTM C1064/C1064M (2011) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

ASTM C1077 (2015) Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation

ASTM C1107/C1107M (2014a) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

ASTM C1260 (2014) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)

ASTM C136/C136M (2014) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

ASTM C143/C143M (2012) Standard Test Method for Slump of Hydraulic-Cement Concrete

ASTM C150/C150M (2015) Standard Specification for Portland Cement

ASTM C1567 (2013) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)

ASTM C1602/C1602M (2012) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete

ASTM C172/C172M (2014a) Standard Practice for Sampling Freshly Mixed Concrete

ASTM C173/C173M (2014) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

ASTM C192/C192M (2015) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory

ASTM C231/C231M (2014) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C260/C260M (2010a) Standard Specification for Air-Entraining Admixtures for Concrete

ASTM C31/C31M (2015a; E 2016) Standard Practice for Making and Curing Concrete Test Specimens in the Field

ASTM C311/C311M (2013) Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete

ASTM C33/C33M (2013) Standard Specification for Concrete Aggregates

ASTM C39/C39M (2015a) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

ASTM C494/C494M (2015a) Standard Specification for Chemical Admixtures for Concrete

ASTM C618 (2012a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

ASTM C78/C78M (2015b) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)

ASTM C937 (2010) Grout Fluidifier for Preplaced-Aggregate Concrete

ASTM C94/C94M (2015) Standard Specification for Ready-Mixed Concrete

ASTM C989/C989M (2014) Standard Specification for Slag Cement for Use in Concrete and Mortars

ASTM D5759 (2012) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses

ASTM D75/D75M (2014) Standard Practice for Sampling Aggregates

NATIONAL READY MIXED CONCRETE ASSOCIATION (NRMCA)

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

NRMCA QC 3 (2011) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities

NRMCA TMMB 100 (2001; R 2007) Truck Mixer, Agitator and Front Discharge Concrete Carrier Standards

1.2 Definitions:

1.2.1 Cementitious Material: As used herein, includes all portland cement, pozzolan, fly ash, ground granulated blast-furnace slag.

1.2.2 Chemical Admixtures: Materials in the form of powder or fluids that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes.

1.2.3 Complementary Cementing Materials (CCM): Coal fly ash, granulated blast-furnace slag, natural or calcined pozzolans, and ultra-fine coal ash when used in such proportions to replace the portland cement that result in considerable improvement to sustainability, durability.

1.2.4 Design Strength (f'c): The specified compressive strength of concrete at time(s) specified in this section to meet structural design criteria.

1.2.5 Mixture Proportioning: The process of designing concrete mixture proportions to enable it to meet the strength, service life and constructability requirements of the project.

1.2.6 Mixture Proportions: The masses or volumes of individual ingredients used to make a unit measure (cubic yard) of concrete.

1.2.7 Pozzolan: Siliceous or siliceous and aluminous material, which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.

1.2.8 Workability or Consistency: The ability of a fresh (plastic) concrete mix to fill the form/mould properly with the desired work (vibration) and without reducing the concrete's quality. Workability depends on water content, chemical admixtures, aggregate (shape and size distribution), cementitious content and age (level of hydration).

1.3 Submittals:

1.3.1 SD-03 Product Data: Cementitious Materials, Chemical Admixtures

1.3.2 SD-05 Design Data: Mixture Proportions

1.3.3 SD-06 Test Reports: Mixture Proportions, Fly Ash, Ground Granulated Blast-Furnace (GGBF) Slag, Aggregates, Air Content, Slump, Compressive Strength, Water, Sampling Plan, Strength Test Reports, water test reports

1.3.4 SD-07 Certificates: Contractor Quality Control personnel, Ready-Mix Plant

1.4 Quality Assurance:

Submit qualifications for Contractor Quality Control personnel assigned to concrete construction as American Concrete Institute (ACI) Certified Workmen in one of the following grades or show written evidence of having completed similar qualification programs:

|  |  |
| --- | --- |
| Concrete Field Testing Technician | Grade I |
| Concrete Laboratory Testing Technician | Grade I or II |

1.4.1 Laboratory Accreditation: Provide laboratory and testing facilities. The laboratories performing the tests must be accredited in accordance with ASTM C1077, including ASTM C78/C78M and ASTM C1260. The accreditation must be current and must include the required test methods, as specified. Furthermore, the testing must comply with the following requirements:

1.4.1.1 Aggregate Testing and Mix Proportioning: Perform aggregate testing and mixture proportioning studies in an accredited laboratory, under the direction of a registered professional engineer in a U.S. state or territory who is competent in concrete materials. This person is required to sign all reports and designs.

1.4.1.2 Acceptance Testing: Furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Furnish and maintain boxes or other facilities suitable for storing and curing the specimens at the site while in the mold within the temperature range stipulated by ASTM C31/C31M.

1.4.1.3 Contractor Quality Control: All sampling and testing must be performed by an approved, onsite, independent, accredited laboratory.

1.4.3 Materials: The Contractor will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. Provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D75/D75M.

1.4.3.1 Fresh Concrete: Fresh concrete will be sampled as delivered in accordance with ASTM C172/C172M and tested in accordance with these specifications, as considered necessary.

1.4.3.2 Inspection: Concrete operations may be tested and inspected by the Contracting Officer’s Representative as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

1.5 Delivery, Storage and Handling:

Follow ACI 301 and ACI 304R requirements and recommendations. Store cement and other cementitious materials in weathertight buildings, bins, or silos that exclude moisture and contaminants and keep each material completely separated. Arrange and use aggregate stockpiles in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Do not store aggregate directly on ground unless a sacrificial layer is left undisturbed. Store other materials in a manner to avoid contamination and deterioration. Materials must be capable of being accurately identified after bundles or containers are opened.

#### PART-2 PRODUCTS

2.1 System Description:

Provide concrete composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

2.1.1 Proportioning Studies-Normal Weight Concrete: Trial design batches, mixture proportions studies, and testing requirements for various types of concrete specified are the responsibility of the Contractor. Base mixture proportions on compressive strength as determined by test specimens fabricated in accordance with ASTM C192/C192M and tested in accordance with ASTM C39/C39M.

a. Samples of all materials used in mixture proportioning studies must be representative of those proposed for use in the project.

b. Make trial mixtures having proportions, consistencies, and air content suitable for the work based on methodology described in ACI 211.1

c. The maximum water-cementitious material ratios allowed in subparagraph WATER-CEMENTITIOUS MATERIAL RATIO below will be the equivalent water-cementitious material ratio as determined by conversion from the weight ratio of water to cement plus pozzolan by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, include the weight of the silica fume and GGBF slag in the equations in ACI 211.1 for the term P, which is used to denote the weight of pozzolan. If pozzolan is used in the concrete mixture, the minimum pozzolan content is 15 percent by weight of the total cementitious material, and the maximum is 35 percent.

d. Design laboratory trial mixtures for maximum permitted slump and air content. For previously approved concrete mix designs for similar pours used within the past twelve months, the previous mix design may be re-submitted without further trial batch testing if accompanied by material test data conducted within the last six months.

e. Submit the results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength of concrete, at least 60 days prior to commencing concrete placing operations. Base aggregate weights on the saturated surface dry condition.

2.1.2 Average Compressive Strength: The mixture proportions selected during mixture design studies must produce a required average compressive strength (f'cr) exceeding the specified compressive strength (f'c) by the amount indicated below, but may not exceed the specified strength at the same age by more than 20 percent. This required average compressive strength, f'cr, will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below f'cr during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day f'cr, adjust the mixture, as approved, to bring the daily average back up to f'cr. During production, the required f'cr must be adjusted, as appropriate, based on the standard deviation being attained on the job.

2.1.3 Tolerances: Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices must be in accordance with ACI 117. Take level and grade tolerance measurements of slabs as soon as possible after finishing; when forms or shoring are used, the measurements must be made prior to removal.

2.1.4 Strength Requirements: Specified compressive strength (f'c) must be as follows:

| COMPRESSIVE STRENGTH | STRUCTURE OR PORTION OF STRUCTURE |
| --- | --- |
| 4500 psi at 28 days | All locations |

2.1.4.1 Evaluation of Concrete Compressive Strength: Fabricate six compressive strength specimens, 6 inch by 12 inch cylinders, laboratory cure them in accordance with ASTM C31/C31M and test them in accordance with ASTM C39/C39M. Test two cylinders at 7 days, two cylinders at 28 days, and hold two cylinder in reserve. The strength of the concrete is considered satisfactory so long as the average of all sets of three consecutive test results do not exceed the specified compressive strength f'c by 20 percent and no individual test result falls below the specified strength f'c by more than 500 psi.

2.1.5 Water-Cementitious Material Ratio: Maximum water-cementitious material ratio (w/c) for normal weight concrete is as follows:

| WATER-CEMENTITIOUS MATERIAL RATIO, BY WEIGHT | STRUCTURE OR PORTION OF STRUCTURE |
| --- | --- |
| 0.42 | All locations |

2.1.6 Air Entrainment: Air entrain normal weight concrete based on the following table:

| MINIMUM AIR CONTENT Percent | STRUCTURE OR PORTION OF STRUCTURE |
| --- | --- |
| 5.0 | All locations |

Attain specified air content at point of placement into the forms within plus or minus 1.5 percent. Determine air content for normal weight concrete in accordance with ASTM C231/C231M.

2.1.7 Slump: Slump of the concrete, as delivered to the point of placement into the forms, must be within the following limits. Determine slump in accordance with ASTM C143/C143M.

|  |  |  |
| --- | --- | --- |
| Structural Element | Slump inches |  |
|  | Minimum | Maximum |
| Foundation walls, footings, slabs | 1 | 3 |

When use of a plasticizing admixture conforming to ASTM C1017/C1017M or when a Type F or G high range water reducing admixture conforming to ASTM C494/C494M is permitted to increase the slump of concrete, concrete must have a maximum slump of 8 inches at the point of delivery after the admixture is added.

2.1.8 Concrete Temperature: The temperature of the concrete as delivered must not exceed 90 degrees F. When the ambient temperature during placing is 40 degrees F or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered must be between 55 and 75 degrees F.

2.1.9 Size of Coarse Aggregate: Use the largest feasible nominal maximum size aggregate (NMSA), specified in PART 2 paragraph AGGREGATES, in each placement. However, do not exceed nominal maximum size of aggregate for any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

2.2 Cementitious Materials:

Cementitious Materials must be portland cement, or portland cement in combination with pozzolan or ground granulated blast furnace slag conforming to appropriate specifications listed below. Restrict usage of cementitious materials in concrete that will have surfaces exposed in the completed structure so there is no change in color, source, or type of cementitious material.

2.2.1 Portland Cement: ASTM C150/C150M, Type II with a maximum 10 percent amount of tricalcium aluminate, and a maximum cement-alkali content of 0.80 percent Na2Oe (sodium oxide) equivalent.

2.2.2 Fly Ash: Conform fly ash to ASTM C618, Class F,except that the maximum allowable loss on ignition cannot exceed 3 percent. If pozzolan is used, it must never be less than 75 percent by weight of the total cementitious material. Report the chemical analysis of the fly ash in accordance with ASTM C311/C311M. Evaluate and classify fly ash in accordance with ASTM D5759. Comply with EPA requirements.

2.2.3 Raw or Calcined Natural Pozzolan: Natural pozzolan must be raw or calcined and conform to ASTM C618, Class N, including the optional requirements for uniformity and effectiveness in controlling Alkali-Silica reaction and must have an on ignition loss not exceeding 3 percent. Class N pozzolan for use in mitigating Alkali-Silica Reactivity must have a Calcium Oxide (CaO) content of less than 13 percent and total equivalent alkali content less than 3 percent.

2.2.4 Ultra Fine Fly Ash and Ultra Fine Pozzolan: Conform Ultra Fine Fly Ash (UFFA) and Ultra Fine Pozzolan (UFP) ASTM C618, Class F or N, and the following additional requirements:

a. The strength activity index at 28 days of age is at least 95 percent of the control specimens.

b. The average particle size does not exceed 6 microns.

c. The sum of SiO2 + Al2O3 + Fe2O3 is greater than 77 percent.

2.2.5 Ground Granulated Blast-Furnace (GGBF) Slag: ASTM C989/C989M, Grade 100. Slag content must be a minimum of 50 percent by weight of cementitious material. Submit test results in accordance with ASTM C989/C989M for GGBF slag. Submit test results performed within 6 months of submittal date.

2.3 Aggregates:  
  
Test and evaluate fine and coarse aggregates for alkali-aggregate reactivity in accordance with ASTM C1260. Evaluate the fine and coarse aggregates separately and in combination, which matches the proposed mix design proportioning. All results of the separate and combination testing must have a measured expansion less than 0.10 (0.08) percent at 16 days after casting. Should the test data indicate an expansion of 0.10 (0.08) percent or greater, reject the aggregate(s) or perform additional testing using ASTM C1260 and ASTM C1567. Perform the additional testing using ASTM C1260 and ASTM C1567 using the low alkali portland cement in combination with ground granulated blast furnace (GGBF) slag, or Class F fly ash. Use GGBF slag in the range of 40 to 50 percent of the total cementitious material by mass. Use Class F fly ash in the range of 25 to 40 percent of the total cementitious material by mass. Provide fine and coarse aggregates conforming to the following.

2.3.1 Fine Aggregate: Conform to the quality and gradation requirements of ASTM C33/C33M.

2.3.2 Coarse Aggregate: Conform to ASTM M43 size designation 7.

2.4 Chemical Admixtures:

When required or permitted, conform to the appropriate specification listed. Furnish admixtures in liquid form and of suitable concentration for easy, accurate control of dispensing.

2.4.1 Air-Entraining Admixture: ASTM C260/C260M and must consistently entrain the air content in the specified ranges under field conditions.

2.4.2 Accelerating Admixture: ASTM C494/C494M, Type C or E, except that calcium chloride or admixtures containing calcium chloride cannot be used.

2.4.3 Water-Reducing or Retarding Admixture: ASTM C494/C494M, Type A, B, or D, except that the 6-month and 1-year compressive strength tests are waived.

2.4.4 High-Range Water Reducer: ASTM C494/C494M, Type F or G, except that the 6-month and 1-year strength requirements are waived. Use the admixture only when approved in writing and contingent upon performance of separate mixture design studies.

2.4.5 Expanding Admixture: Aluminum powder type expanding admixture conforming to ASTM C937.

2.4.6 Other Chemical Admixtures Provide chemical admixtures for use in producing flowing concrete in compliance with ASTM C1017/C1017M, Type I or II. Use these admixtures only when approved in writing and contingent upon performance of separate mixture design studies.

2.5 Water:

Provide water complying with the requirements of ASTM C1602/C1602M. Provide potable water for mixing, free of injurious amounts of oil, acid, salt, or alkali. Submit test report showing water complies with ASTM C1602/C1602M.

2.6 Non-shrink Grout:

Provide non-shrink grout conforming to ASTM C1107/C1107M, and a commercial formulation suitable for the proposed application.

2.7 Embedded Items:

Provide the size and type indicated or as needed for the application.

#### PART-3 EXECUTION

3.1 Preparation for Placing:

Before commencing concrete placement, perform the following: Clean surfaces to receive concrete, free from frost, ice, mud, and water. Transporting and conveying equipment is in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete is at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage is at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material is at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking.

3.1.1 Foundations:

3.1.1.1 Concrete on Earth Foundations: Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed is clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation must be well drained, satisfactorily graded and uniformly compacted.

3.1.2 Embedded Items: Before placement of concrete, determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items must be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete is permitted only when specifically authorized or directed. Temporarily fill voids in sleeves, inserts, and anchor slots with readily removable materials to prevent the entry of concrete into voids. Do not Weld on embedded metals within 12 inches of the surface of the concrete. Do not tack weld on or to embedded items.

3.2 Concrete Production:  
  
3.2.1 General Requirements: Batch and mix concrete onsite or furnish from a ready-mixed concrete plant. Batch, mix, and transport ready-mixed concrete in accordance with ASTM C94/C94M. Truck mixers, agitators, and non-agitating transporting units must comply with NRMCA TMMB 100. Ready-mix plant equipment and facilities must be certified in accordance with NRMCA QC 3. Furnish approved batch tickets for each load of ready-mixed concrete. Conform site-mixed concrete to the following subparagraphs. Begin mixing within 30 minutes after the cement has been added to the aggregates. The time between the introduction of water to the cement and the start of placing of the concrete in final position shall not exceed 45 minutes if the air temperature is greater than 85 degrees F. Re-tempering concrete that has lost the required slump is strictly prohibited.

3.3 Concrete Production, Small Projects:

Use batch-type equipment for producing concrete. Batch, mix and transport ready-mixed concrete in accordance with ASTM C94/C94M, except as otherwise specified. Use truck mixers, agitators, and nonagitating transporting units in compliance with NRMCA TMMB 100. Ready-mix plant equipment and facilities must be certified in accordance with NRMCA QC 3. Furnish approved batch tickets for each load of ready-mixed concrete. Produce site-mixed concrete in accordance with ACI 301, with plant conforming to NRMCA CPMB 100.

3.4 Transporting Concrete to the Project Site:

Transport concrete to the placing site in agitators. Nonagitating equipment, other than pumps, cannot be used for transporting lightweight aggregate concrete.

3.5 Placing Concrete:

Discharge mixed concrete within 1.5 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 85 degrees F, reduce the time to 45 minutes. Place concrete within 15 minutes after it has been discharged from the transporting unit. Handle concrete from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Provide adequate scaffolding, ramps and walkways so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities prevent proper consolidation, finishing and curing. Provide sufficient placing capacity so that concrete can be kept free of cold joints.

3.5.1 Depositing Concrete: Deposit concrete in accordance with ACI 301 Section 5 and ACI 304.2R.

3.5.2 Consolidation: Immediately after placing, consolidate each layer of concrete in accordance with ACI 301 Section 5 and ACI 309R.

3.5.3 Cold Weather Requirements: Perform cold weather concreting in accordance with ACI 306.1. Use special protection measures, approved by the COR, if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete must be not less than 40 degrees F. The temperature of the concrete when placed must be not less than 50 degrees F nor more than 75 degrees F. Heat the mixing water or aggregates to regulate the concrete placing temperature. Materials entering the mixer must be free from ice, snow, or frozen lumps. Do not incorporate salt, chemicals or other materials in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C494/C494M, Type C or E may be used, provided it contains no calcium chloride.

3.5.4 Hot Weather Requirements: When job-site conditions are present or anticipated that accelerate the rate of moisture loss or rate of cement hydration of freshly mixed concrete, including an ambient temperature of 80 degrees F or higher, and an evaporation rate that exceeds 0.2 lb/ft2/h, conform concrete work to all requirements of ACI 305.1.

3.5.5 Prevention of Plastic Shrinkage Cracking: During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, be alert to the tendency for plastic shrinkage cracks to develop and institute measures to prevent this. Conform with the requirement of ACI 305.1. Protect the concrete placement by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Fill plastic shrinkage cracks that occur by injection of epoxy resin as directed, after the concrete hardens. Never trowel over plastic shrinkage cracks or fill with slurry.

3.6 Setting Base Plates and Bearing Plates:

After being properly positioned, set column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Concrete and metal surfaces in contact with grout must be clean and free of oil and grease, and concrete surfaces in contact with grout damp and free of laitance when grout is placed.

3.7 Testing and Inspection:

Perform the inspection and tests described below and, based upon the results of these inspections and tests, take the action required. Submit certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, ground granulated blast furnace slag, aggregate, admixtures, and curing compound proposed for use on this project.

a. When, in the opinion of the COR, the concreting operation is out of control, cease concrete placement and correct the operation.

b. The laboratory performing the tests must be onsite and conform with ASTM C1077. Materials may be subjected to check testing by the Contracting Officer’s Representative from samples obtained at the manufacturer, at transfer points, or at the project site.

3.7.1 Grading and Corrective Action:

3.7.1.1 Fine Aggregate: At least once during each shift when the concrete plant is operating, there must be one sieve analysis and fineness modulus determination in accordance with ASTM C136/C136M for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. Select the location at which samples are taken as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, immediately resample and retest the fine aggregate. If there is another failure on any sieve, immediately report the failure to the COR, stop concreting and take immediate steps to correct the grading.

3.7.1.2 Coarse Aggregate: At least once during each shift in which the concrete plant is operating, there must be a sieve analysis in accordance with ASTM C136/C136M for each size of coarse aggregate. Select the location at which samples are taken as the most advantageous for control. However, the Contractor is responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations must show the results of the current test. Limits may be adopted for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, immediately resample and retest the coarse aggregate. If the second sample fails on any sieve, report that failure to the COR. Stop concreting and take immediate steps to correct the grading.

3.7.2 Quality of Aggregates: Thirty days prior to the start of concrete placement, perform all tests for aggregate quality required by ASTM C33/C33M. In addition, after the start of concrete placement, perform tests for aggregate quality. Take samples for testing after the start of concrete placement immediately prior to entering the concrete mixer.

3.7.3 Scales, Batching and Recording: Check the accuracy of the scales by test weights prior to start of concrete operations and at least once every three months. Also conduct such tests as directed whenever there are variations in properties of the fresh concrete that could result from batching errors. At the same time, test and ensure that the devices for dispensing admixtures are operating properly and accurately. When either the weighing accuracy or batching accuracy does not comply with specification requirements, do not operate the plant until necessary adjustments or repairs have been made.

3.7.4 Batch-Plant Control: Continuously control the measurement of concrete materials, including cementitious materials, each size of aggregate, water, and admixtures. Adjust the aggregate weights and amount of added water as necessary to compensate for free moisture in the aggregates. Adjust the amount of air-entraining agent to control air content within specified limits. Prepare a report indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water weights per cubic yard amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic yard for each class of concrete batched during each day's plant operation.

3.7.5 Concrete Mixture

3.7.5.1 Air Content Testing: Perform air content tests when test specimens are fabricated. Perform additional tests when excessive variation in workability is reported by the placing foreman or Government inspector. Conduct tests in accordance with ASTM C231/C231M for normal weight concrete and ASTM C173/C173M for lightweight concrete. Plot test results on control charts. When a single test result reaches either the upper or lower action limit, perform a second test immediately. Average the results of the two tests and use this average as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. Plot the result of each test, or average as noted in the previous sentence, on a separate control chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph AIR ENTRAINMENT. Set an upper warning limit and a lower warning limit line 1.0 percentage point above and below the average line, respectively. Set an upper action limit and a lower action limit line 1.5 percentage points above and below the average line, respectively. Plot the range between each two consecutive tests on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content may be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated air content.

3.7.5.2 Slump Testing: In addition to slump tests which are made when test specimens are fabricated during concrete placement/discharge, make at least two slump tests on randomly selected batches in accordance with ASTM C143/C143M for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Plot test results on control charts. Update the control charts and make them readily available to the Government. Keep copies of the current control charts in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, immediately perform a second test. Average the results of the two tests and use this average as the slump of the batch to plot on both the control charts for slump and the chart for range, and for determining need for any remedial action. Set limits on separate control charts for slump for each type of mixture. Set the upper warning limit at 1/2 inch below the maximum allowable slump specified in paragraph SLUMP in PART 1 for each type of concrete and, set an upper action limit line and lower action limit line at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. Plot the range between each consecutive slump test for each type of mixture on a single control chart for range on which an upper action limit is set at 2 inches. Take samples for slump at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump.

3.7.5.3 Temperature: Measure the temperature of the concrete when compressive strength specimens are fabricated in accordance with ASTM C1064/C1064M. Report the temperature along with the compressive strength data.

3.7.5.4 Strength Specimens: Perform on at least one set of test specimens, for compressive strength as appropriate, on each batch of concrete placed each day. Perform on additional sets of test specimens, as directed by the COR, when the mixture proportions are changed or when low strengths have been detected.

a. A set of test specimens for concrete with a 28-day specified strength in accordance with paragraph STRENGTH REQUIREMENTS in PART 2 consists of five specimens, two to be tested at 7 days, two at 28 days, and one cylinder held in reserve.

b. A strength test is the average of the strengths of at least two 6 inch by 12 inch cylinders made for the same sample of concrete.

c. Mold and cure test specimens in accordance with ASTM C31/C31M, and test in accordance with ASTM C39/C39M for test cylinders.

d. Maintain quality control charts for individual strength "tests", ("test" as defined in paragraph STRENGTH REQUIREMENTS) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. Provide charts similar to those found in ACI 214R.

3.7.6 Inspection Before Placing: Inspect foundations, construction joints, forms, and embedded items in sufficient time prior to each concrete placement.

3.8 Concrete Placement:

The placing foreman must supervise placing operations, determine that the correct quality of concrete or grout is placed in each location as specified, and be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman must not permit batching and placing to begin until it has been verified that adequate vibration equipment is in working order and with competent operators available. If any batch of concrete fails to meet the temperature requirements, take immediate steps to improve temperature controls. Place and consolidate concrete so to prevent segregation of materials and to ensure concrete is thoroughly worked around embedded items, around reinforcement and into corners. Place concrete at a constant temperature between 50 and 90 degrees F throughout fabrication of each panel. Refer to ACI 305R and ACI 306. Do not place concrete in uncovered areas during periods of precipitation; or in standing water. Consolidate concrete with high frequency, internal, mechanical vibrating equipment supplemented by hand spading and tamping.

3.8.1 Finishing: Consolidate and immediately strike off concrete to bring the top surfaces of the decks to proper contour, grade, and elevations as shown. Immediately strike off the surface using a wooden bull-float and wooden tools so as to correct any unevenness. Complete striking-off before bleed water appears. Remove bleed water using a rubber hose. Float the surface by hand with a wood trowel. Floating of any one area shall be the minimum necessary to produce an even finish. Curing and Protection: Protect concrete adequately from injurious action by weather and mechanical injury for a minimum of 72 hours. Coat with a liquid membrane conforming to ACI A309.

---End of Section 03 30 00---

1. DIVISION 05 00 00  
   METALS  
   Metals

SECTION 05 12 40  
STRUCTURAL STEEL  
Structural Steel

#### PART-1 GENERAL

1.1 References:

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 325 (2011) Steel Construction Manual

AISC 326 (2009) Detailing for Steel Construction

AISC 360 (2010) Specification for Structural Steel Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (2012) Standard Symbols for Welding, Brazing and Nondestructive Examination

AWS D1.1/D1.1M (2015; Errata 2015) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B46.1 (2009) Surface Texture, Surface Roughness, Waviness and Lay

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2014) Standard Specification for Carbon Structural Steel

ASTM A53/A53M (2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A123/A123M (2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A307 Carbon Steel Bolts, Studs, and Threaded Rods 60,000 psi Strength

ASTM A500/A500M (2013) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A563 (2015) Standard Specification for Carbon and Alloy Steel Nuts

ASTM A780/A780M (2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM A992/A992M (2011) Standard Specification for Structural Steel Shapes

ASTM F593 Stainless Steel Bolts, Hex Cap Screws and Studs

ASTM F594 Stainless Steel Nuts

ASTM F844 (2007a; R 2013) Washers, Steel, Plain (Flat), Unhardened for General Use

ASTM F1554 (2015) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

ASTM F2329 (2013) Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

STEEL STRUCTURES PAINTING COUNCIL (SSPC):

SP-10 Near-White Metal Blast Cleaning

1.2 Submittals:

1.2.1 SD-01 Preconstruction Submittals: Tower Assembly Drawings

1.2.2 SD-02 Shop Drawings: Fabrication Drawings Including Description of Connections

1.2.3 SD-03 Product Data: Welding Electrodes and Rods

1.2.4 SD-06 Test Reports: Bolts, Nuts, and Washers

1.2.5 SD-07 Certificates: Steel, Bolts, Nuts, and Washers, Galvanizing,

AISC Fabrication Plant Quality Certification

AISC Erector Quality Certification

Welding Procedures and Qualifications, Welding Electrodes and Rods

1.3 AISC Quality Certification:  
  
1.3.1 Work must be fabricated in an AISC Certified Fabrication Plant, Category Std. Submit AISC fabrication plant quality certification.

1.3.2 Work must be erected by an AISC Certified Erector, Category CSE. Submit AISC erector quality certification.

1.4 Quality Assurance:

1.4.1 Preconstruction Submittals

1.4.2 Fabrication Drawing Requirements: Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 326 and AISC 325. Fabrication drawings must not be reproductions of contract drawings. Sign and seal fabrication drawings by a registered professional engineer. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS A2.4 standard welding symbols. Any deviations from the details shown on the contract drawings must be clearly highlighted on the fabrication drawings. Explain the reasons for any deviations from the contract drawings.

1.4.3 Certifications

1.4.3.1 Welding Procedures and Qualifications: Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. Conform to all requirements specified in AWS D1.1/D1.1M.

1.5 Storage and Handling: Material must be stored out of contact with the ground in such manner and location as will minimize deterioration.

#### PART-2 PRODUCTS

2.1 System Description:

Provide the structural steel system, including required finishes, complete and ready for use. Structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing must be provided in accordance with AISC 360, AISC 341, UFC 3-301-01 and UFC 3-310-04 except as modified in this contract.

2.2 Steel:

2.2.1 Structural Steel: Wide flange and WT shapes, ASTM A992/A992M. Angles, Channels and Plates, ASTM A36/A36M.

2.2.2 Structural Steel Tubing: ASTM A500/A500M, Grade C.

2.2.3 Steel Pipe: ASTM A53/A53M, Type E or S, Grade B.

2.3 Bolts, Nuts and Washers:

2.3.1 Bolts: ASTM F593 Grade 18-8. .

2.3.2 Nuts: ASTM F594

2.3.3 Washers: ASTM F844, Galvanized

3.3.4 Anchor Studs: ASTM F1554, Grade 36 55, Class 1A, Galvanized

3.3.5 Anchor Nuts: ASTM A563, Grade A, Hex-Style, Galvanized

2.3.6 Anchor Washers: ASTM F436, plain carbon steel, Galvanized

2.3.7 Anchor Plate Washers: ASTM A36/A36M

2.4 Structural Steel Accessories:

2.4.1 Welding Electrodes and Rods: AWS D1.1/D1.1M.

2.5 Fabrication:

Fabrication must be in accordance with the applicable provisions of AISC 325. Fabrication and assembly must be done in the shop to the greatest extent possible.

2.5.1 General: Material must be straight before laid off or worked. If straightening is necessary, it shall be done by methods that will not impair the metal. Bends, except for minor details, shall be made by approved dies, press brakes, or bending rolls. Where heating is required, precautions shall be taken to avoid overheating the metal and allowed to cool in a manner that does not alter the properties of the metal. Shearing shall be accurately done and be square. Finished members shall be free from twists, bends, and open joints.

2.5.2 Cutting and Shaping: Steel shall be fabricated in accordance with approved drawings, cuts, details, and samples. Structural steel shall be cut by mechanically-guided torches to provide an accurate profile with a smooth surface, free from cracks and notches. Surfaces and edges to be welded shall be prepared in accordance with AWS D1.1 to maintain proper root clearances. Joints shall be milled to a close fit and corner joints shall be coped or mitered, well formed, and in true alignment. Exposed steel edges at cut ends of members shall be rounded over. Welding shall be continuous and uniform along the entire area of contact. Drilling and punching shall produce clean true lines and surfaces. Punch, subpunch and ream, or drill bolt holes perpendicular to the surface of the member.

2.6 Welding:  
  
2.6.1 General: Welding of structural steel shall be by an electric arc welding process, using a method which excludes the atmosphere from the molten metal. Welding and all equipment shall conform to the applicable provisions of AWS D1.1.

2.6.2 Filler Metal: The electrode, electrode-flux combination, and grade of weld metal shall conform to the appropriate AWS specification for the base metal and welding process being used. Only low hydrogen electrodes shall be used for manual shielded metal-arc welding regardless of the thickness of the steel. All electrodes shall be selected to provide full strength and of equivalent characteristics of the respective steel being welded. All welding materials shall be in good condition with no damage to the flux.

2.6.3 Qualification of Welders and Welding Operators: Welding operators, welders, and tack welders shall be qualified for the particular type of work to be done.

2.6.4 Workmanship Requirements:

2.6.4.1 Preheat and Interpass Temperature: Preheating shall be performed as required by AWS D1.1, except that the temperature of the base metal shall be at least 70o F. Preheat weldments uniformly by approved means to the prescribed temperature, held at that temperature until the welding is completed and then permitted to cool slowly in still air.

2.6.4.2 Tacky Welds: Tack welds that are to be incorporated into the permanent work shall be subject to the same quality requirements as the permanent welds. Defective tack welds shall be removed before permanent welding.

2.6.5 Rolled Shapes and Plates: Flanges/webs of structural shapes shall be coped/mitered as required to attain near full contact between joints prior to welding. Gaps in joints shall not exceed 1/8-inch. Sections shall be joined with 100 percent penetration welds to develop 100 percent joint efficiency. Plate seams shall be continuous full penetration welds and shall not require a permanent backing bar.

2.6.6 Tubular Connections: All tubular connections shall be accomplished with full penetration welds to develop 100 percent joint efficiency. Use of the automatic submerged arc welding method shall be utilized whenever possible. Where welding can be accomplished from one side only, all joints shall be carefully mitered and coped to enable 100 percent fusion of the root weld. Beveling of edges shall be performed as required to facilitate welding.

2.6.7 Visual Examination: AWS D1.1/D1.1M. Furnish the services of AWS-certified welding inspectors for fabrication, testing and verification inspections. All welds shall be free of slag, spatter, dirt grease, oil and loose scale. Prior to any welding, the Contractor shall visually inspect the preparation of material for welding to assure compliance with AWS D1.1. All completed welds shall be cleaned and examined for insufficient throat or leg sizes, cracks, undercutting, overlap, excessive convexity or reinforcement, and other surface defects.

2.6.8 Acceptability of Welds: Welds shall be unacceptable, if shown to have defects prohibited by AWS D1.1, or shown to possess any degree of incomplete fusion, inadequate penetration or undercutting. Defective weld metal shall be removed by air carbon-arc or oxygen gouging to sound metal. The surfaces shall be thoroughly cleaned before welding. All costs of repairs and retesting shall be borne by the Contractor.

2.7 Surface Finishes  
  
ASME B46.1 maximum surface roughness of 125 for pin, pinholes, and sliding bearings, unless indicated otherwise.

2.7.1 Blasting Medium: Use sand, grit or shot-grit which is clean, dry, clean, and free from contaminants. Shot-grit shall include at least 25 percent grit with abrasive sizes and mixture ranges as recommended by the coating system manufacturer.

2.7.2 Blast Cleaning: Sand blast metal surfaces to receive galvanizing to a near-white metal condition in accordance with SSPC-SP-10. Surface shall be free of dirt, oil, grease and other foreign matter. The blast-cleaned surface when viewed without magnification shall be found free of visible mill scale, rust, corrosion, oxides, paint, oil or other foreign matter. Use an approved abrasive to obtain a profile between 1.25 and 1.75 mils. Grind smooth rough welds, burrs and sharp surface projections and corners and ensure welding flux is removed from crevices prior to blast cleaning. Remove abrasive dust upon completion of blast cleaning. Do not blast clean when metal surface temperatures are less than 5 degrees F above the dew point and when the relative humidity if above 85 percent. Perform blast cleaning during daylight hours only.

2.7.3 Surface Preparation: Surface preparation will be considered unsatisfactory for any specified reason, including flash rusting, presence of dust, dampness, or unnecessary extended period prior to finishing. All surfaces shall be cleaned to remove any rust or surface imperfections.

2.8 Galvanizing:

2.8.1 Materials: ASTM F2329 for threaded parts or ASTM A123/A123M, Grade G90 for structural steel members, as applicable, galvanize after fabrication where practicable.

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, G90, as applicable.

2.8.2 All weld flux and spatter shall be removed and steel shall be thoroughly clean of all grease, dirt, contaminates and rust prior to galvanizing.

2.8.3 Inspection: The film thickness of the galvanizing shall be within the limits recommended by ASTM A123. Film thickness shall be measured by a certified testing agency using a calibrated film thickness gauge. A total of ten measurements shall be taken on randomly selected member samples.

#### PART-3 EXECUTION

3.1 Assembly:   
  
Erection of structural steel must be in accordance with the applicable provisions of AISC 325. After final positioning of steel members, provide full bearing under base plates and bearing plates using non-shrink grout. Place non-shrink grout in accordance with the manufacturer's instructions.

3.1.1 Connections: Connections not detailed must be designed in accordance with AISC 360. Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Holes must not be cut or enlarged by burning. Bolts, nuts, and washers must be clean of dirt and rust and lubricated immediately prior to installation.

3.4 Welding:

Welding must be in accordance with AWS D1.1/D1.1M. Grind exposed welds smooth as indicated. Provide AWS D1.1/D1.1M qualified welders, welding operators, and tackers.

3.5 SHOP COATINGS REPAIR

Repair shop primer in accordance with the paint manufacturer's recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

3.5.1 Field Priming

Steel exposed to the weather, or located in building areas without HVAC for control of relative humidity must be field primed. After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat must be cleaned and primed with paint of the same quality as that used for the shop coat.

3.6 Galvanizing Repair

Repair damage to galvanized coatings using ASTM A780/A780M zinc rich paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces to which repair paint has been applied.

3.7 Field Quality Control

Perform field tests, and provide labor, equipment, utilities and incidentals required for testing.

---End of Section 05 12 40---

SECTION 05 50 13  
MISCELLANEOUS METAL FABRICATIONS  
Miscellaneous Metal Fabrications

#### PART 1 GENERAL

1. 1.1 References:

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 2015) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A53/A53M (2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A653/A653M (2015) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A780/A780M (2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM A924/A924M (2014) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM D1187/D1187M (1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal

MASTER PAINTERS INSTITUTE (MPI)

MPI 79 (Oct 2009) Alkyd Anti-Corrosive Metal Primer

1.2 Submittals:  
  
1.2.1 SD-02 Shop Drawings: Provide fabrication and installation for sheet metal and other miscellaneous metal fabrications.

Submit templates, erection and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the construction.

1.3 Qualifications of Welders:  
  
Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

1.4 Delivery, Storage and Protection:

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

#### PART 2 PRODUCTS

1. 2.1 Materials:

2.1.1 Steel Pipe: ASTM A53/A53M, Type E or S, Grade B.

2.1.2 Sheet Metal: ASTM A653/A653M, Galvanized

1. 2.2 Fabrication Finishes
2. 2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, G90, as applicable.

2.2.2 Repair of Zinc-Coated Surfaces: Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A780/A780M or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by COR if determined at the work site and does not conflict with contract documents. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallic in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

#### PART 3 EXECUTION

3.1 General Installation Reuirements:  
  
Exposed fastenings shall be compatible materials, shall generally match in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners shall be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Form joints exposed to the weather shall be formed to exclude water. Items listed below require additional procedures.

3.2 Workmanship:

Provide miscellaneous metalwork that is well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections of work in place and ground smooth. Provide a smooth finish on exposed surfaces of work in place and unless otherwise approved, flush exposed riveting. Mill joints where tight fits are required. Corner joints shall be coped or mitered, well formed, and in true alignment. Accurately set work to established lines and elevations and securely fastened in place. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

3.3 Anchorage, Fastenings and Connections:

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.4 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.5 FINISHES

3.5.1 Dissimilar Materials: Where dissimilar metals are in contact, protect surfaces with a coat conforming to MPI 79 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D1187/D1187M, asphalt-base emulsion.

-- End of Section 05 50 13 --

SECTION 05 51 33  
METAL LADDERS  
Metal Ladders

#### PART 1 GENERAL

1.1 References:

AMERICAN LADDER INSTITUTE (ALI)

ALI A14.3 (2008) Standard for Fixed Ladders and Safety Requirements

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 2015) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A36/A36M (2014) Standard Specification for Carbon Structural Steel

ASTM A47/A47M (1999; R 2014) Standard Specification for Ferritic Malleable Iron Castings

ASTM A500/A500M (2013) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A53/A53M (2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A653/A653M (2015) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A780/A780M (2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM A924/A924M (2014) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM D1187/D1187M (1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal

MASTER PAINTERS INSTITUTE (MPI)

MPI 79 (Oct 2009) Alkyd Anti-Corrosive Metal Primer

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

29 CFR 1910.27 Fixed Ladders

Federal Specification (FED. SPEC):

RR-S-001301 Safety Equipment, Climbing

1.2 Submittals:

1.2.1 SD-02 Shop Drawings: Ladders, Installation Drawings

1.2.2 SD-03 Product Data: Ladders, Ladder Safety Devices

1.2.3 SD-07 Certificates: Fabricator Certification for Ladder Assembly

1.3 Certificates:

Provide fabricator certification for ladder assembly stating that the ladder and associated components have been fabricated according to the requirements of 29 CFR 1910.27.

1.4 Qualifications of Welders:

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

1.5 Delivery, Storage and Protection:

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

#### PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Structural Carbon Steel: ASTM A36/A36M.

2.1.2 Structural Tubing: ASTM A500/A500M.

2.1.3 Steel Pipe: ASTM A53/A53M, Type E or S, Grade B.

2.1.4 Fittings for Steel Pipe: Standard malleable iron fittings ASTM A47/A47M.

2.2 Fabrication Finishes

2.2.1 Galvanizing: Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, G90, as applicable.

2.2.2 Galvanize: Anchor bolts, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces: Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A780/A780M or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by COR if determined at the work site and does not conflict with contract documents.. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.3 Ladders:

Fabricate vertical ladders conforming to 29 CFR 1910.27and Section 5 of ALI A14.3. Use 3 by 1/2 inch steel flats for stringers and 1-inch diameter steel rods for rungs. Rungs must not be less than 16 inches wide or as shown on the drawings, spaced one foot apart, plug welded or shouldered and headed into stringers. Install ladders so that the distance from the rungs to the finished wall surface will not be less than 7 inches. Provide intermediate clip angles as required or as detailed on the drawings. The top rung of the ladder must be level with the top of the access level, parapet or landing served by the ladder except for hatches or wells. Extend the side rails of through or side step ladders 42 inches above the access level. Provide ladder access climb protection. The drawings must indicate ladder locations and details of critical dimensions and materials.

2.3.1 Ladder Safety Devices: Conform to 29 CFR 1910.27 and Section 7 of ALI A14.3. Install ladder safety devices on ladders over 20 feet long or more. The ladder safety systems must meet the design requirement of the ladders which they serve. The ladder safety system must be capable of sustaining a static load of 1,000 pounds.

2.3.1.1 Sleeve: Cast manganese bronze sleeve with cadmium steel roller bearings and double locking snap, tested to ANSI 14.3-1974. The sleeve shall be allowed to freely travel over the carrier rail by 5 precision rollers with Grade 17-4 aircraft locking prawl and double locking snap hook.

2.3.1.2 Belt: ANSI Class I belt with special front ring designed to attach to a locking sleeve, with 3" polyester body pad with minimum 1,650 lb strength; two side rings and two drop forged tongues. The belt shall withstand a minimum drop test of 250 pounds in a 6 foot free fall (ANSI 10.14-1974).

2.3.1.3 Carrier Rail: Notched carrier rail, keyhole, galvanized. Notched, galvanized rigid carrier rail with channel, HREW in a one-piece configuration and notched every 6" with drilled and tapped mounting holes every 10". Provide connector straps to all joint sections.

2.3.1.4 Ladder Rung Clamps: Galvanized steel mounting bracket with serrated edges; slotted on 10" centers, to fit round or square rung configurations up to 1-1/2". (Fabricate as required in accordance with manufacturer’s recommendations.)

2.3.1.5 Safety Belt: Nylon webbing, with 3 O- rings on each side and center D-ring for attaching to safety sleeve. All hardware is cadmium plated drop-forged steel.

#### PART 3 EXECUTION

3.1 General Installation Requirements:

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Provide Exposed fastenings of compatible materials, generally matching in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners will be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports must provide strength and stiffness. Formed joints exposed to the weather to exclude water. Items listed below require additional procedures.

3.2 Workmanship:

Metalwork must be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching must produce clean true lines and surfaces. Continuously weld along the entire area of contact. Tack weld connections shall not be exposed to view. Grind smooth exposed welds. Provide smooth finish on exposed surfaces of work in place, unless otherwise approved. Where tight fits are required, mill joints. Cope or miter corner joints, well formed, and in true alignment. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

3.3 Anchorage, Fastening and Connections:

Provide anchorage where necessary for fastening metal items securely in place. Include for anchorage not otherwise specified; machine bolts, carriage bolts and powder-actuated threaded studs for steel. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.4 Welding:  
  
Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.5 Finishes:

3.5.1 Dissimilar Materials: Where dissimilar metals are in contact, protect surfaces with a coat conforming to MPI 79 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D1187/D1187M, asphalt-base emulsion.

3.5.2 Field Preparation: Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matter.

3.5.3 Environmental Conditions: Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

3.6 Ladder:

Secure to the adjacent construction with the clip angles attached to the stringer. Install intermediate clip angles brackets as required for securing of ladders welded or bolted to structural steel or built into the masonry or concrete. Bottom ends of ladders must supported by the foundation.

3.6.1 Installation: Install rigid rail on the tower ladder utilizing clamps and fasteners in accordance with manufacturer’s recommendations. The top of the safety climb shall extend 6” above the top of the ladder.

---End of Section 05 51 33---

1. DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

SECTION 06 73 01  
FIBERGLASS REINFORCED PLASTIC (FRP) GRATING  
Fiberglass Reinforced Plastic (FRP) Grating

#### PART 1 GENERAL

1.1 References:

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2010; Errata 2011; Supp 1 2013) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM D2344/D2344M (2013) Standard Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates

ASTM D2863 (2013) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

ASTM D635 (2014) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

ASTM D638 (2014) Standard Test Method for Tensile Properties of Plastics

ASTM D696 (2008; E 2013) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer

ASTM D790 (2015; E 2016; E 2016) Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

ASTM D953 (2010) Standard Test Method for Bearing Strength of Plastics

ASTM E662 (2015) Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials

ASTM E84 (2015b) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM G154 (2012a) Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

ASTM G155 (2013) Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2012) International Building Code

U.S. DEPARTMENT OF DEFENSE (DOD)

SAE CMH-17-36 (2012) Composite Materials Handbook, Vol. 3, Polymer Matrix Composites Material Usage, Design, and Analysis

UNDERWRITERS LABORATORIES (UL)

UL 94 (2013; Reprint Jan 2016) Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

1.2 SUBMITTALS

1.2.1 SD-02 Shop Drawings: Submit installation drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are embedded in concrete or masonry.

1.2.2 SD-03 Product Data:

FRP Grating: Submit Manufacturer's catalog data to include two copies of manufacturer's specifications, load tables, dimension diagrams

Clips and Anchorage: anchor details for the FRP grating, clips and anchorage

Installation Drawings, Templates, and Directions

1.2.3 SD-06 Test Reports:

Bearing Strength Testing

Flexural Properties

Ultraviolet Testing

Shear Strength

Toxicity Testing

Flame Spread Testing

Tensile Properties

Coefficient of Lineal Thermal Expansion

1.2.4 SD-07 Certificates

Manufacturer's Sample Warranty

Certification of Anchorage System compliance with ASCE 7

1.2.5 SD-08 Manufacturer's Instructions

Shipping, Handling, Erection Procedures

Care and Maintenance Instructions

1.2.6 SD-09 Manufacturer's Field Reports: Manufacturer's Certification of Installation

1.2.7 SD-11 Closeout Submittals: Manufacturer's Warranty, Provide three year manufacturer's limited warranty on all FRP products against defects in materials and workmanship. Submit Manufacturer's Sample Warranty prior to commencement of the work.

1.3 Quality Control:

Provide items by manufacturers having a minimum of ten years’ experience in the design and manufacture of similar products and systems.

1.4 Delivery, Handling and Storage

Deliver manufactured materials in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Ensure all adhesives, resins and their catalysts and hardeners are crated or boxed separately, and noted as such to facilitate their movement to a dry indoor storage facility. Handle all materials to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Store adhesives, resins and their catalysts in dry indoor storage facilities between 70 and 85 degrees F until they are required.

#### PART 2 PRODUCTS

2.1 System description:

2.1.1 Provide gratings composed of continuous roving fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified.

2.1.2 Provide resin of isophthalic polyester with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties conforming to the specified requirements.

2.1.3 Ensure all surfaces of FRP items and fabrications are non-slip grit, resin-rich, free of voids and without dry spots, cracks, and un-reinforced areas. Completely cover all glass fibers with resin to protect against their exposure due to ultraviolet, wear, or weathering.

2.2 Design Requirements:

| Test | Standard | Structural Performance Requirements | Minimum Flexural Strength | Minimum Flexural Modulus |
| --- | --- | --- | --- | --- |
| Bearing Strength Testing | ASTM D953 |  |  |  |
| Flexural Properties | ASTM D790 |  | 30,000 psi | (1.8 x 10 to power of 6) psi |
| Ultraviolet Testing | ASTM G155 ASTM G154 |  |  |  |
| Shear Strength | ASTM D2344/D2344M | 4,500 psi |  |  |
| Tensile Properties | ASTM D638 | 30,000 psi |  |  |
| Toxicity Testing | SAE CMH-17-36 |  |  |  |
| Coefficient of Lineal Thermal Expansion | ASTM D696 | 8.0 x 10 power minus 6 in/in/degree F |  |  |
| Flame Spread Testing | ASTM D2863 ASTM E662  UL 94 |  |  |  |

2.3 Performance Requirements

2.3.1 Structural Performance of Gratings: Provide gratings capable of withstanding the effects of gravity loads in accordance with ASCE 7, ICC IBC, and the loading and stress limits for walkways and elevated platforms used as exits. Design for a uniform load of 100 lb/sq.ft.

2.3.2 Flame Spread: Provide grating products with a flame spread rating of 25 or less per ASTM E84 Tunnel Test. Test gratings for burn time of less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D635.

2.2 FRP Grating:

2.2.1 General: Ensure all field and shop fabricated grating cuts are coated with vinyl ester resin to provide maximum corrosion resistance in accordance with the manufacturer's instructions.

2.2.2 Grating: Provide grating made as one piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane with a square mesh pattern providing unidirectional strength and reinforced with continuous roving of equal number of layers in each direction. Ensure the top layer of reinforcement is no more than 1/8-inch below the top surface of the grating to provide maximum stiffness and prevent resin chipping of unreinforced surfaces having percentage of glass (by weight) not exceeding 35 percent. Ensure no dry glass fibers are visible on any surface of bearing bars or cross bars after molding, and that all bars are smooth and uniform with no evidence of fiber orientation irregularities, inter-laminar voids, porosity, resin rich or resin starved areas.

2.2.3 Surface: Non-slip surfacing to be manufactured with a concave, meniscus profile on the top of each bar providing maximum slip resistance.

2.2.4 Flame Spread: Provide fire retardant grating with a tested flame spread rating of 25 or less when tested in accordance with ASTM E84.

2.3 Fasteners

Provide Type 316 stainless-steel fasteners, clips and anchorage for exterior use. Select fasteners for type, grade, and class required. Install fasteners as recommended by the grating manufacturer.

#### PART 3 EXECUTION

3.1 Installation:

General: Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, to be included. Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack. Comply with recommendations of referenced bar grating standards, including installation clearances and standard anchoring details.

a. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

b. Attach non-removable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.1.1 Shaping and Fitting: Fillet grating bar intersections to a minimum radius of 1/16-inch to eliminate local stress concentrations and the possibility of resin cracking at these locations. All grating which requires cutting during installation shall have the affected surfaces sealed with catalyzed resin sealant of equal or superior corrosion and UV resistance to the grating. Panels shall be cut to assure that all seams/joints are centered over structural members.

3.2 Anchorage, Fastenings, and Connections:

Provide anchorage where necessary for fastening miscellaneous FRP items securely in place. Include for anchorage not otherwise specified or indicated.

3.2 CLOSEOUT ACTIVITIES

3.2.1 Manufacturer's Warranty

Submit original and 3 copies of manufacturer's signed Warranty.

-- End of Section 06 73 01 --

1. division 26 - electrical

SECTION 26 00 00  
ELECTRICAL SYSTEMS

Electrical Systems

#### PART-1 GENERAL

1.1 APPLICABLE PUBLICATIONS (LATEST EDITIONS):

A. Federal Specifications:

HH-I-553 Insulation Tape, Electrical, (Rubber, Natural, and

Synthetic)

HH-I-595 Insulation Tape, Electrical, (Pressure Sensitive Adhesive,

Plastic)

WW-C-566 Conduit, Metal, Flexible

B. American National Standards Institute (ANSI):

C2 National Electrical Safety Code

C. National Fire Protection Association (NFPA):

70 National Electrical Code (NEC)

72 National Fire Alarm and Signaling Code

101 Life Safety Code

D. National Electrical Manufacturer's Association (NEMA):

AB 1 Molded Case Circuit Breakers and Molded Case Switches

C80.1 Specification for Rigid Steel Conduit, Zinc-Coated

C80.3 Specification for Electrical Metallic Tubing, Zinc-Coated

FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for

Conduit and Cable Assemblies

KS 1 Enclosed Switches

MG 1 Motors and Generators

OS 1 Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box

Supports

PB 1 Panelboards

RN 1 Polyvinyl-Chloride (PVC) Externally Coated Galvanized

Rigid Steel Conduit and Intermediate Metal Conduit

TC 2 Electrical Plastic Tubing and Conduit

TC 3 PVC Fittings for Use with Rigid PVC Conduit and

Tubing

WC 3 Rubber-Insulated Wire and Cable

WC 5 Thermoplastic-Insulated Wire and Cable

WD 1 General-Purpose Wiring Devices

E. Underwriters Laboratories (UL):

UL 1 Flexible Metal Conduit

UL 6 Rigid Metal Conduit -Steel

UL 50 Safety Enclosures for Electrical Equipment

UL 67 Panelboards

UL 83 Thermoplastic Insulated Wires and Cables

UL 360 Liquid Tight Flexible Steel Conduit

UL 467 Grounding and Bonding Equipment

UL 486A Wire Connectors and Soldering Lugs for Use with Copper

Connectors

UL 486C Splicing Wire Connectors

UL 489 Molded Case Circuit Breakers, Molded Case Switches,

and Circuit Breaker Enclosures

UL 506 Specialty Transformers

UL 510 Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape

UL 514B Fittings for Cable and Conduit

UL 869A Service Equipment

UL 886 Outlet Boxes and Fittings for Use in Hazardous

(Classified) Locations

1.2 STANDARDS:

1.2.1 Work under this contract shall be performed as stated in these specifications and shall in all respects be done by mechanics skilled in the trade. Workmanship shall meet or exceed the best standard practice.

1.2.2 Electrical contractor shall currently be a city or state-certified master electrician or certified master electrical contractor. Submit a photocopy of the certification to the Contracting Officer before beginning any electrical work.

1.2.3 The city or state-certified master electrician, the certified master electrical contractor, or a journeyman electrician with a current journeyman's card shall be at the job site whenever electrical work is being performed.

1.2.4 Work and materials shall comply with applicable laws, ordinances, rules and regulations, including national, state, and local electrical codes. As a minimum, materials and installation shall comply with NFPA 70.

1.2.5 When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturer's Association (NEMA), and Underwriters Laboratories (UL), proof of such conformance shall be submitted to the Contracting Officer for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual paragraphs.

1.2.6 The Contractor shall furnish equipment that is new and a standard product of the manufacturer and currently commercially available. The models quoted shall include the latest engineering changes of the manufacturer. Where two or more items of the same kind are required, they shall be the product of the same manufacturer. Contractor shall submit product data of all equipment to the Contracting Officer for approval.

1.2.7 The existing site installation shall be reviewed by the Contractor prior to procurement, fabrication, or delivery of all materials to verify actual size restrictions and electrical requirements.

1.2.8 Provide items of a minor nature not specifically called for in these specifications that are required to make the systems complete and operable.

1.3 SUBMITTALS: Items to be submitted are specified in this section and the “List of Submittals”. Submittals shall be approved prior to procurement, fabrication, or delivery of all materials.  
  
1.4 DELIVERY AND STORAGE: Equipment and materials shall be properly stored, adequately protected, and carefully handled to prevent damage before and during installation. Equipment and materials shall be handled, stored, and protected in accordance with the manufacturer's recommendations and as approved by the Contracting Officer’s Representative. Damaged or defective items, in the opinion of the Contracting Officer’s Representative, shall be replaced with new items at no cost to the Government.

PART-2 PRODUCTS

2.1 CONDUCTORS: NEMA WC 3, NEMA WC 5; conductors shall be copper. Conductors manufactured more than 12 months before date of delivery to the site shall not be used.

2.1.1 Power Conductors: Minimum size of conductors shall be #12 AWG. Interior conductors shall be type THW or THWN. Conductors in exterior raceway shall be Type XHHW. Conductors shall be suitable for use in dry and wet locations at temperatures not exceeding 75 degrees C.

2.1.2 Control Conductors: Minimum size of conductors shall be #14 AWG for Class 1 remote-control and signal circuits and #16 AWG for Class 2 remote-control and signal circuits. Minimum size of control conductors for 50 volts and less shall be #16 AWG for Class 1 and #18 AWG for Class 2. Control circuit voltages in equipment controllers shall not exceed 120 volts.

2.1.3 Color Coding: Provide conductors with a continuous factory-applied color compound or coating except that where factory-applied coating is not available, apply colored pressure-sensitive tape for a distance of 6 inches along the length of the conductor at terminal points and locations where the conductor is accessible. Color code power conductors according to the voltage of the electrical system in which they are used.

2.1.4 Power wire sizes #10 AWG and smaller shall be solid. Wire sizes #8 AWG and larger shall be stranded.

2.2 CONDUIT, FITTINGS, AND BOXES:

2.2.1 Exterior Boxes: Boxes suitable for outdoor and corrosive environment, NEMA 4X.

2.2.2 Flexible Metal Conduit: Federal Specification WW‑C‑566, galvanized steel. Fittings shall conform to NEMA FB 1, galvanized. Liquid-tight conduit shall have a PVC jacket.

2.2.3 Plastic Conduit: NEMA TC 2; Polyvinyl Chloride (PVC) Schedule 80. Fittings shall conform to NEMA TC 3.

2.3 TAPE: Insulating natural rubber tape shall meet the requirements of Federal Specification HH-I-553. Vinyl tape shall meet the requirements of Federal Specification HH-I-595.

#### PART-3 EXECUTION

3.1 GENERAL:

3.1.1 As a minimum, installation shall be in accordance with NFPA 70 except as otherwise specified. The installation of equipment shall conform to the instructions issued by the manufacturer.

3.1.2 The Contractor shall furnish all labor, equipment and materials (except as noted), tools, and services necessary for the proper completion of all electrical work for this project in accordance with these specifications, the contract drawings, and the intent thereof.

3.1.3 All work shall be executed in a thorough, workmanlike manner by competent and efficient laborers, mechanics, electricians, or artisans in strict accordance with these specifications and the contract drawings and to the entire satisfaction of the Contracting Officer's Representative.

3.1.4 The Contractor shall obtain all necessary permits required for this project.

3.1.5 All material removed shall become the property of the Contractor and shall be removed from Coast Guard property. Its value shall be reflected in the bid price.

3.2 CONDUCTOR AND CONDUIT INSTALLATION:

3.2.1 All conductor shall be run in conduit. Minimum conduit size shall be 3/4 inch unless otherwise indicated and shall conform to the regulations of NFPA 70.

3.2.2 Install separate conduit systems for each of the following circuits: low voltage, control, and power.

3.2.3 All control devices, junction boxes, pull boxes, and specialties shall be located to provide easy access for operation, repair, and maintenance.

3.2.4 Exposed exterior conduit shall be PVC Schedule 80 or liquid tight flex, unless otherwise indicated.

3.2.5 Support conduit securely by pipe straps, wall brackets, hangers, etc. All exterior fasteners and fastening hardware to be stainless steel.

3.2.6 Provide manufactured expansion joint fittings for all above grade conduit that exceeds 25 feet in length. Install per manufacturer’s spacing and recommendation.

3.3 CONDUCTOR IDENTIFICATION:

3.3.1 Provide conductor identification within each enclosure where a tap, splice, or termination is made. Identification shall be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, or heat shrink type sleeves.

3.3.2 Identify control circuit terminations.

3.4 SPLICES: Make splices in accessible locations. All splices shall be made in junction boxes. No splices will be permitted in the conduit. Splices in wires #10 AWG and smaller shall be made with an insulated wire nut twist-on pressure type connector. Splices in wire #8 AWG and larger shall be made with a solderless connector and covered with an insulation material equivalent to the conductor insulation. Do not use twist-on wire nuts with wire larger than #10 AWG.

3.5 GROUNDING:

3.5.1 All grounding shall be in accordance with Article 250 of NFPA 70. Equipment grounding and bonding shall be in accordance with ANSI 467.

3.5.2 All conduits shall have a grounding conductor installed. This conductor shall be separate from the electrical system neutral conductor. In addition, all metallic conduits shall be grounded.

3.5.3 All connections and splices for grounding wires, except the terminal connections at equipment, shall be brazed. Compression type solderless connection shall be used at equipment terminations. Solder lugs will not be permitted.

3.5.4 Noncurrent carrying metallic parts associated with electrical equipment shall have a

maximum resistance to solid earth ground not exceeding 25 ohms.

3.6 CLEANING AND RESTORATION:

3.6.1 Prior to leaving the job, the contractor shall thoroughly clean all new electrical equipment and all existing equipment and surrounding areas disturbed/soiled by new installation work.

3.6.2 Paved and unpaved surfaces disturbed during the installation of electrical systems shall be restored to their original condition. Asphalt or concrete shall be used as required to repair paved surfaces and walkways to their original condition.

3.7 TESTING:

3.7.1 After the installation and connection of all equipment has been accomplished, the Contractor shall place the equipment in operation and test it in the presence of the Contracting Officer's Representative for a period of at least one day to demonstrate that all equipment and devices operate in accordance with the requirements of the drawings and specifications. Any defects or adjustments in the wiring or equipment provided by the Contractor shall promptly be corrected by the Contractor at his expense. The Contractor shall furnish all labor, material, and equipment to accomplish the testing.

3.7.2 Should any cable fail due to a weakness of conductor insulation or due to defects or injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections, the Contractor shall make necessary repairs or replace cables as directed.

3.7.3 Acceptance checks and tests shall include, but not be limited to the following:

3.7.3.1 Compare actual connections with wiring diagrams. If differences are found, determine if error is in diagram or in actual wiring and correct as necessary.

3.7.3.2 Inspect all devices, equipment, and materials for damage or maladjustment caused by shipment or installation.

3.7.3.3 Verify that all fuses are the proper types and range.

3.7.3.4 Remove wedges, ties, and blocks installed by the manufacturer to prevent damage during shipment.

3.7.3.5 Verify minimum resistance to ground of all grounding systems.

3.7.3.6 Each device subject to manual operation shall be operated at least three times demonstrating satisfactory operation each time.

3.7.3.7 Test all conductors to verify that no short circuits or accidental grounds exist.

3.7.4 Upon completion of all acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that all circuits and devices are in good operating condition and properly performing their intended function.

END OF SECTION 26 00 00

SECTION 26 41 13  
LIGHTNING PROTECTION FOR STEEL TOWER STRUCTURES

Lightning Protection for Structures

#### PART 1 - GENERAL

* 1. Submittals:

1.1.1 Shop Drawings: For air terminals and mounting accessories. Layout of the lightning protection system, along with details of the components to be used in the installation. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.

1.1.2 Product Data: For each type of product indicated.

1.1.3 Field quality-control reports.

1.2 Quality Assurance

1.2.1 Installer Qualifications: Certified by LPI as a Master Installer/Designer, trained and approved for installation of units required for this Project.

1.2.2 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 780, "Definitions" Article.

#### PART 2 – PRODUCTS

2.1 Lightning Protection System Components

2.1.1 Comply with UL 96 and NFPA 780. Class as required.

2.1.2 Air Terminals: NFPA 780, aluminum, with safety tip, unless otherwise indicated.

2.1.3 Air Terminal Support: Provide bracing/supports as required and per the manufacturer’s recommendation.

2.1.4 Main and Bonding Conductors: Upper Tower: Aluminum, Lower Tower: Tinned Copper.

2.1.5 Ground Loop Conductor: Tinned copper, the same size (or larger) as the main conductor.

2.1.6 Ground Rods: Copper-clad, 3/4 inch diameter by 10 feet long.

#### PART 3 – EXECUTION

3.1 Installation

3.1.1 Install lightning protection components and systems according to UL 96A and NFPA 780.

3.1.2 Cable Connections: Use exothermic-welded connections for all conductor splices and connections between conductors and other components.

3.1.3 Bond extremities of vertical metal bodies exceeding 60 feet in length to lightning protection components.

3.1.4 Ground Loop: Install ground-level, potential equalization conductor and extend around the perimeter of structure or area or item indicated. Bury ground ring not less than 24 inches from building/tower foundation. Bond ground terminals to the ground loop. Bond grounded building/tower systems to the ground loop conductor within 12 feet of grade level.

3.2 Corrosion Protection

3.2.1 Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

3.2.2 Use conductors with protective coatings where conditions cause deterioration or corrosion of conductors.

3.3 Field Quality Control

3.3.1 Notify the Contracting Officer’s Representative at least 48 hours in advance of inspection before concealing lightning protection components. One of the following inspection methods shall be used:

3.3.2 UL Inspection: Meet requirements to obtain a UL Master Label for system.

3.3.3 LPI System Inspection: Meet requirements to obtain an LPI System Certificate.

END OF SECTION 264113

1. division 31 - EARTHWORK

SECTION 31 66 15  
HELICAL PILES

Helical Piles

PART-1 GENERAL

1.1 References

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36 Carbon Structural Steel

ASTM A 53 Pipe, Steel, Black and Hot-Dipped,Zinc Coated Welded and Seamless

ASTM D 1143 Piles Under Static Axial Compressive Load

AMERICAN WELDING SOCIETY, INC. (AWS)

AWS D1.1 Structural Welding Code Steel

1.2 Submittals:

1.2.1 SD-01 Preconstruction Submittals:

Certificates showing evidence of Installing Contractor’s competence in the installation of helical piles shall be provided to include a list of at least three projects completed within the previous three years wherein the Installing

1.2.2 SD-03 Product Data:

Product designations for helix and extension sections and all ancillary products

Equipment data for the helical pile installation.

1.2.3 SD-05 Design Data:

Individual pile load capacity

Manufacturer’s published mechanical strengths for the pile assemblies, including load transfer devices

Minimum effective torsional resistance criteria

Mmaximum allowable installation torque of pile,

Minimum embedment lengths as appropriate for the site soil profiles and inclination angle and location tolerance requirements.

1.2.4 SD-06 Test Reports: Provide installation record reports as outlined in Paragraph 3.4.

1.3 Definitions:   
  
Crowd: Axial compressive force or pressure applied to the helical pile as needed during installation to ensure the pile progresses into the ground a distance approximately equal to the helix pitch per revolution.

Extension Section: Helical pile component installed between the lead section and the load transfer device allowing installation of the helix plates to such depth as may be necessary to attain the required load capacity. Extension shaft ends are adapted to interconnect with helical lead sections, other extension sections and the load transfer device.

Effective Torsional Resistance: The average installation torque typically taken over a distance equal to the last three diameters of penetration of the largest helix plate.

Helical Pile: Consists of 1) One or more helical deformed plates (“helix plates”) attached to a central shaft and 2) Load transfer device for attachment to a structure. It may also include surface coating or other corrosion protection means. It is installed by screwing into the soil with down pressure (“crowd”), and thereafter resists compressive loads through bearing of the helical plates on the soil in which they are embedded.

Helical Plate: Generally round steel plate formed into a helical spiral and welded to the central steel shaft. The plate transfers axial load to the soil through bearing.

Lead Section: The first helical pile component installed into the soil. It consists of one or

more helical plates welded to the central steel shaft.

Mechanical Strength: The maximum compressive load that can be resisted by the structural elements of a helical pile.

Reveal: The distance from ground surface to the end of the last installed extension of a pile, measured along the pile’s longitudinal axis.

PART-2 PRODUCTS

2.1 Piles: Helical piles shall be designed to support the nominal compressive load(s) as shown on the project plans. The piles shall be designed such that the maximum test load for piles do not exceed 80% of the manufacturer’s rated ultimate mechanical strength of any pile component or load transfer device.

2.1.1 Materials: Helical shall be fabricated of ASTM A53 pipe with A36 helix. All fasteners and connectors shall be grade 304 stainless steel. Steels with higher strength properties may be used.

PART-3 EXECUTION

3.1 Placement Requirements

3.1.1 General: Piles shall be placed such that the pile head is within 3 inches, and the pile shaft alignment is within 2 degrees of the inclination angle, shown on the project plans. Cutoff elevation shall be within 2” of design.

3.1.2 Pile Installation: Installing Contractor shall furnish and install all helical piles per the project plan. The Installing Contractor shall conduct his construction operations in a manner to insure the safety of persons and property in the vicinity of the work. The Installing Contractor’s personnel shall comply with safety procedures in accordance with OSHA standards and any established project safety plan.

3.1.3 Underground Utilities: The Installing Contractor shall request marking of underground utilities by an underground utility location service as required by law, and shall avoid contact with all marked underground facilities.

3.2 Site Requirements: The portion of the construction site occupied by the Installing Contractor, his equipment and his material stockpiles shall be kept reasonably clean and orderly. Installation of helical piles may be observed by representatives of the Contracting Officer’s Representative. The Installing Contactor shall give the Government Representative at least 48 hours prior notice of pile installation operations. All helical pile sections and ancillary products shall be marked as necessary to allow correlation with the pile design documentation before shipment from the manufacturer.

3.3 Installation: The helical pile installation technique shall be such that it is consistent with the geotechnical, logistical, environmental, and load carrying conditions of the project. The lead section shall be positioned at the location as shown on the pile design drawings. Inclined helical piles can be positioned perpendicular to the ground to assist in initial advancement into the soil before the required batter angle shall be established. After initial penetration, the required inclination angle shall be established. The helical pile sections shall be engaged and advanced into the soil in a smooth, continuous manner. Sufficient down pressure (crowd) shall be applied to uniformly advance the helical pile sections a distance approximately equal to the pitch of the helix plate (typically 3 inches) per revolution. The rate of rotation and magnitude of down pressure shall be adjusted for different soil conditions and depths. Extension sections shall be provided to obtain the required minimum overall length and minimum effective torsional resistance as shown on the project plans.

3.3.1 Termination Criteria: The minimum overall length criteria and the minimum effective torsional resistance criteria as specified in the Design Documentation Submittals must be satisfied prior to terminating the pile installation. In the event any helical pile fails to meet these criteria, continue the installation to greater depths until the torsional resistance criterion is met,

3.4 Installation Record: Provide installation records that show the following:

A. Date and time of installation

B. Location of helical pile

C. Pile Reveal

D. Actual helical pile type and configuration

E. Total length of installed pile

F. Actual inclination of pile

G. Actual effective torsional resistance

H. Calculated geotechnical capacity based on actual torsional resistance and soil parameters appropriate for subsurface conditions within 3 helix diameters above below the helix depth.

I. Comments pertaining to interruptions, obstructions, or other relevant information

3.5 Cleanup: Within one week of completion of the work, the Installing Contractor shall remove any and all material, equipment, tools, building materials, concrete forms, debris, or other items belonging to the Installing Contractor.

---End of Section 31 66 15---