

PATRICK AIR FORCE BASE

Technical Specifications

for

SXHT 16-1100

Repair/Replace Lift Station 725

100% Submittal

DATE: February 2018



RAEIS

Range Architect-Engineer Inspection Services

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SUMMARY OF WORK
10/14

PART 1 GENERAL

1.1 SUMMARY

The work to be performed under this project is located at Patrick Air Force Base. Patrick Air Force Base is located approximately three miles south of Cocoa Beach on State Road A1A.

The work to be performed under this project consists of providing the labor, equipment and materials for the removal, repair, rehabilitation and replacement of sanitary sewer pipes and lift station pump system components located outside of the Hangar Bldg. 750 on the east side. Project includes demolition and total replacement at Lift Station #725 and installation of new force main piping .

1.2 PROJECT DESCRIPTION

1.2.1 Civil/Site

Furnish all material, labor and equipment to furnish and install repairs, and replacement of sanitary sewer service pipe connected from Bldg. 750 into new replacement Lift Station 725 located near Bldg. 750 east wall as indicated on the drawings. Installation methods include, but are not limited to, conventional open trenching, asphalt pavement, curb, and concrete sidewalk cutting, except horizontal directional drilling of force main pipe must be done beneath the 750 Ramp concrete pavement. Connect to existing portions of existing sanitary pipe coming out of east side of Bldg. 750. Verify locations, sizes, depths, and materials prior to ordering. Construct new wet well for Lift Station 725. Demolish and dispose of existing Lift Station 725 to be replaced. Obtain wastewater service outage during construction. The contractor is responsible for construction sequencing, by-pass pumping if required, and testing as necessary to limit system outage duration. Site restoration will include asphalt/ concrete pavements, concrete curbs, walks, and sod areas.

1.2.2 Electrical

Disconnect and remove power to the existing lift station pumps. Remove existing control panel, and associated conduit and wire. Provide power to the replaced lift station control panel as indicated on the drawings at Lift Station #725. Install new NEMA 4X disconnect switch, including conduit and wire. Power shall be taken from existing lift station source.

1.3 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.

45TH SPACE WING (SWI)

45 SWI 31-1

Integrated Defense Plan

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2015; ERTA 2015) Life Safety Code

U.S. AIR FORCE (USAF)

AFI 33-580 (2013) Spectrum Management

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

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

29 CFR 1910 Occupational Safety and Health Standards

29 CFR 1926 Safety and Health Regulations for Construction

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control information only. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Submit the following items to the Contracting Officer:

Lifting Operation Plan;G

Utility Outage Requests;G

Connection Requests;G

Air Force Form 3952 (AF 3952), Chemical/Hazardous Material Request Authorization;G (including all paint)

SOLID WASTE DISPOSAL DIVERSION TRACKING;G

Premises/Access Plan;G

Storage Area Request;G

Superintendent Contact and Qualifications;G

1.5 CONTRACT DRAWINGS

See Drawing Index for list of project drawings.

Contract drawings, maps, and specifications will be furnished to the Contractor either hard copy or electronic at the Government's discretion. Reference publications will not be furnished.

Contractor shall immediately check furnished drawings and notify the

Contracting Officer of any discrepancies.

The drawings indicate the general location and arrangement of existing conditions. Field measurements may be necessary to determine the size and quantity of materials. Conditions which are obvious/visible or which should be reasonably anticipated by the Contractor on inspection will not be considered under the Differing Site Conditions clause of this contract.

1.5.1 Layout of Work and Elevations

Dimensions and elevations indicated in the layout of work shall be verified by the Contractor. Discrepancies between the drawings, specifications and/or existing conditions shall be referred to the Contracting Officer in writing, for review, before the affected work is performed. Failure to make notification shall place the responsibility upon the Contractor to carry out the work in a satisfactory and workmanlike manner.

1.6 WORK SCHEDULING

Work Schedules for all on-site activities must be reviewed and approved by the Contracting Officer prior to start of the project; and all activities coordinated with the Contracting Officer once work has begun. Due to the critical nature of the work location, all work pertaining to this contract shall be completed without disrupting the operation of the entire Base.

Contractor shall allow for non-access days where construction activity is prohibited due to hazardous operations or launch activity. When possible, the Government will provide 24 hour notification each time the restrictions are invoked.

1.6.1 Requirements

Working hours will normally range between the hours of 7:30 AM and 4:00 PM (0730-1600) excluding Saturdays, Sundays and Federal Holidays. If work must be done during periods other than above, additional Government inspection and Range Support personnel may be required. Notification must be given to the Contracting Officer five working days in advance of intention to work during other periods to allow assignment of additional inspection forces when the Contracting Officer determines that they are reasonably available. If such support is reasonably available, the Contracting Officer may authorize work to be performed during periods other than normal duty hours/days. Work beyond normal hours/days may be required for major utility outages. It is to the government's discretion to request copies of contractor inspection records for periods worked on holidays and weekends (FAR 52.246-12 Inspection of Construction).

No construction work shall take place over the Christmas/New Year holiday period. This period will start one full work day before the Federal Christmas holiday and end the first work day after the Federal New Year Holiday. The Contractor may request to work during this time at the discretion of the Contracting Officer, however no base support will be available.

1.7 OCCUPANCY OF PREMISES/ACCESS REQUIREMENTS

Premises will be occupied during performance of work under this Contract. Occupancy notifications will be posted in a prominent location in the work area. Contractor shall post warning signs in accordance with OSHA requirements.

Before work is started, the Contractor shall submit a [Premises/Access Plan](#) to the Contracting Officer or Representative for approval. The plan shall include a sequence of procedures, means of access, space plan for storage of materials and equipment, and use of approaches, corridors, and stairways.

This plan must comply with [NFPA 101](#) requirements that all exits and exit access must be maintained at all times. Base Fire Department is required to approve any deviations which affect the exiting or exit access from the building.

1.7.1 Facility Contents

1.7.1.1 Responsibilities

The schedule of work shall be closely coordinated with the Contracting Officer. Unless otherwise stated, remove all equipment, etc., as required to perform the work. Any movable or fixed equipment, etc., remaining in the work area shall be covered and protected from damage. All relocated items shall also be protected from damage throughout the construction period. After completion of work and prior to final acceptance, replace removed items in their original location.

1.7.1.2 Maintain Clean Work Areas

All work areas shall be kept clean at all times. Contractor shall prevent introduction of dirt or dust into areas adjacent to the work areas. All materials, tools and equipment shall be thoroughly cleaned prior to being brought into the work areas or adjacent areas.

1.7.1.3 Damage To Existing Equipment

Any damage must be reported to the Contracting Officer immediately. Damage to existing materials, equipments, systems, or properties occurring from Contractor activities or neglect, shall, at the sole discretion of the Contracting Officer, be repaired or replaced by the Contractor at no cost to the Federal Government.

1.7.1.4 New Material and Construction Equipment

Only material and construction equipment designated for performance of contract work may be stored at the construction site or located in Government-controlled warehouses or shop facilities.

1.7.2 Construction Area Access And Control

1.7.2.1 Access and Control Requirements

Exclusive use or control of any area will not be allowed as the Government must have access to all areas at all times. All work must be scheduled around operational constraints.

1.7.3 Vehicle Parking

1.7.3.1 Requirements

Job and support vehicles for workers will be parked in designated parking areas within reasonable access to the worksite. All vehicle operators must comply with all traffic laws including mandatory seat belt usage, speed

limits and hauling restrictions. Contractor shall be responsible for repairing or replacing any facility/grounds damaged areas.

1.8 STORAGE, TRANSPORTATION AND PROTECTION

1.8.1 Storage

At Government discretion, Contractor may be assigned a storage area upon submitting written [Storage Area Request](#) to the Contracting Officer. Contractor's Storage Area Request shall indicate dimensions of trailer, size of storage area, and utilities required. All trailers shall be in good and safe condition. Storage space is normally co-located with construction site, at the Contracting Officer's discretion. Storage areas may require fence and screening as required by Government. Contractor shall secure storage areas during inclement weather situation.

Office trailers and long term (longer than one year) storage trailers shall be painted to match the base approved color", as noted in the base Facilities Sustainment guide. Trailers located on site for short term storage, less than one year, will not need to meet this requirement. In addition, all office trailers and long term storage trailers shall be skirted along the entire perimeter with a wood lattice material. This skirting shall be painted to match the same trailer color as described above. Contractor shall be responsible for the storage and protection of all of their materials and equipment, whether incorporated into the job or not.

1.8.2 Protection

Store and protect products in accordance with manufacturer's instructions. Store products with seals, labels intact and legible. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to the product. Products acceptable for exterior storage shall be on sloped supports above ground. Contractor shall not use swales, drainage ditches, or any other storm water permitted area to store materials or equipment. If swales, drainage ditches or any other storm water permitted areas must be used for storage, Contractor must get special permission from Contracting Officer.

1.8.3 Transportation

Transport and handle products in accordance with manufacturer's instructions. Promptly inspect shipments to ensure the products comply with requirements, quantities are correct, and products are undamaged. Protect products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products. Store loose granular materials on solid flat surfaces in a well drained area. Prevent mixing with foreign materials.

1.8.4 Hazardous Materials

Submit an Air Force Form 3952 ([AF 3952](#)), Chemical/Hazardous Material Request Authorization if hazardous materials & petroleum product will be used on site. Hazardous Materials & petroleum product containers shall be stored on an impervious surface with containment. Incompatible materials shall be segregated and have separate containment systems. Additional HAZMAT requirements are provided in Section [01 57 19](#) TEMPORARY ENVIRONMENTAL CONTROLS.

1.8.5 Site Protection Plan

Structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations shall be protected against damage. Contractor shall comply with "FAR 52.236-9, Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements" and is required to protect areas adjacent to the construction site.

1.9 GOVERNMENT-FURNISHED EQUIPMENT - None

1.10 ON-SITE PERMITS

1.10.1 Utility Outage Requests And Connection Requests

Work shall be scheduled to hold outages to a minimum.

Utility outages and Connection Requests required during the execution of work that affect existing systems shall be arranged at the convenience of the Government, which may require scheduling outside of the regular working hours or on weekends, at no additional cost to the Government.

Each Utility Outage and Connection Requests shall state the system involved, area involved, approximate duration of outage, and the nature of work involved.

1.10.1.1 Requirements

A written request for a utilities outage (electricity, communication, water, compressed air, gas, steam, air conditioning, fire detection and suppression systems, etc.) must be submitted to the Contracting Officer at least 14 calendar days in advance of the desired outage. Approval is required prior to scheduling any outage. All limitations noted on the approved outage authorization shall be carefully observed. A utilities outage without prior approval and coordination is prohibited.

Utility outages affecting fire alarm, fire detection, fire suppression, fire pumps and water supplies to fire protection systems greater than 4 hours will require a fire watch.

Since many systems are critical to facility operations, the number and duration of utility outages shall be kept to an absolute minimum. All work effort shall be coordinated and sufficient manpower, materials, and equipment shall be provided to complete the work within the authorized outage window.

Existing utility services may be interrupted only when approved by the Contracting Officer. The interruption shall be scheduled at a time of minimum demand on the utility, convenient to the Government. Outages on weekends, holidays, or evenings shall be performed at no additional cost to the Government.

Contractor shall make all necessary arrangements to schedule and provide connections to existing utilities and to cause minimum interruption to system operation. All temporary utility hook-ups and disconnects shall be made by the Contractor.

If the Contractor fails to comply with a scheduled outage, the cost to reschedule the outage will be deducted from the final contract payment.

1.10.2 Protection of Work

All construction work requires a Work Clearance Request, AF Form 103. This permit is processed by the Government and provided to the Contractor. It is required prior to the start of any construction at the project site and must be posted in a conspicuous location on site during all construction activities.

Contractor shall obtain (from technical representative), prepare, and properly complete "Base Civil Engineering Work Clearance Request" AF Form 103. Prior to submitting 103 for review and approval, contractor shall mark in white paint all locations requiring utility locates and a commercial utility locate ticket number must be obtained by calling SUNSHINE at 1-800-432-4770. Contractor shall provide coordination for location of buried structures and utility lines before beginning any work involving digging/excavation. Contact the Government Technical Representative to schedule locates prior to any excavation. The Technical representative shall be the first and the last to coordinate on the AF Form 103.

After excavation permit has been obtained and prior to any excavating, verify with Cape Support (853-5211) that there are no "Critical Days" that would prevent excavation.

Contractor shall temporarily halt any machine excavation work or other surface penetration when approaching within 5 feet of the existing utility line until the Contractor has exposed the utility line by hand excavation to fix its location.

1.10.3 Burn Permits

Burn permits are required for any spark, flame, or welding activity. Burn Permits shall be obtained thru [PAFB Fire Department \(494-7642\)](#).

Permits shall be posted at a conspicuous location in the construction area.

Burning of trash or rubbish is not permitted on any USAF facility.

1.11 SALVAGE AND DISPOSAL OF MATERIAL AND EQUIPMENT

1.11.1 Removal

Remove and/or relocate only those materials or items of equipment specifically indicated in the drawings and specifications. Removal operations shall be performed in such a manner that adjacent areas, installed equipment, or existing utilities are not damaged. Repair all openings that occur due to removal or demolition operations to match adjacent, existing surfaces. Any damage incurred during removal operations shall be repaired at no additional cost to the Government.

1.11.2 Housekeeping

Sufficient personnel and equipment shall be provided to ensure compliance with all housekeeping requirements. Work will not be allowed in those areas that do not comply with the requirements of Section 14.C of [EM 385-1-1](#). Job sites are to be kept clean on an ongoing, daily basis. All areas are to be thoroughly cleaned prior to leaving the jobsite at completion of project work.

1.11.3 Salvage of Material And Equipment

All salvageable materials or items to be removed shall remain the property of the Federal Government. Salvageable items are listed below in the paragraph entitled, "Salvage Items". Salvageable items shall be transported to and deposited at the Defense Logistics Agency Office - Disposition Services (DLA) located in Jacksonville, Florida at the contractor's expense.

Salvageable material must be segregated and separated into categories before transport. Material shall be palletized or moveable by forklift (maximum 10,000 lbs). For material that is not palletized, it will be the responsibility of the Contractor to provide labor support for material removal.

Deliveries to DLA shall be scheduled through the Contracting Officer a minimum of 72 hours in advance. All salvageable items delivered to DLA shall be accompanied by a properly prepared DD Form 1348. This form will be furnished by the Contracting Officer. A signed copy by DLA reflecting the turn in materials shall be furnished to the Contracting Officer.

Contractor shall maintain property control records for material or equipment designated as salvage. Contractor's system of property control may be used if approved by the Contracting Officer. Contractor shall be responsible for storage and protection of salvaged materials and equipment until disposition by the Contracting Officer.

Material to be salvaged and reinstalled by the Contractor shall be protected during removal and stored to prevent damage.

For reference purposes salvageable is defined as: items, material, equipment which can be refitted, reworked, and restored and put to use or sold. The Contracting Officer shall have sole discretion as to determining whether any particular item is salvageable.

1.11.3.1 Salvage Items

1.11.4 Waste Disposal

Non-salvageable material and debris shall be removed from work areas and disposed of daily. Contractor shall dispose of C&D at a State approved disposal site.

Refer to Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS for further waste disposal and record keeping requirements.

1.11.5 Cleanup

All waste materials, except indicated salvaged items, generated by the construction shall be hauled off U.S. Government property at the end of each work day and deposited at a disposal site selected by the Contractor. Disposal shall be in accordance with federal, state, county and city ordinances and at the expense of the Contractor.

Upon completion of the construction each day, the Contractor shall leave the work premises in a clean, neat and workmanlike condition, satisfactory to the Contracting Officer.

1.11.6 Salvage And Disposal Record Keeping

Contractor shall maintain and submit quarterly and at the completion of the project the [SOLID WASTE DISPOSAL DIVERSION TRACKING](#) form to the Contracting Officer of all materials removed from the job site. This inventory shall include waste materials disposed in landfills and materials reused on the job, sold for salvage and recycled.

1.12 RADIO FREQUENCY MANAGEMENT PROCEDURES

The following procedures shall be followed in obtaining radio frequency authorization:

The policy and procedures contained in [AFI 33-580](#) shall be followed to obtain frequency allocation approval of electronic devices and USAF Radio Frequency Assignment.

1.13 COMMUNICATION SECURITY

Government telecommunications networks are continually subject to interception by hostile/unfriendly intelligent organizations. Therefore, the DOD has authorized the military departments to conduct COMSEC monitoring and recording of telephone calls from, or terminating at, DOD organizations. Contractor shall assume the responsibility for ensuring frequent dissemination of this information to all employees dealing with official DOD information.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 ACCESS REQUIREMENTS

3.1.1 Construction Site Requirement

Most on-site project work is confined to non-restricted areas. That is, no restricted area badge shall be necessary to accomplish the on-site work. However, normal access requirements into [PAFB](#) must still be accomplished.

Portion of the on-site project work is located within a restricted area. The restricted area requirement must be accomplished in order to access the construction site.

3.1.2 Air Force Restricted Area Requirements (Black & Blue Restricted Unescorted Badge)

Access to construction sites located in restricted areas requires a Black & Blue Restricted Area Unescorted Badge. Contractor is responsible for satisfying the prerequisites for unescorted entry and/or providing escorted entry to a restricted area for all their personnel and subcontractor personnel. Escort services will not be provided by the Government. It is the Contractor's responsibility to determine the minimum number of personnel needed and obtain the required badges with escort authority in order to meet the contract requirements. Failure to do so could result in denied access to the construction site, interruption of performance and negatively impact timely contract completion.

Individuals meeting the 45 SWI 31-1 security requirements will be allowed to acquire restricted area badges. If the Contractor has proper clearance in JPAS, the Contractor may complete an AF Form 2586 "Unescorted Entry Authorization Certificate" (signed by the CE Security Manager in signature block #2) and transmit it to the Facility Manager of the restricted area for signature. After obtaining signatures, the individual must make an appointment with Visitor Control Center to obtain a Restricted Area Badge.

In order for Contractor personnel to enter restricted areas, a Restricted Area Badge for the area is required. Those individuals not in possession of a Restricted Area Badge (RAB) must remain under the surveillance of the escorts at all times while working in the restricted area. Escorts are subject to having their base access privileges revoked if it is found that they are not in visual contact with the employees they are escorting. The required responsibilities and duties of an escort shall be adhered to by all Contractor and subcontractor personnel. 45 SWI 31-1 and Restricted Area Badge Processing Guide outline the requirements and procedures in obtaining a restricted area badge.

Contingent upon the location and nature of the work, a construction site "Free Zone" may be established by the Commander of the restricted area site. If the area is designated as a construction site "Free Zone", only normal access requirements will apply.

3.2 PAFB VEHICLE INSPECTION

The Oversized Vehicle Search Area is located on State Road A1A approximately 1 mile north of Pineda Causeway. Manned Operating hours are scheduled from 0600-1700. For after hours access, call PAFB Security Forces at (321) 494-2000 to co-ordinate entry. Mandatory inspection is required for all: Commercial Vehicles, Tractor Trailers, Trailers, RVs and Boats. All other passenger vehicles will be turned away from this gate and are required to enter at either the Main Gate or South Gate. Allow ample time for inspections, especially for the critical delivery period of mixed concrete. The government will not be responsible for rejected batches, caused by Contractor delays. Advance coordination is highly recommended.

3.3 PAFB DELIVERIES

3.3.1 Non-Hazardous Deliveries

All deliveries of construction material and equipment to job sites (including cement trucks) shall use the PAFB Oversized Vehicle Search Area (located on State Road A1A approximately 1 mile north of Pineda Causeway) for access. The operating hours for the Oversized Vehicle Search Area are 0600-1700. After hours access shall be through the South Gate. The driver of each delivery vehicle and their passengers must have the following:

- a. A valid photo ID; and
- b. A valid bill of lading; and
- c. A known delivery point on PAFB; and
- d. An on-base or local phone number and POC to vouch for delivery

Only deliveries that can be verified will be allowed to proceed. Special deliveries, deliveries after normal business hours, or deliveries that cannot negotiate through the barricades must be coordinated in advance.

All delivery vehicles shall be inspected by Security Forces personnel prior to being allowed to proceed onto the installation.

3.3.2 Hazardous Deliveries

Deliveries of fuel, large volume of chemicals, or other hazardous materials shall comply with this section. All hazardous deliveries shall enter through the same gates as non-hazardous deliveries and have the information required for non-hazardous deliveries (see subpart entitled "Non-Hazardous Deliveries" of this section). Only deliveries that can be verified will be allowed to proceed. In addition, hazardous deliveries must be scheduled a minimum of 48 hours in advance for escort by Security Forces to and from job site. Contractors shall contact the [PAFB Security Forces at 321-494-2000](tel:321-494-2000) to arrange for hazardous delivery escorts. Deliveries that have not arranged in advance for Security Forces escorts will be turned away and must be re-scheduled.

3.4 RESPONSIBILITIES

The Government reserves the right to revoke badging authority, escort authority and/or base access privileges for any person, at any time and for any reason. Contractor understands that the Government has made every attempt to identify potential delays associated with background checks and badging requirements and those delays have been considered in the construction schedule. Delays resulting from the Contractor's failure to follow the badging guidelines above shall not be considered grounds for contract extension or compensation.

3.5 EXCAVATION

3.5.1 Dig/Utility Locate Permit Requirements

Excavation shall be accomplished only after the Dig permit is received and utility locates accomplished and then with extreme caution to prevent damage to the existing buried utilities in the area. All open trenches must comply with OSHA regulations. All excavation must be further approved by daily contact with Cape Support (321-853-5211)

3.5.1.1 Location of Buried Structures and Utility Lines

[Accurately locate and paint structures and utility lines indicated by the Government provided Utility Locators on PAFB.](#) If unidentified underground utilities are encountered during excavation, notify the Contracting Officer and cease operations until they are properly identified.

3.5.1.2 Excavation, Trenching, and Backfilling

Open only those trenches for which material is ready to be placed. As soon as approved by the Technical Representative, trenches shall be backfilled and tamped as required by the drawings and specifications. As a minimum, the topsoil shall be replaced and the disturbed area shall be grassed by seeding, watered and maintained for a minimum of 60 calendar days. All excavation shall be in compliance with OSHA regulations. Mark or barricade construction work which may present a hazard.

3.5.1.3 Cutting of Roads, Streets, Driveways, and Paved Areas

Repair roads, streets, and paved parking areas which require surface

cutting under this project within 10 calendar days after initial cutting. The topping shall be a minimum of 2 inches of asphalt and match existing (concrete topping on asphalt areas is not allowed). Mark, barricade, and illuminate construction work on or near roads or streets which may present a traffic hazard per OSHA 29 CFR 1910. Contractor shall provide signaling, lighting, and barricades in the construction area conforming to the Manual on Uniform Traffic Control Devices, OSHA 29 CFR 1926.201 and 1926.202. Closures of Streets, parking lots, and other traffic areas will not be permitted unless approved by the Contracting Officer after written request 14 calendar days before the scheduled closure.

3.5.2 Restrictions

Excavation at the work site may be accomplished with machinery only after underground utilities have been identified and with approval by Contracting Officer.

Hand digging is required within five feet of located underground utilities.

3.5.3 Temporary Shoring, Bracing And Supports

All new excavation and trenching work shall be securely and safely supported during installation with temporary, but substantial, shoring, bracing, hangers and other supports as required by OSHA regulations. After new work is completed and completely cured (if required) and all permanent fasteners, anchors and supports are properly installed, the temporary supports shall be removed.

3.5.4 Barricades

Guardrails, fences or other suitable barricades and warning lights shall be placed at all open excavations/trenches which are adjacent to paths, walkways, sidewalks, vehicle parking areas, and other pedestrian or vehicle thoroughfares. Coordinate with 45 CE Environmental prior to placing warning lights.

3.6 LAND SURVEYING REQUIREMENTS

Land surveying, to include all projections and datum points, shall be required for all modifications affecting civil site plans (e.g., utilities, additions, new construction or storm water modifications). The survey shall be performed by a State of Florida Professional Licensed Surveyor (PLS) and shall be submitted by the Contractor in digital and hard copy format.

3.6.1 Contractor Provided Survey Support

Record drawings shall reflect all civil site developments such as new facility and/or land modifications, external structural changes to aboveground structures, and changes to underground structures and utilities external to facilities located on lands owned by or held in leasehold interest of the federal government.

Information in record drawings shall include, but not be limited to:

Location of all new lines, conduits, valves, fittings, fire hydrants, meters, terminal points using at least two ties to permanent points (manholes, power poles, curbs, or storm water inlets), or GPS coordinates with accuracy to 1 foot or better unless more stringent

accuracy requirements are specified in other sections of this contract. Locate manhole, catch basin, and storm water control structures noting top of rim, inverts, weirs, dimensions and conduit sizes and material entering the structure. An acceptable station and offset system may be used for service lines and fittings only.

Location of new lines from property easement lines or edges of pavement at intervals of 300 feet.

All utility routing and interface changes shall be reflected on the drawings to scale and defined with sufficient dimensions.

Locate with elevation all improvements constructed or modified including but not limited to pavement, striping, curbs, sidewalks, signs, gutters, walls, fences, buildings, pads, open stormwater conveyance systems, stormwater retention/detention ponds, etc. Elevation information should be adequate to illustrate flow patterns, retention capacity and overflow levels. Ground contours at intervals of 1 foot in elevation shall be shown on unpaved areas of the site on the sketch of survey

Contractor shall facilitate the receipt of surveyed coordinates for facility footprint corners coordinates and underground structures and utilities external to facilities by submitting digital data using the spatial reference identified below to 45 CES through the Contracting Officer within five (5) working days of foundation construction, or open excavation.

Record drawing prints will be drawn at a minimum scale of 1 inch = 100 feet. Areas requiring additional detail shall be enlarged as necessary.

Record drawings shall be provided in digital format. Geospatially referenced files shall be in ESRI GIS Geodatabase, ESRI GIS Shapefile, or AutoCAD DWG format. Information should be provided in separate layers/levels as specified by GIS and in at least the same degree of separation as the design drawings that were provided. Designation for naming of layers/levels shall adhere to current DOD, A/E/C CAD Standards with strict adherence to layer format. <https://cadbim.usace.army.mil/>. New like items shall be contained in the same levels to permit easy conversion to GIS layers.

All lines, letters, and details shall be sharp, clean, and fully legible.

One (1) reproducible print and one digital copy in an electronic storage media of the Contractor Survey Record Drawings are required for submittal.

3.6.1.1 Horizontal Reference Datum

All surveys shall be referenced to Florida State Plane Coordinate System, East Zone, North American Datum 1983/2011 adjustment based on Second order Class II horizontal control monument.

3.6.1.2 Vertical Reference Datum

All surveys shall be referenced to North American Vertical Datum (NAVD) 1988. The survey shall include a description of the reference benchmarks from which the NAVD has been determined.

3.7 HOISTING AND LIFTING

3.7.1 [Lifting Operation Plan](#)

Contractor shall have a Lifting Operation Plan and procedure that is fully in accordance with the requirements of OSHA regulations, and shall include drawings/sketches of lifting slings, lifting equipment, and tag lines. The plan shall show weights, center of gravity, and clearances of load over entire lift. Plans shall have details showing any structural mounting of hoisting equipment on sheaves or structural steel, and shall show loading calculations on any such structural mounting showing forces, weights, turning moments, etc. A procedure shall accompany the drawings describing all lifting operations. Use spreader bars wherever necessary to prevent hoisting cables from contacting equipment/material.

3.8 QUALITY CONTROL

It is the Contractor's responsibility to provide, inspect and document the level of quality that has been established by all applicable standards, codes and guidelines. The Contractor shall use skilled workers, an adequate number of which are thoroughly trained and have a minimum of 3 years experience in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for the proper performance of the work in each section of these specifications. Contractor shall submit [Superintendent Contact and Qualifications](#) to the Contracting Officer.

3.8.1 Licenses

Contractor or their subcontractors shall be licensed by the State of Florida or have an equivalent out-of-state license in all areas applicable to this contract or as otherwise stated elsewhere in this contract. Copies of licenses and certificates shall be provided to the Contracting Officer. Asbestos Abatement Contractor shall be licensed by the State of Florida.

3.8.2 Quality Control Manager

The Quality Control Manager shall direct the execution of the Contractor's approved Quality Control Plan with exclusive responsibility for administration of the plan and inspections of work. The Quality Control Manager shall be available during normal duty within thirty (30) minutes after notification to meet with the Contracting Officer, or designated representative. The Quality Control Manager shall be a different individual than the project superintendent.

3.8.3 Government Inspection/Approval

When the Contractor considers that the work is acceptable to the Government and is complete, he/she shall inform the Contracting Officer, or designated representative, and the Government Project Manager that the work is complete and ready for inspections. In the event that the work is not acceptable, the Contractor shall record a list of items noted by the Government Project Manager. A subsequent inspection may take place in order to review the corrected items. The Government is not required to inspect all work.

3.8.4 Inspection Files

The Contractor shall be responsible for keeping inspection files for all

projects. Files shall include on site records of all inspections conducted by the Contractor and the necessary corrective actions taken. Daily Reports shall be kept and made available to the Government throughout the contract performance period and for the period after completion until final settlement of any claims made under this contract.

3.9 SUPERINTENDENT

Provide name and qualifications and past experience for review. Designate a competent superintendent who shall have full authority to act for the Contractor and who shall be the primary contact with the Government until acceptance. Contractor's superintendent shall be at the job site at all times when work is taking place and shall have full authority to act for the Contractor.

3.10 CONSTRUCTION SCHEDULING REQUIREMENTS

3.10.1 Contractor Coordination Meetings

Contractor shall attend weekly project meetings, not to exceed 3 hours, scheduled by the Government. Subcontractor representatives shall attend as required.

Discussion shall address the progress schedule, potential factors of delay, deficiencies, material delivery schedules, submittals, and safety issues.

3.10.2 On-Site Construction Sequence

The required work shall be performed in a sequence to minimize the time when stormwater drainage, is inoperative or out-of-service.

-- End of Section --

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SECTION 01 33 00

SUBMITTAL PROCEDURES
05/11

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Submittal Descriptions (SD)

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

[SD-01 Preconstruction Submittals](#)

Submittals which are required prior to

- Certificates of insurance
- Surety bonds
- List of proposed Subcontractors
- List of proposed products
- Construction progress schedule
- Network Analysis Schedule (NAS)
- Submittal register
- Schedule of prices or Earned Value Report
- Health and safety plan
- Work plan
- Quality Control (QC) plan
- Environmental protection plan

[SD-02 Shop Drawings](#)

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

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

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

[SD-03 Product Data](#)

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

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

SD-05 Design Data

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

SD-06 Test Reports

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

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

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

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

SD-07 Certificates

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

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

Confined space entry permits.

Text of posted operating instructions.

SD-08 Manufacturer's Instructions

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

SD-10 Operation and Maintenance Data

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

This data is intended to be incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

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

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

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

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

1.1.2 Approving Authority

Office or designated person authorized to approve submittal.

1.1.3 Work

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

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor QC approval. Submit the following in accordance with this section.

SD-01 Preconstruction Submittals

Submittal Register; G

1.3 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.3.1 Government Approved (G)

Within the terms of the Contract Clause entitled, "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.4 PREPARATION

1.4.1 Transmittal Form

1.5 QUANTITY OF SUBMITTALS

1.5.1 Number of Copies of SD-02 Shop Drawings

Submit three copies of submittals of shop drawings requiring review and approval only by QC organization and three copies of shop drawings requiring review and approval by Contracting Officer.

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

Submit in compliance with quantity requirements specified for shop drawings.

1.5.3 Number of Samples SD-04 Samples

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

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

Submit in compliance with quantity requirements specified for shop drawings.

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

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

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

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

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

Unless otherwise specified, submit two sets of administrative submittals.

1.6 VARIATIONS

Variations from contract requirements require both Designer of Record (DOR) and Government approval pursuant to contract Clause FAR 52.236-21 and will be considered where advantageous to Government.

1.6.1 Considering Variations

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

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

1.6.2 Proposing Variations

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

1.6.3 Warranting that Variations are Compatible

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

1.6.4 Review Schedule is Modified

In addition to normal submittal review period, a period of 15 working days will be allowed for consideration by the Government of submittals with variations.

1.7 SUBMITTAL REGISTER

Prepare and maintain submittal register, as the work progresses. Do not change data which is output in columns (c), (d), (e), and (f) as delivered by Government; retain data which is output in columns (a), (g), (h), and (i) as approved. A submittal register showing items of equipment and materials for which submittals are required by the specifications is provided as an attachment. This list may not be all inclusive and additional submittals may be required.

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

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

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

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns, including dates on

which submittals are received and returned by the Government.

1.7.1 Use of Submittal Register

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

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

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

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

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

1.7.2 Contractor Use of Submittal Register

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

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

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

Column (l) List date of submittal transmission.

Column (q) List date approval received.

1.7.3 Approving Authority Use of Submittal Register

Update the following fields.

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

Column (l) List date of submittal receipt.

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

Column (q) List date returned to Contractor.

1.7.4 Copies Delivered to the Government

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

1.8 SCHEDULING

Schedule and submit concurrently submittals covering component items forming a system or items that are interrelated. Include certifications to

be submitted with the pertinent drawings at the same time. No delay damages or time extensions will be allowed for time lost in late submittals. An additional 15 calendar days will be allowed and shown on the register for review and approval of submittals for refrigeration and HVAC control systems.

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

1.9 GOVERNMENT APPROVING AUTHORITY

When approving authority is Contracting Officer, the Government will:

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

Upon completion of review of submittals requiring Government approval, stamp and date submittals. Two copies of the submittal will be retained by the Contracting Officer and one copies of the submittal will be returned to the Contractor.

1.9.1 Review Notations

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

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

appropriate changes. No work shall proceed for this item until resubmittal is approved.

- d. Submittals marked "not reviewed" will indicate submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

1.10 DISAPPROVED OR REJECTED SUBMITTALS

Contractor shall make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications; notice as required under the clause entitled, "Changes," is to be given to the Contracting Officer. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.

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

1.11 APPROVED/ACCEPTED SUBMITTALS

The Contracting Officer's approval or acceptance of submittals is not to be construed as a complete check, and indicates only that

Approval or acceptance will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for.

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

1.12 APPROVED SAMPLES

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

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

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of

the same brand or make of that material. Government reserves the right to disapprove any material or equipment which previously has proved unsatisfactory in service.

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

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

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

TITLE: Repair/Replace Lift Station 725													SUBMITTAL REGISTER									
JOB NAME:																						
LOCATION: PAFB																						
CONTRACT NO:																						
CONTRACTOR:																						
								CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION				APPROVING AUTHORITY							
	(a)	(b)	(c)		(d)		(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)		
Line	Acti vity #	Trans- mittal #	Specification Section	SD #	Submittal Description	Item Submitted	Paragraph #	Classificati on: GOVT or A/E Revwr	Submit	Approval Needed By	Material Needed By	Action Code	Date Of Action	Date FWD to APPR / Auth Date RCD From CONTR	Date FWD To Other Revwr	Date RCD From Other Revwr	Action Code	Date Of Action	Mailed To CONTR/ Date RCD From APPR Authority	Remarks		
1			01 11 00.00 30	01	Preconstruction Submittals	Lifting Operation Plan	3.7.1	G														
2			01 11 00.00 30	01	Preconstruction Submittals	Utility Outage Requests	1.10.1	G														
3			01 11 00.00 30	01	Preconstruction Submittals	Connection Requests	1.10.1	G														
4			01 11 00.00 30	01	Preconstruction Submittals	AF 3952	1.8.4	G														
5			01 11 00.00 30	01	Preconstruction Submittals	SOLID WASTE DISPOSAL DIVERSION TRACKING	1.11.6	G														
6			01 11 00.00 30	01	Preconstruction Submittals	Premises/Access Plan	1.7	G														
7			01 11 00.00 30	01	Preconstruction Submittals	Storage Area Request	1.8.1	G														
8			01 11 00.00 30	01	Preconstruction Submittals	Superintendent Contact and Qualifications	3.8	G														
9			01 33 00	01	Preconstruction Submittals	Submittal Register	1.7	G														
10			01 35 26	01	Preconstruction Submittals	Accident Prevention Plan (APP)	1.7	G														
11			01 35 26	06	Test Reports	Monthly Exposure Reports	1.4															
12			01 35 26	06	Test Reports	Notifications and Reports	1.12															
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15			01 35 26	07	Certificates	Crane Operators/Riggers	1.6.1.4															
16			01 35 26	07	Certificates	Standard Lift Plan	1.7.2.2	G														
17			01 35 26	07	Certificates	Critical Lift Plan	1.7.2.3	G														
18			01 35 26	07	Certificates	Activity Hazard Analysis (AHA)	1.8															
19			01 35 26	07	Certificates	Certificate of Compliance	1.12.4															
20			01 57 19	01	Preconstruction Submittals	Preconstruction Survey	1.6.1															
21			01 57 19	01	Preconstruction Submittals	Solid Waste Management Permit	1.10	G														
22			01 57 19	01	Preconstruction Submittals	Regulatory Notifications	1.6.2	G														
23			01 57 19	01	Preconstruction Submittals	Environmental Protection Plan	1.7	G														
24			01 57 19	01	Preconstruction Submittals	Stormwater Notice of Intent	3.2.1.2	G														
25			01 57 19	01	Preconstruction Submittals	Dirt and Dust Control Plan	1.7.9.1	G														
26			01 57 19	01	Preconstruction Submittals	Employee Training Records	1.6.4	G														
27			01 57 19	06	Test Reports	Inspection Reports	3.2.1.3															
28			01 57 19	06	Test Reports	Solid Waste Management Report	3.7.2.1	G														
29			01 57 19	07	Certificates	Employee Training Records	1.6.4	G														
30			01 57 19	07	Certificates	Erosion and Sediment Control Inspector	1.6.4															
31			01 57 19	11	Closeout Submittals	Stormwater Pollution Prevention Plan Compliance Notebook	3.2.1.4	G														
32			01 57 19	11	Closeout Submittals	Stormwater Notice of Termination	3.2.1.5	G														
33			01 57 19	11	Closeout Submittals	Waste Determination Documentation	3.7.1	G														
34			01 57 19	11	Closeout Submittals	Disposal Documentation for Hazardous and Regulated Waste	3.7.3.3	G														

TITLE: Repair/Replace Lift Station 725																		SUBMITTAL REGISTER									
JOB NAME:																											
LOCATION: PAFB																											
CONTRACT NO:																											
CONTRACTOR:																											
						CONTRACTOR SCHEDULE DATES					CONTRACTOR ACTION		APPROVING AUTHORITY														
	(a)	(b)	(c)	(d)		(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)								
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36			01 57 19	11	Closeout Submittals	Solid Waste Management Permit	1.10	G																			
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45			01 78 00	03	Product Data	Warranty Management Plan	1.7.1																				
46			01 78 00	03	Product Data	Warranty Tags	1.7.4																				
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PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.34	(2001; R 2012) Protection of the Public on or Adjacent to Construction Sites
ASSE/SAFE A10.44	(2014) Control of Energy Sources (Lockout/Tagout) for Construction and Demolition Operations
ASSE/SAFE Z244.1	(2003; R 2014) Control of Hazardous Energy Lockout/Tagout and Alternative Methods
ASSE/SAFE Z359.0	(2012) Definitions and Nomenclature Used for Fall Protection and Fall Arrest
ASSE/SAFE Z359.1	(2016) The fall Protection Code
ASSE/SAFE Z359.11	(2014) Safety Requirements for Full Body Harnesses
ASSE/SAFE Z359.12	(2009) Connecting Components for Personal Fall Arrest Systems
ASSE/SAFE Z359.13	(2013) Personal Energy Absorbers and Energy Absorbing Lanyards
ASSE/SAFE Z359.14	(2014) Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems
ASSE/SAFE Z359.15	(2014) Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems
ASSE/SAFE Z359.2	(2017) Minimum Requirements for a Comprehensive Managed Fall Protection Program
ASSE/SAFE Z359.3	(2017) Safety Requirements for Lanyards and Positioning Lanyards
ASSE/SAFE Z359.4	(2013) Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components

ASSE/SAFE Z359.6 (2016) Specifications and Design Requirements for Active Fall Protection Systems

ASSE/SAFE Z359.7 (2011) Qualification and Verification Testing of Fall Protection Products

ASME INTERNATIONAL (ASME)

ASME B30.20 (2013; INT Oct 2010 - May 2012) Below-the-Hook Lifting Devices

ASME B30.22 (2016) Articulating Boom Cranes

ASME B30.26 (2015; INT Jun 2010 - Jun 2014) Rigging Hardware

ASME B30.3 (2016) Tower Cranes

ASME B30.5 (2014) Mobile and Locomotive Cranes

ASME B30.8 (2015) Floating Cranes and Floating Derricks

ASME B30.9 (2014; INT Feb 2011 - Nov 2013) Slings

ASTM INTERNATIONAL (ASTM)

ASTM F855 (2015) Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1048 (2003) Guide for Protective Grounding of Power Lines

IEEE C2 (2017) National Electrical Safety Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10 (2013) Standard for Portable Fire Extinguishers

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

NFPA 70 (2017) National Electrical Code

NFPA 70E (2015; ERTA 1 2015) Standard for Electrical Safety in the Workplace

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

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

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.147	Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1910.333	Selection and Use of Work Practices
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1915.89	Control of Hazardous Energy (Lockout/Tags-Plus)
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.1400	Cranes and Derricks in Construction
29 CFR 1926.450	Scaffolds
29 CFR 1926.500	Fall Protection
CPL 2.100	(1995) Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146

1.2 DEFINITIONS

1.2.1 Competent Person (CP)

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

1.2.2 Competent Person, Confined Space

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

1.2.3 Competent Person, Cranes and Rigging

The CP, Cranes and Rigging, as defined in EM 385-1-1 Appendix Q, is a person meeting the competent person, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the Crane and Rigging Program, who through training, knowledge and experience in crane and rigging is capable of identifying, evaluating and

addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

1.2.4 Competent Person, Excavation/Trenching

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

1.2.5 Competent Person, Fall Protection

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

1.2.6 Competent Person, Scaffolding

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

1.2.7 Competent Person (CP) Trainer

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

1.2.8 High Risk Activities

High Risk Activities are activities that involve work at heights, crane and

rigging, excavations and trenching, scaffolding, electrical work, and confined space entry.

1.2.9 High Visibility Accident

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

1.2.10 Load Handling Equipment (LHE)

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

1.2.11 Medical Treatment

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

1.2.12 Near Miss

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

1.2.13 Operating Envelope

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

1.2.14 Qualified Person (QP)

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

1.2.15 Qualified Person, Fall Protection (QP for FP)

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

1.2.16 Recordable Injuries or Illnesses

Recordable Injuries or Illnesses are any work-related injury or illness that results in:

- a. Death, regardless of the time between the injury and death, or the

length of the illness;

b. Days away from work (any time lost after day of injury/illness onset);

c. Restricted work;

d. Transfer to another job;

e. Medical treatment beyond first aid;

f. Loss of consciousness; or

g. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (a) through (f) above.

1.2.17 USACE Property and Equipment

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

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

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

1.3 SUBMITTALS

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

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G

SD-06 Test Reports

Monthly Exposure Reports

Notifications and Reports

Accident Reports; G

LHE Inspection Reports

SD-07 Certificates

Crane Operators/Riggers

Standard Lift Plan; G

Critical Lift Plan ; G

Activity Hazard Analysis (AHA)

Certificate of Compliance

1.4 MONTHLY EXPOSURE REPORTS

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

1.5 REGULATORY REQUIREMENTS

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

1.6 SITE QUALIFICATIONS, DUTIES, AND MEETINGS

1.6.1 Personnel Qualifications

1.6.1.1 Contractor Quality Control (QC) Manager:

The Contractor Quality Control Manager can be the SSHO on this project.

1.6.1.2 Competent Person Qualifications

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

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

1.6.1.3 Qualified Trainer Requirements

Individuals qualified to instruct the 40 hour contract safety awareness

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

Instructors are required to:

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

1.6.1.4 Crane Operators/Riggers

Provide Operators meeting the requirements in EM 385-1-1, Section 15.B for Riggers and Section 16.B for Crane Operators. In addition, for mobile cranes with Original Equipment Manufacturer (OEM) rated capacities of 50,000 pounds or greater, designate crane operators qualified by a source that qualifies crane operators (i.e., union, a government agency, or an organization that tests and qualifies crane operators). Provide proof of current qualification.

1.6.2 Personnel Duties

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

The SSHO must:

- a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily production report.
- b. Conduct mishap investigations and complete required accident reports. Report mishaps and near misses.
- c. Use OSHA's Form 300 to log work-related injuries and illnesses occurring on the project site for Prime Contractors and subcontractors. Post and maintain the Form 300 on the site Safety Bulletin Board.
- d. Maintain applicable safety reference material on the job site.
- e. Attend the pre-construction conference, pre-work meetings including preparatory meetings, and periodic in-progress meetings.

- f. Review the APP and AHAs for compliance with EM 385-1-1, and approve, sign, implement and enforce them.
- g. Establish a Safety and Occupational Health (SOH) Deficiency Tracking System that lists and monitors outstanding deficiencies until resolution.
- h. Ensure subcontractor compliance with safety and health requirements.
- i. Maintain a list of hazardous chemicals on site and their material Safety Data Sheets (SDS).
- j. Maintain a weekly list of high hazard activities involving energy, equipment, excavation, entry into confined space, and elevation, and be prepared to discuss details during QC Meetings.
- k. Provide and keep a record of site safety orientation and indoctrination for Contractor employees, subcontractor employees, and site visitors.

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

1.6.3 Meetings

1.6.3.1 Preconstruction Conference

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

1.6.3.2 Safety Meetings

Conduct safety meetings to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation.

Conduct meetings at least once a month for all supervisors on the project location. The SSHO, supervisors, foremen, or CDSOs must conduct meetings at least once a week for the trade workers. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting Officer on request. Notify the Contracting Officer of all scheduled meetings 7 calendar days in advance.

1.7 ACCIDENT PREVENTION PLAN (APP)

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

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

1.7.1 Names and Qualifications

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

- a. Names and qualifications (resumes including education, training, experience and certifications) of site safety and health personnel designated to perform work on this project to include the designated Site Safety and Health Officer and other competent and qualified personnel to be used. Specify the duties of each position.
- b. Qualifications of competent and of qualified persons. As a minimum, designate and submit qualifications of competent persons for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; and personal protective equipment and clothing to include selection, use and maintenance.

1.7.2 Plans

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

1.7.2.1 Confined Space Entry Plan

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

1.7.2.2 Standard Lift Plan (SLP)

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

1.7.2.3 Critical Lift Plan - Crane or Load Handling Equipment

Provide a Critical Lift Plan as required by EM 385-1-1, Section 16.H.01, using Form 16-3. Critical lifts require detailed planning and additional or unusual safety precautions. Develop and submit a critical lift plan to the Contracting Officer 30 calendar days prior to critical lift. Comply with load testing requirements in accordance with EM 385-1-1, Section 16.F.03.

In addition to the requirements of EM 385-1-1, Section 16.H.02, the critical lift plan must include the following:

- a. For lifts of personnel, demonstrate compliance with the requirements of 29 CFR 1926.1400 and EM 385-1-1, Section 16.T.
- b. For barge mounted mobile cranes, provide a Naval Architecture Analysis and include an LHE Manufacturer's Floating Service Load Chart in accordance with the criteria from the selected standard in EM 385-1-1, Section 16.L.02. The Floating Service Load Chart must provide a table of rated load versus boom angle and radius. The Floating Service Load Chart must also provide the maximum allowable machine list and trim associated with the tabular loads and radii provided. If the Manufacturer's Floating Service Load Chart is not available, a floating service load chart may be developed and provided by a qualified Registered Professional Engineer (RPE), competent in the field of floating cranes. The Load Chart must be in accordance with the criteria from the selected standard in EM 385-1-1, Section 16.L; provide a table of rated load versus boom angle and radius; provide the maximum allowable machine list and machine trim associated with the tabular loads and radii provided; and be stamped by a RPE qualified and competent in the field of floating cranes. The RPE, competent in the field of floating cranes must stamp and certify (sign) that the Naval Architectural Analysis (NAA) meets the requirements of EM 385-1-1, Section 16.L.03.
- c. Multi-purpose machines, material handling equipment, and construction equipment used to lift loads that are suspended by rigging gear, require proof of authorization from the machine OEM that the machine is capable of making lifts of loads suspended by rigging equipment. Demonstrate that the operator is properly trained and that the equipment is properly configured to make such lifts and is equipped with a load chart.

1.7.2.4 Fall Protection and Prevention (FP&P) Plan

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

1.7.2.5 Rescue and Evacuation Plan

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

assistance; and transportation routes to a medical facility.

1.7.2.6 Hazardous Energy Control Program (HECP)

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

1.7.2.7 Excavation Plan

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

1.8 ACTIVITY HAZARD ANALYSIS (AHA)

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

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

1.8.1 AHA Management

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

1.8.2 AHA Signature Log

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

1.9 DISPLAY OF SAFETY INFORMATION

1.9.1 Safety Bulletin Board

Within one calendar day(s) after commencement of work, erect a safety bulletin board at the job site. Where size, duration, or logistics of project do not facilitate a bulletin board, an alternative method, acceptable to the Contracting Officer, that is accessible and includes all mandatory information for employee and visitor review, may be deemed as meeting the requirement for a bulletin board. Include and maintain information on safety bulletin board as required by EM 385-1-1, Section 01.A.06.

1.9.2 Safety and Occupational Health (SOH) Deficiency Tracking System

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

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

1.10 SITE SAFETY REFERENCE MATERIALS

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

1.11 EMERGENCY MEDICAL TREATMENT

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

1.12 NOTIFICATIONS and REPORTS

1.12.1 Mishap Notification

Notify the Contracting Officer as soon as practical, but no more than twenty-four hours, after any mishaps, including recordable accidents, incidents, and near misses, as defined in EM 385-1-1 Appendix Q, any report of injury, illness, load handling equipment (LHE) or rigging mishaps, or any property damage. The Contractor is responsible for obtaining appropriate medical and emergency assistance and for notifying fire, law enforcement, and regulatory agencies. Immediate reporting is required for electrical mishaps, to include Arc Flash; shock; uncontrolled release of hazardous energy (includes electrical and non-electrical); load handling equipment or rigging; fall from height (any level other than same surface); and underwater diving. These mishaps must be investigated in depth to identify all causes and to recommend hazard control measures.

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

1.12.2 Accident Reports

- a. Conduct an accident investigation for recordable injuries and illnesses, property damage, and near misses as defined in EM 385-1-1, to establish the root cause(s) of the accident. Complete the applicable USACE Accident Report Form 3394, and provide the report to the Contracting Officer within 5 calendar day(s) of the accident. The Contracting Officer will provide copies of any required or special forms.

1.12.3 LHE Inspection Reports

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

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

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

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

1.13 DIVE SAFETY REQUIREMENTS

Develop a Dive Operations Plan, AHA, emergency management plan, and personnel list that includes qualifications, for each separate diving operation. Submit these documents to the District Dive Coordinator (DDC) for review and acceptance at least 15 working days prior to commencement of diving operations. These documents must be at the diving location at all times. Provide each of these documents as a part of the project file.

1.14 SEVERE STORM PLAN

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

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

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 CONSTRUCTION AND OTHER WORK

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

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

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

3.1.1 Worksite Communication

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

3.1.2 Unforeseen Hazardous Material

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

3.2 FALL PROTECTION PROGRAM

Establish a fall protection program, for the protection of all employees exposed to fall hazards. Within the program include company policy, identify roles and responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and

evacuation procedures in accordance with ASSE/SAFE Z359.2 and EM 385-1-1, Sections 21.A and 21.D.

3.2.1 Training

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

3.2.2 Fall Protection Equipment and Systems

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

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

3.2.2.1 Additional Personal Fall Protection

In addition to the required fall protection systems, other protection such as safety skiffs, personal floatation devices, and life rings, are required when working above or next to water in accordance with EM 385-1-1, Sections 21.O through 21.O.06. Personal fall protection systems and equipment are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall protection systems are required when operating other equipment such as scissor lifts. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, travel, or while performing work.

3.2.2.2 Personal Fall Protection Harnesses

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

3.2.3 Horizontal Lifelines (HLL)

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

3.2.4 Guardrails and Safety Nets

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

3.2.5 Rescue and Evacuation Plan and Procedures

When personal fall arrest systems are used, ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. Prepare a Rescue and Evacuation Plan and include a detailed discussion of the following: methods of rescue; methods of self-rescue or assisted-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and Evacuation Plan within the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan, and the Accident Prevention Plan (APP). The plan must comply with the requirements of EM 385-1-1, ASSE/SAFE Z359.2, and ASSE/SAFE Z359.4.

3.3 EQUIPMENT

3.3.1 Material Handling Equipment (MHE)

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

3.3.2 Load Handling Equipment (LHE)

- a. Equip cranes and derricks as specified in EM 385-1-1, Section 16.
- b. Notify the Contracting Officer 15 working days in advance of any LHE entering the activity, in accordance with EM 385-1-1, Section 16.A.02,

so that necessary quality assurance spot checks can be coordinated. Contractor's operator must remain with the crane during the spot check. Rigging gear must comply with OSHA, ASME B30.9 Standards and Federal safety standards.

- c. Comply with the LHE manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person (as defined in ASME B30.5). Perform all testing in accordance with the manufacturer's recommended procedures.
- d. Comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, ASME B30.8 for floating cranes and floating derricks, ASME B30.9 for slings, ASME B30.20 for below the hook lifting devices and ASME B30.26 for rigging hardware.
- e. Under no circumstance must a Contractor make a lift at or above 90 percent of the cranes rated capacity in any configuration.
- f. When operating in the vicinity of overhead transmission lines, operators and riggers must be alert to this special hazard and follow the requirements of EM 385-1-1 Section 11, and ASME B30.5 or ASME B30.22 as applicable.
- g. Do not use crane suspended personnel work platforms (baskets) unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Do not lift personnel with a line hoist or friction crane. Additionally, submit a specific AHA for this work to the Contracting Officer. Ensure the activity and AHA are thoroughly reviewed by all involved personnel.
- h. Inspect, maintain, and recharge portable fire extinguishers as specified in NFPA 10, Standard for Portable Fire Extinguishers.
- i. All employees must keep clear of loads about to be lifted and of suspended loads.
- j. Use cribbing when performing lifts on outriggers.
- k. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.
- l. A physical barricade must be positioned to prevent personnel access where accessible areas of the LHE's rotating superstructure poses a risk of striking, pinching or crushing personnel.
- m. Maintain inspection records in accordance by EM 385-1-1, Section 16.D, including shift, monthly, and annual inspections, the signature of the person performing the inspection, and the serial number or other identifier of the LHE that was inspected. Records must be available for review by the Contracting Officer.
- n. Maintain written reports of operational and load testing in accordance with EM 385-1-1, Section 16.F, listing the load test procedures used along with any repairs or alterations performed on the LHE. Reports must be available for review by the Contracting Officer.
- o. Certify that all LHE operators have been trained in proper use of all

safety devices (e.g. anti-two block devices).

- p. Take steps to ensure that wind speed does not contribute to loss of control of the load during lifting operations. At wind speeds greater than 20 mph, the operator, rigger and lift supervisor must cease all crane operations, evaluate conditions and determine if the lift may proceed. Base the determination to proceed or not on wind calculations per the manufacturer and a reduction in LHE rated capacity if applicable. Include this maximum wind speed determination as part of the activity hazard analysis plan for that operation.

3.3.3 Machinery and Mechanized Equipment

- a. Proof of qualifications for operator must be kept on the project site for review.
- b. Manufacture specifications or owner's manual for the equipment must be on-site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Incorporate such additional safety precautions or requirements into the AHAs.

3.3.4 USE OF EXPLOSIVES

Explosives must not be used or brought to the project site without prior written approval from the Contracting Officer. Such approval does not relieve the Contractor of responsibility for injury to persons or for damage to property due to blasting operations.

Storage of explosives, when permitted on Government property, must be only where directed and in approved storage facilities. These facilities must be kept locked at all times except for inspection, delivery, and withdrawal of explosives.

3.4 EXCAVATIONS

Soil classification must be performed by a competent person in accordance with 29 CFR 1926 and EM 385-1-1.

3.4.1 Utility Locations

Provide a third party, independent, private utility locating company to positively identify underground utilities in the work area in addition to any station locating service and coordinated with the station utility department.

3.4.2 Utility Location Verification

Physically verify underground utility locations, including utility depth, by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system.

3.4.3 Utilities Within and Under Concrete, Bituminous Asphalt, and Other Impervious Surfaces

Utilities located within and under concrete slabs or pier structures, bridges, parking areas, and the like, are extremely difficult to identify. Whenever contract work involves chipping, saw cutting, or core drilling

through concrete, bituminous asphalt or other impervious surfaces, the existing utility location must be coordinated with station utility departments in addition to location and depth verification by a third party, independent, private locating company. The third party, independent, private locating company must locate utility depth by use of Ground Penetrating Radar (GPR), X-ray, bore scope, or ultrasound prior to the start of demolition and construction. Outages to isolate utility systems must be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the Contractor from meeting this requirement.

3.5 ELECTRICAL

Perform electrical work in accordance with EM 385-1-1, Appendix A, Sections 11 and 12.

3.5.1 Conduct of Electrical Work

As delineated in EM 385-1-1, electrical work is to be conducted in a de-energized state unless there is no alternative method for accomplishing the work. In those cases obtain an energized work permit from the Contracting Officer. The energized work permit application must be accompanied by the AHA and a summary of why the equipment/circuit needs to be worked energized. Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Attach temporary grounds in accordance with ASTM F855 and IEEE 1048. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator is allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method.

When working in energized substations, only qualified electrical workers are permitted to enter. When work requires work near energized circuits as defined by NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves and electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA. Ensure that each employee is familiar with and complies with these procedures and 29 CFR 1910.147.

3.5.2 Qualifications

Electrical work must be performed by QP personnel with verifiable credentials who are familiar with applicable code requirements. Verifiable credentials consist of State, National and Local Certifications or Licenses that a Master or Journeyman Electrician may hold, depending on work being performed, and must be identified in the appropriate AHA. Journeyman/Apprentice ratio must be in accordance with State, Local and Federal requirements applicable to where work is being performed.

3.5.3 Arc Flash

Conduct a hazard analysis/arc flash hazard analysis whenever work on or near energized parts greater than 50 volts is necessary, in accordance with NFPA 70E.

All personnel entering the identified arc flash protection boundary must be QPs and properly trained in NFPA 70E requirements and procedures. Unless permitted by NFPA 70E, no Unqualified Person is permitted to approach nearer than the Limited Approach Boundary of energized conductors and circuit parts. Training must be administered by an electrically qualified source and documented.

3.5.4 Grounding

Ground electrical circuits, equipment and enclosures in accordance with NFPA 70 and IEEE C2 to provide a permanent, continuous and effective path to ground unless otherwise noted by EM 385-1-1.

Check grounding circuits to ensure that the circuit between the ground and a grounded power conductor has a resistance low enough to permit sufficient current flow to allow the fuse or circuit breaker to interrupt the current.

3.5.5 Testing

Temporary electrical distribution systems and devices must be inspected, tested and found acceptable for Ground-Fault Circuit Interrupter (GFCI) protection, polarity, ground continuity, and ground resistance before initial use, before use after modification and at least monthly. Monthly inspections and tests must be maintained for each temporary electrical distribution system, and signed by the electrical CP or QP.

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PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization (e.g. ASTM B564 Standard Specification for Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided.

45TH SPACE WING (SWI)
45 CES/CE, 1224 JUPITER STREET PATRICK AIR FORCE BASE, FLORIDA
32925
AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)
444 North Capital Street, NW, Suite 249
Washington, DC 20001
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@aaashto.org
Internet: <http://www.aashto.org>

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)
38800 Country Club Drive
Farmington Hills, MI 48331-3439
Ph: 248-848-3700
Fax: 248-848-3701
E-mail: bkstore@concrete.org
Internet: <http://www.concrete.org>

AMERICAN PETROLEUM INSTITUTE (API)
Internet: <http://www.api.org>

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)
1800 East Oakton Street
Des Plaines, IL 60018
Ph: 847-699-2929
Internet: <http://www.asse.org>

AMERICAN WATER WORKS ASSOCIATION (AWWA)
6666 West Quincy Avenue

Denver, CO 80235-3098
Ph: 303-794-7711
E-mail: distribution@awwa.org
Internet: <http://www.awwa.org>

AMERICAN WELDING SOCIETY (AWS)
13301 NW 47 Ave
Miami, FL 33054

Ph: 888-WELDING, 305-824-1177, 305-826-6192
Fax: 305-826-6195
E-mail: customer.service@awspubs.com
Internet: <http://www.aws.org>

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)
P.O. Box 361784
Birmingham, AL 35236-1784
Ph: 205-733-4077
Fax: 205-733-4075
Internet: <http://www.awpa.com>

ASME INTERNATIONAL (ASME)
Two Park Avenue, M/S 10E
New York, NY 10016-5990
Ph: 800-843-2763
Fax: 973-882-1717
E-mail: customercare@asme.org
Internet: <http://www.asme.org>

ASPHALT INSTITUTE (AI)
2696 Research Park Drive
Lexington, KY 40511-8480
Ph: 859-288-4960
Fax: 859-288-4999
E-mail: info@asphaltinstitute.org
Internet: <http://www.asphaltinstitute.org>

ASTM INTERNATIONAL (ASTM)
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959
Ph: 877-909-2786
Internet: <http://www.astm.org>

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)
1322 Riverhaven Place
Birmingham, AL 35244
Ph: 205-402-8700
Internet: <http://www.dipra.org>

HYDRAULIC INSTITUTE (HI)
6 Campus Drive, First Floor North
Parsippany, NJ 07054-4406
Ph: 973-267-9700
Fax: 973-267-9055
Internet: <http://www.pumps.org>

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
445 and 501 Hoes Lane

Piscataway, NJ 08854-4141
Ph: 732-981-0060 or 800-701-4333
Fax: 732-562-9667
E-mail: onlinesupport@ieee.org
Internet: <http://www.ieee.org>

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)
3050 Old Centre Ave. Suite 102
Portage, MI 49024
Ph: 269-488-6382
Internet: <http://www.netaworld.org>

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)
1, ch. de la Voie-Creuse
Case Postale 56
CP 56 - CH-1211 Geneva 20
Switzerland
Ph: 41-22-749-01-11
Fax: 41-22-733-34-30
E-mail: central@iso.ch
Internet: <http://www.iso.org>

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)
127 Park Street, NE
Vienna, VA 22180-4602
Ph: 703-281-6613
E-mail: info@mss-hq.com
Internet: <http://mss-hq.org/Store/index.cfm>

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
1300 North 17th Street, Suite 900
Arlington, VA 22209
Ph: 703-841-3200
Internet: <http://www.nema.org/>

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
1 Batterymarch Park
Quincy, MA 02169-7471
Ph: 617-770-3000
Fax: 617-770-0700
Internet: <http://www.nfpa.org>

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)
1320 N. Courthouse Rd., Suite 200
Arlington, VA 22201
Ph: 703-907-7700
Fax: 703-907-7727
Internet: <http://www.tiaonline.org>

TURFGRASS PRODUCERS INTERNATIONAL (TPI)
2 East Main Street
East Dundee, IL 60118
Ph: 847-649-5555
Fax: 847-649-5678
E-mail: info@turfgrasssod.org
Internet: <http://www.turfgrasssod.org>

UNIFIED FACILITIES CRITERIA (UFC)

from: Whole Building Design Guide (WBDG) National Institute of
Building Sciences (NIBS) 1090 Vermont Avenue NW, Suite 700
Washington, CD 20005 Ph: 202-289-7800 Fax: 202-289-1092

Internet: http://www.wbdg.org/references/docs_refs.php

U.S. AIR FORCE (USAF)

Air Force Publishing Distribution Center

Ph: 202-404-2438 Internet: <http://www.e-publishing.af.mil/>

U.S. ARMY CORPS OF ENGINEERS (USACE)

CRD-C DOCUMENTS available on Internet:

http://www.wbdg.org/ccb/browse_cat.php?c=68

Order Other Documents from:

USACE Publications Depot

Attn: CEHEC-IM-PD

2803 52nd Avenue

Hyattsville, MD 20781-1102

Ph: 301-394-0081

Fax: 301-394-0084

E-mail: pubs-army@usace.army.mil

Internet: <http://www.publications.usace.army.mil/>

or

<http://www.hnc.usace.army.mil/Missions/Engineering/TECHINFO.aspx>

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

General Services Administration

1275 First St. NE

Washington, DC 20417

Ph: 202-501-1231

Internet: <http://www.gsaelibrary.gsa.gov/ElibMain/home.do>

Obtain documents from:

Acquisition Streamlining and Standardization Information System
(ASSIST)

Internet: <https://assist.dla.mil/online/start/>; account
registration required

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

8601 Adelphi Road

College Park, MD 20740-6001

Ph: 866-272-6272

Fax: 301-837-0483

Internet: <http://www.archives.gov>

Order documents from:

Superintendent of Documents

U.S. Government Printing Office (GPO)

710 North Capitol Street, NW

Washington, DC 20401

Ph: 202-512-1800

Fax: 202-512-2104

E-mail: contactcenter@gpo.gov

Internet: <http://www.gpoaccess.gov>

UNDERWRITERS LABORATORIES (UL)

2600 N.W. Lake Road

Camas, WA 98607-8542

Ph: 877-854-3577

E-mail: CEC.us@us.ul.com

Internet: <http://www.ul.com/>

UL Directories available through IHS at <http://www.ihs.com>

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)
2711 LBJ Freeway, Suite 1000
Dallas, TX 75234
Ph: 972-243-3902
Fax: 972-243-3907
E-mail: info@uni-bell.org
Internet: <http://www.uni-bell.org>

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

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TEMPORARY ENVIRONMENTAL CONTROLS
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PART 1 GENERAL

1.1 REFERENCES

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

45TH SPACE WING (SWI)

45 SW Haz Waste Mgmt Plan (2017) Hazardous Waste Management Plan

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

29 CFR 1910.120 Hazardous Waste Operations and Emergency Response

40 CFR 112 Oil Pollution Prevention

40 CFR 122.26 Storm Water Discharges (Applicable to State NPDES Programs, see section 123.25)

40 CFR 241 Guidelines for Disposal of Solid Waste

40 CFR 243 Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste

40 CFR 258 Subtitle D Landfill Requirements

40 CFR 260 Hazardous Waste Management System: General

40 CFR Part 260-279 Protection of Environment

40 CFR 261 Identification and Listing of Hazardous Waste

40 CFR 262 Standards Applicable to Generators of Hazardous Waste

40 CFR 262.31 Standards Applicable to Generators of Hazardous Waste-Labeling

40 CFR 263 Standards Applicable to Transporters of Hazardous Waste

40 CFR 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 265 Interim Status Standards for Owners and

	Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 273	Standards For Universal Waste Management
40 CFR 279	Standards for the Management of Used Oil
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 300.125	National Oil and Hazardous Substances Pollution Contingency Plan - Notification and Communications
40 CFR 355	Emergency Planning and Notification
40 CFR 403	General Pretreatment Regulations for Existing and New Sources of Pollution
40 CFR 50	National Primary and Secondary Ambient Air Quality Standards
40 CFR 60	Standards of Performance for New Stationary Sources
40 CFR 63	National Emission Standards for Hazardous Air Pollutants for Source Categories
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings

1.2 DEFINITIONS

1.2.1 Class I and II Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act. A list of Class I ODS can be found on the EPA website at the following weblink.
<http://www.epa.gov/ozone/science/ods/classone.html>.

Class II ODS is defined in Section 602(s) of The Clean Air Act. A list of Class II ODS can be found on the EPA website at the following weblink.
<http://www.epa.gov/ozone/science/ods/classtwo.html>.

1.2.2 Contractor Generated Hazardous Waste

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

1.2.3 Electronics Waste

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

1.2.4 Environmental Pollution and Damage

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

1.2.5 Environmental Protection

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

1.2.6 Hazardous Debris

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

1.2.7 Hazardous Materials

Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

Hazardous material is any material that: Is regulated as a hazardous material in accordance with 49 CFR 173; or requires a Safety Data Sheet (SDS) in accordance with 29 CFR 1910.120; or during end use, treatment, handling, packaging, storage, transportation, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by 40 CFR 261 Subparts A, B, C, or D. Designation of a material by this definition, when separately regulated or controlled by other sections or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this section for "control" purposes. Such material includes ammunition, weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, medical waste and infectious materials, bulk fuels, radioactive materials,

and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs).

1.2.8 Hazardous Waste

Hazardous Waste is any material that meets the definition of a solid waste and exhibit a hazardous characteristic (ignitability, corrosivity, reactivity, or toxicity) as specified in 40 CFR 261, Subpart C, or contains a listed hazardous waste as identified in 40 CFR 261, Subpart D.

1.2.9 Land Application

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

1.2.10 Municipal Separate Storm Sewer System (MS4) Permit

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

1.2.11 National Pollutant Discharge Elimination System (NPDES)

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

1.2.12 Oily Waste

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

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

If it is determined that a hazardous waste determination is required, call ESC at 853-6985 to make arrangements for sampling and managing of the materials

1.2.13 Regulated Waste

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

1.2.14 Sediment

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

1.2.15 Solid Waste

Solid waste is a solid, liquid, semi-solid or contained gaseous waste. A solid waste can be a hazardous waste, non-hazardous waste, or non-Resource Conservation and Recovery Act (RCRA) regulated waste. Types of solid waste typically generated at construction sites may include:

1.2.15.1 Debris

Debris is non-hazardous solid material generated during the construction, demolition, or renovation of a structure that exceeds 2.5-inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (for example, cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.

1.2.15.2 Green Waste

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

1.2.15.3 Material not regulated as solid waste

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

1.2.15.4 Non-Hazardous Waste

Non-hazardous waste is waste that is excluded from, or does not meet, hazardous waste criteria in accordance with 40 CFR 263.

1.2.15.5 Surplus Soil

Surplus soil is existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars, and paving. Contaminated soil meeting the definition of hazardous waste must be managed in accordance with 40 CFR Part 260-279. Contact ESC at 853-6985 if contaminated soil is encountered.

1.2.15.6 Scrap Metal

This includes scrap and excess ferrous and non-ferrous metals such as

reinforcing steel, structural shapes, pipe, and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

1.2.15.7 Wood

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

1.2.16 Surface Discharge

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

1.2.17 Wastewater

Wastewater is the used water and solids from a community that flow to a treatment plant.

1.2.17.1 Stormwater

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

1.2.18 Waters of the United States

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

1.2.19 Wetlands

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

1.2.20 Universal Waste

Contact ESC 853-6985 if any universal waste generation is anticipated. The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (for example, thermostats), and lamps (for example, fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal. These regulations can be found at [40 CFR 273](#).

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When

used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preconstruction Survey

Solid Waste Management Permit; G

Regulatory Notifications; G

Environmental Protection Plan; G

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

Dirt and Dust Control Plan; G

Employee Training Records; G

SD-06 Test Reports

Inspection Reports

Solid Waste Management Report; G

SD-07 Certificates

Employee Training Records; G

Erosion and Sediment Control Inspector Qualifications

SD-11 Closeout Submittals

~~Stormwater Pollution Prevention Plan Compliance Notebook; G~~

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

Waste Determination Documentation; G

Disposal Documentation for Hazardous and Regulated Waste; G

Assembled Employee Training Records; G

Solid Waste Management Permit; G

Solid Waste Management Report; G

Hazardous Waste/Debris Management; G

Regulatory Notifications; G

Contractor Certification

As-Built Topographic Survey

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

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

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

1.4.1 Conformance with the Environmental Management System

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

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

1.5 SPECIAL ENVIRONMENTAL REQUIREMENTS

Comply with the special environmental requirements listed here, Joint Environmental Resource Permit and attached at the end of this section.

1.6 QUALITY ASSURANCE

1.6.1 Preconstruction Survey and Protection of Features

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, perform a [Preconstruction Survey](#) of the project site with the Contracting Officer, and take

photographs showing existing environmental conditions in and adjacent to the site. Submit a report for the record. Include in the report a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. The Contractor and the Contracting Officer will sign this survey report upon mutual agreement regarding its accuracy and completeness. Protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference that their preservation may cause to the work under the Contract.

1.6.2 Regulatory Notifications

Coordinate all regulatory notification requirements with the Installation Environmental Office. In all instances, the Installation Environmental Office shall provide regulatory notifications. Typically, regulatory notifications must be provided for the following (this listing is not all-inclusive): demolition, renovation, NPDES defined site work, construction, removal or use of a permitted air emissions source, and remediation of controlled substances (asbestos, hazardous waste, lead paint).

1.6.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting. Provide the following information: types, quantities, and use of hazardous materials that will be brought onto the installation; and types and quantities of wastes/wastewater that may be generated during the Contract. Discuss the results of the Preconstruction Survey at this time.

Prior to initiating any work on site, meet with the Contracting Officer and installation Environmental Office to discuss the proposed Environmental Protection Plan (EPP). Develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural and cultural resources, required reports, required permits, permit requirements (such as mitigation measures), and other measures to be taken.

1.6.4 Employee Training Records

Prepare and maintain [Employee Training Records](#) throughout the term of the contract meeting applicable 40 CFR requirements. Provide Employee Training Records in the Environmental Records Binder. Submit these [Assembled Employee Training Records](#) to the Contracting Officer at the conclusion of the project, unless otherwise directed.

Train personnel to meet state requirements. Conduct environmental protection/pollution control meetings for personnel prior to commencing construction activities. Contact additional meetings for new personnel and when site conditions change. Include in the training and meeting agenda: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, waters of the United States, and endangered species and their habitat that are known to be in the area. Provide copy of the [Erosion and](#)

Sediment Control Inspector Certification as required by state.

1.6.5 Non-Compliance Notifications

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

1.7 ENVIRONMENTAL PROTECTION PLAN

The purpose of the EPP is to present an overview of known or potential environmental issues that must be considered and addressed during construction. Incorporate construction related objectives and targets from the installation's EMS into the EPP. Include in the EPP measures for protecting natural and cultural resources, required reports, and other measures to be taken. Meet with the Contracting Officer or Contracting Officer Representative to discuss the EPP and develop a mutual understanding relative to the details for environmental protection including measures for protecting natural resources, required reports, and other measures to be taken. Submit the EPP within 15 days after notice to proceed and not less than 10 days before the preconstruction meeting. Revise the EPP throughout the project to include any reporting requirements, changes in site conditions, or contract modifications that change the project scope of work in a way that could have an environmental impact. No requirement in this section will relieve the Contractor of any applicable federal, state, and local environmental protection laws and regulations. During Construction, identify, implement, and submit for approval any additional requirements to be included in the EPP. Maintain the current version onsite.

The EPP includes, but is not limited to, the following elements:

1.7.1 General Overview and Purpose

1.7.1.1 Descriptions

A brief description of each specific plan required by environmental permit or elsewhere in this Contract such as stormwater pollution prevention plan, solid waste management plan, a historical, archaeological, cultural resources, biological resources and wetlands plan, Non-Hazardous Solid Waste Disposal Plan borrowing material plan.

1.7.1.2 Duties

The EPP shall describe the duties and level of authority assigned to the person(s) on the job site who oversee environmental compliance, such as who is responsible for adherence to the EPP, who is responsible for spill cleanup and training personnel on spill response procedures, who is responsible for manifesting hazardous waste to be removed from the site (if applicable), and who is responsible for training the Contractor's environmental protection personnel. If hazardous waste is present or

anticipated, the contractor shall be fully trained prior to starting work and must complete training for appropriate type of hazardous facility as well as DOT training on the ESOHTN site.

1.7.1.3 Procedures

A copy of any standard or project-specific operating procedures that will be used to effectively manage and protect the environment on the project site.

1.7.1.4 Communications

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

1.7.1.5 Contact Information

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

1.7.2 General Site Information

1.7.2.1 Drawings

Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, jurisdictional wetlands, material storage areas, structures, sanitary facilities, storm drains and conveyances, and stockpiles of excess soil.

1.7.2.2 Work Area

Work area plan showing the proposed activity in each portion of the area and identify the areas of limited use or nonuse. Include measures for marking the limits of use areas, including methods for protection of features to be preserved within authorized work areas and methods to control runoff and to contain materials on site, and a traffic control plan.

1.7.2.3 Documentation

A letter signed by an officer of the firm appointing the Environmental Manager and stating that person is responsible for managing and implementing the Environmental Program as described in this contract. Include in this letter the Environmental Manager's authority to direct the removal and replacement of non-conforming work.

1.7.3 Management of Natural Resources

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

- g. Wetland areas

1.7.4 Protection of Historical and Archaeological Resources

- a. Objectives

- b. Methods

1.7.5 Stormwater Management and Control

- a. Ground cover

- b. Erodible soils

- c. Temporary measures

- (1) Structural Practices

- (2) Temporary and permanent stabilization

- d. Effective selection, implementation and maintenance of Best Management Practices (BMPs).

1.7.6 Protection of the Environment from Waste Derived from Contractor Operations

The Contractor is responsible for the control and disposal of solid waste, and sanitary waste.

This item consist of the management procedures for hazardous waste to be generated. The elements of those procedures will coincide with the Installation Hazardous Waste Management Plan. The Contracting Officer will provide a copy of the Installation Hazardous Waste Management Plan. As a minimum, include the following:

- a. List of the types of hazardous wastes expected to be generated
- b. Procedures to ensure a written waste determination is made for appropriate wastes that are to be generated
- c. Sampling/analysis plan, including laboratory method(s) that will be used for waste determinations and copies of relevant laboratory certifications
- d. Methods and proposed locations for hazardous waste accumulation/storage (that is, in tanks or containers). If hazardous waste accumulation/storage is needed, the contractor shall contact 853-6985 to coordinate and must complete ESOHTN training.
- e. Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted)
- f. Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268)
- g. Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and similar

- h. Used oil management procedures in accordance with 40 CFR 279; Hazardous waste minimization procedures
- i. Plans for the disposal of hazardous waste by permitted facilities; and Procedures to be employed to ensure required employee training records are maintained.

1.7.7 Prevention of Releases to the Environment

Procedures to prevent releases to the environment

Notifications in the event of a release to the environment

1.7.8 Regulatory Notification and Permits

List what notifications and permit applications must be made. Some permits require up to 180 days to obtain. Demonstrate that those permits have been obtained or applied for by including copies of applicable environmental permits. The EPP will not be approved until the permits have been obtained.

1.7.9 Clean Air Act Compliance

1.7.9.1 Haul Route

Submit truck and material haul routes along with a [Dirt and Dust Control Plan](#) for controlling dirt, debris, and dust on Installation roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

1.7.9.2 Pollution Generating Equipment

Identify air pollution generating equipment or processes that may require federal, state, or local permits under the Clean Air Act. Determine requirements based on any current installation permits and the impacts of the project. Provide a list of all fixed or mobile equipment, machinery or operations that could generate air emissions during the project to the Installation Environmental Office (Air Program Manager).

1.7.9.3 Stationary Internal Combustion Engines

Identify portable and stationary internal combustion engines that will be supplied, used or serviced. Comply with 40 CFR 60 Subpart IIII, 40 CFR 60 Subpart JJJJ, 40 CFR 63 Subpart ZZZZ, and local regulations as applicable. At minimum, include the make, model, serial number, manufacture date, size (engine brake horsepower), and EPA emission certification status of each engine. Maintain applicable records and log hours of operation and fuel use. Logs must include reasons for operation and delineate between emergency and non-emergency operation.

1.8 LICENSES AND PERMITS

Obtain licenses and permits required for the construction of the project and in accordance with FAR 52.236-7. Notify the Government of all general use permitted equipment the Contractor plans to use on site. This paragraph supplements the Contractor's responsibility under FAR 52.236-7.

1.9 ENVIRONMENTAL RECORDS BINDER

Maintain on-site a separate three-ring Environmental Records Binder and submit at the completion of the project. Make separate parts within the binder that correspond to each submittal listed under paragraph CLOSEOUT SUBMITTALS in this section.

1.10 SOLID WASTE MANAGEMENT PERMIT

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

1.10.1 Solid Waste Management Report

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

1.11 FACILITY HAZARDOUS WASTE GENERATOR STATUS

Project is designated as a Large Quantity Generator. Meet the regulatory requirements of this generator designation for any work conducted within the boundaries of this Installation. Comply with provisions of federal, state, and local regulatory requirements applicable to this generator status regarding training and storage, handling, and disposal of construction derived wastes.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants, including their habitats. Prior to the commencement of activities, consult with the Installation Environmental Office, regarding rare species or sensitive habitats that need to be protected. The protection of rare, threatened, and endangered animal and plant species identified, including their habitats, is the Contractor's responsibility. The following species are known and could be affected within the construction area: manatees, sea turtles, and smalltooth sawfish; seagrass, cordgrass, and mangroves.

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

3.1.1 Flow Ways

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

3.1.2 Vegetation

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

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

3.2 STORMWATER

Do not discharge stormwater from construction sites to the sanitary sewer. If the water is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization in advance from the Installation Environmental Office for any release of contaminated water.

3.2.1 Construction General Permit

Provide a Construction General Permit as required by 40 CFR 122.26 of the State of Florida General Permit. Under the terms and conditions of the permit, install, inspect, maintain BMPs, prepare stormwater erosion and sediment control inspection reports, and submit SWPPP inspection reports. Maintain construction operations and management in compliance with the terms and conditions of the general permit for stormwater discharges from construction activities.

3.2.1.1 Stormwater Pollution Prevention Plan

Submit a project-specific Stormwater Pollution Prevention Plan (SWPPP) to the Contracting Officer for approval, prior to the commencement of work. The SWPPP must meet the requirements of 40 CFR 122.26 and the Florida State General Permit for stormwater discharges from construction sites.

Include the following:

- a. Comply with terms of the state general permit for stormwater discharges from construction activities. Prepare SWPPP in accordance with state requirements. Use Florida Department of Environmental Protection Stormwater Permitting website to prepare the SWPPP
- b. Select applicable BMPs from EPA Fact Sheets located at <http://water.epa.gov/polwaste/npdes/swbmp/Construction-Site-StormWater-Run-Off-Control.cfm> or in accordance with applicable state or local requirements.

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

3.2.1.2 Stormwater Notice of Intent for Construction Activities

Prepare and submit the Notice of Intent for NPDES coverage under the general permit for construction activities to the Contracting Officer for review and approval.

Submit the approved NOI and appropriate permit fees onto the appropriate federal or state agency for approval. No land disturbing activities may commence without permit coverage. Maintain an approved copy of the SWPPP at the onsite construction office, and continually update as regulations require, reflecting current site conditions.

3.2.1.3 Inspection Reports

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

3.2.1.4 Stormwater Pollution Prevention Plan Compliance Notebook

Create and maintain a three ring binder of documents that demonstrate compliance with the Construction General Permit. Include a copy of the permit Notice of Intent, proof of permit fee payment, SWPPP and SWPPP update amendments, inspection reports and related corrective action records, copies of correspondence with the FDEP State Permitting Agency, and a copy of the permit Notice of Termination in the binder. At project completion, the notebook becomes property of the Government. Provide the compliance notebook to the Contracting Officer.

3.2.1.5 Stormwater Notice of Termination for Construction Activities

Submit a Notice of Termination to the Contracting Officer for approval once construction is complete and final stabilization has been achieved on all portions of the site for which the permittee is responsible. Once approved, submit the Notice of Termination to the appropriate state or federal agency. Prepare as-built topographic survey information required by the permitting agency for certification of the shoreline erosion protection system, and provide to the Contracting Officer.

3.2.2 Erosion and Sediment Control Measures

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

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

3.2.2.1 Erosion Control

Prevent erosion by Geotextiles, temporary slope drains. Stabilize slopes by sodding and riprap or such combination of these methods necessary for effective erosion control. Use of hay bales is prohibited.

3.2.2.2 Sediment Control Practices

Implement sediment control practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement sediment control practices prior to soil disturbance and prior to creating areas with concentrated flow, during the construction process to minimize erosion and sediment laden runoff. Include the following devices: silt fence, floating turbidity barriers. Location and details of installation and construction are indicated on the drawings.

3.2.3 Work Area Limits

Mark the areas that need not be disturbed under this Contract prior to commencing construction activities. Mark or fence isolated areas within the general work area that are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, any markers must be visible in the dark. Personnel must be knowledgeable of the purpose for marking and protecting particular objects.

3.2.4 Contractor Facilities and Work Areas

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

3.2.5 Municipal Separate Storm Sewer System (MS4) Management

Comply with the Installation's MS4 permit requirements.

3.3 SURFACE AND GROUNDWATER

3.3.1 Cofferdams, Diversions, and Dewatering

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure must be constantly controlled to maintain compliance with existing state water quality standards and designated uses of the surface water body. Comply with the State of Florida water quality standards and anti-degradation provisions and the Clean Water Act Section 404, Nation Wide Permit No. TBD. Do not discharge excavation ground water to the sanitary sewer, storm drains, or to surface waters without prior specific authorization in writing from the Installation Environmental Office. Discharge of hazardous substances will not be permitted under any circumstances. Use sediment control BMPs to prevent construction site runoff from directly entering any storm drain or surface waters.

If the construction dewatering is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization for any contaminated groundwater release in advance from the Installation Environmental Officer and the federal or state authority, as applicable. Discharge of hazardous substances will not be permitted under any circumstances.

3.3.2 Waters of the United States

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

3.4 PROTECTION OF CULTURAL RESOURCES

3.5 AIR RESOURCES

3.5.1 Burning

Burning is prohibited on the Government premises.

3.5.2 Dust Control

Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations.

3.5.2.1 Particulates

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

3.5.3 Odors

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

3.6 WASTE MINIMIZATION

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

construction when requesting information.

3.7 WASTE MANAGEMENT AND DISPOSAL

3.7.1 Waste Determination Documentation

Complete a Waste Determination form (provided at the pre-construction conference) for Contractor-derived wastes to be generated. All potentially hazardous solid waste streams that are not subject to a specific exclusion or exemption from the hazardous waste regulations (e.g. scrap metal, domestic sewage) or subject to special rules, (lead-acid batteries and precious metals) must be characterized in accordance with the requirements of 40 CFR 261 or corresponding applicable state or local regulations. Base waste determination on user knowledge of the processes and materials used, and analytical data when necessary. Consult with the Installation environmental staff for guidance on specific requirements. Attach support documentation to the Waste Determination form. As a minimum, provide a Waste Determination form for the following waste (this listing is not inclusive): oil- and latex -based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and containers of the original materials.

3.7.2 Solid Waste Management

3.7.2.1 Solid Waste Management Report

Provide copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, a statement indicating the disposal location for the solid waste that is signed by an employee authorized to legally obligate or bind the firm may be submitted. The [Contractor certification](#) must include the receiver's tax identification number and business, EPA or state registration number, along with the receiver's delivery and business addresses and telephone numbers. For each solid waste retained for the Contractor's own use, submit the information previously described in this paragraph on the solid waste disposal report. Prices paid or received do not have to be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

3.7.2.2 Control and Management of Solid Wastes

Pick up solid wastes, and place in covered containers that are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Employ segregation measures so that no hazardous or toxic waste will become co-mingled with non-hazardous solid waste. Transport solid waste off Government property and dispose of it in compliance with [40 CFR 260](#), state, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill is the minimum acceptable offsite solid waste disposal option. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. Solid waste disposal offsite must comply with most stringent local, state, and federal requirements, including [40 CFR 241](#), [40 CFR 243](#), and [40 CFR 258](#).

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

3.7.3 Control and Management of Hazardous Waste

All hazardous waste will be managed by 45 CES/CEIE (494-9387) and ESC (853-6985)

3.7.3.1 Hazardous Waste/Debris Management

Contractor will identify to ESC (853-6945) all construction activities that will generate hazardous waste or debris. Provide a documented waste determination using Process Waste Questionnaire (PWQ) for all resultant waste streams. Use Technical Response Package (TRP) to Identify, label, handle, and store hazardous waste at contractor's satellite or < 90 day site. Submit pickup request for transportation and disposal of all generated hazardous waste to Environmental Support Contractor (ESC), 853-6985. ESC will ensure that the disposal of hazardous waste or debris is in accordance with federal, state, and local regulations, including Management Plan 19-14, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, and 40 CFR 268.

Manage hazardous waste in accordance with the approved 45 SW Haz Waste Mgmt Plan. Hazardous waste generated within the confines of Government facilities is identified as being generated by the Government. The installation Hazardous Waste Program Manager will sign all Uniform Hazardous Waste Manifests. Do not bring hazardous waste onto Government property.

3.7.3.2 Hazardous Waste Disposal

3.7.3.2.1 Responsibilities for Contractor's Disposal

Per 45 SW Haz Waste Mgmt Plan provide completed internal waste manifest to the Installations Environmental Support Contractor prior to sending pickup request to ESC for transfer to Government permitted Transfer Storage and Disposal Facility.

3.7.3.2.1.1 Services

Ensure all waste stream have a hazard determination completed using the Process Waste Questionnaire. The Technical Response Package received will give you management, labeling, marking, container type needed as well proper shipping name for internal manifest to be in onsite compliance. (See 45 SW Haz Waste Mgmt Plan).

3.7.3.2.1.2 Samples

Use Waste Characterization Sampling request for needed sampling and analytical (See 45 SW Haz Waste Mgmt Plan).

3.7.3.2.1.3 Analysis

Use analytical generated from Waste Characterization Sampling Request to generate a Process Waste Questionnaire for a hazard determination.

3.7.3.2.1.4 Labeling

The Technical Response Package received after submittal of Process Waste Questionnaire will determine the Department of Transportation's (DOT's) proper shipping names for waste (each container requiring disposal) and demonstrate to the Contracting Officer how this determination is developed

and supported by the sampling and analysis requirements contained herein. Label all containers of hazardous waste with the proper shipping name to describe the contents of the container in accordance with 40 CFR 262.31 and applicable state or local regulations.

3.7.3.3 Disposal Documentation for Hazardous and Regulated Waste

The internal manifest will be contractor's documentation that waste was received by the ESC contractor and stored at government permitted Transfer Storage and Disposal Facility.

3.7.4 Releases/Spills of Oil and Hazardous Substances

3.7.4.1 Response and Notifications

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated in accordance with 40 CFR 300. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the Installation Fire Department, the Installation Command Duty Officer, the Installation Environmental Office, the Contracting Officer and the state or local authority.

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

3.7.4.2 Clean Up

Clean up hazardous and non-hazardous waste spills. Reimburse the Government for costs incurred including sample analysis materials, clothing, equipment, and labor if the Government will initiate its own spill cleanup procedures, for Contractor- responsible spills, when: Spill cleanup procedures have not begun within one hour of spill discovery/occurrence; or, in the Government's judgment, spill cleanup is inadequate and the spill remains a threat to human health or the environment.

3.7.5 Mercury Materials

Immediately report to the Environmental Office and the Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction of the Contracting Officer.

Do not recycle a mercury spill cleanup; manage it as a hazardous waste for disposal.

3.7.6 Wastewater

3.7.6.1 Disposal of wastewater must be as specified below.

3.7.6.1.1 Treatment

Do not allow wastewater from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, and forms to enter water ways or to be discharged prior to being treated to remove pollutants. Dispose of the construction- related waste water off-Government property in accordance with 40 CFR 403, state, regional, and local laws and regulations.

3.7.6.1.2 Surface Discharge

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

3.7.6.1.3 Land Application

Water generated from the flushing of lines after disinfection or disinfection in conjunction with hydrostatic testing must be land- applied in accordance with federal, state, and local laws and regulations for land application.

3.8 HAZARDOUS MATERIAL MANAGEMENT

Include hazardous material control procedures in the Safety Plan, in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Do not bring hazardous material onto Government property that does not directly relate to requirements for the performance of this contract. Submit an SDS and estimated quantities to be used for each hazardous material to the Contracting Officer prior to bringing the material on the installation. Typical materials requiring SDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. Use hazardous materials in a manner that minimizes the amount of hazardous waste generated. Containers of hazardous materials must have National Fire Protection Association labels or their equivalent. Certify that hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste, in accordance with 40 CFR 261.

3.9 PREVIOUSLY USED EQUIPMENT

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

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

POL products include flammable or combustible liquids, such as gasoline, diesel, lubricating oil, used engine oil, hydraulic oil, mineral oil, and cooking oil. Store POL products and fuel equipment and motor vehicles in a manner that affords the maximum protection against spills into the environment. Manage and store POL products in accordance with EPA

40 CFR 112, and other federal, state, regional, and local laws and regulations. Use secondary containments, dikes, curbs, and other barriers, to prevent POL products from spilling and entering the ground, storm or sewer drains, stormwater ditches or canals, or navigable waters of the United States. Describe in the EPP (see paragraph ENVIRONMENTAL PROTECTION PLAN) how POL tanks and containers must be stored, managed, and inspected and what protections must be provided. Storage of fuel on the project site must be in accordance with EPA, state, and local laws and regulations and paragraph OIL STORAGE INCLUDING FUEL TANKS.

3.10.1 Used Oil Management

Manage used oil generated on site in accordance with 40 CFR 279. Determine if any used oil generated while onsite exhibits a characteristic of hazardous waste. Used oil containing 1,000 parts per million of solvents is considered a hazardous waste that will be disposed of by 45 CES/CEIE. Used oil mixed with a hazardous waste is also considered a hazardous waste. Dispose in accordance with Hazardous Waste Management Plan.

3.10.2 Oil Storage Including Fuel Tanks

Provide secondary containment and overfill protection for oil storage tanks. A berm used to provide secondary containment must be of sufficient size and strength to contain the contents of the tanks plus 5 inches freeboard for precipitation. Construct the berm to be impervious to oil for 72 hours that no discharge will permeate, drain, infiltrate, or otherwise escape before cleanup occurs. Use drip pans during oil transfer operations; adequate absorbent material must be onsite to clean up any spills and prevent releases to the environment. Cover tanks and drip pans during inclement weather. Provide procedures and equipment to prevent overfilling of tanks. If tanks and containers with an aggregate aboveground capacity greater than 1320 gallons will be used onsite (only containers with a capacity of 55 gallons or greater are counted), provide and implement a SPCC plan meeting the requirements of 40 CFR 112. Do not bring underground storage tanks to the installation for Contractor use during a project. Submit the SPCC plan to the Contracting Officer for approval.

Monitor and remove any rainwater that accumulates in open containment dikes or berms. Inspect the accumulated rainwater prior to draining from a containment dike to the environment, to determine there is no oil sheen present.

3.11 INADVERTENT DISCOVERY OF PETROLEUM-CONTAMINATED SOIL OR HAZARDOUS WASTES

If petroleum-contaminated soil, or suspected hazardous waste is found during construction that was not identified in the Contract documents, Immediately notify the base Spill phone at 321-298-7022 then the Contracting Officer.

3.12 POST CONSTRUCTION CLEANUP

Clean up areas used for construction in accordance with Contract Clause:

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

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SECTION 01 74 19

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT
01/07

PART 1 GENERAL

1.1 GOVERNMENT POLICY

Government policy is to apply sound environmental principles in the design, construction and use of facilities. As part of the implementation of that policy: (1) practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction and demolition waste from landfills and incinerators and to facilitate their recycling or reuse. Divert a minimum of 60 percent by weight of total project solid waste from the landfill.

1.2 MANAGEMENT

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

1.3 SUBMITTALS

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

SD-01 Preconstruction Submittals

Waste Management Plan; G

SD-11 Closeout Submittals

Records

1.4 MEETINGS

Conduct Construction Waste Management meetings. After award of the Contract and prior to commencement of work, schedule and conduct a meeting with the Contracting Officer to discuss the proposed Waste Management Plan and to develop a mutual understanding relative to the details of waste management. The requirements for this meeting may be fulfilled during the coordination and mutual understanding meeting outlined in Section QUALITY CONTROL. At a minimum, discuss environmental and waste management goals and issues at the following additional meetings:

- a. Pre-bid meeting.
- b. Preconstruction and Pre-demolition meeting.
- c. Regular site meetings.
- d. Work safety meetings.

1.5 WASTE MANAGEMENT PLAN

Submit a waste management plan within 15 days after contract award and not less than 10 days before the preconstruction meeting. The plan demonstrates how to meet the the project waste diversion goal. Also, include the following in the plan:

- a. Name of individuals on the Contractor's staff responsible for waste prevention and management.
- b. Actions that will be taken to reduce solid waste generation, including coordination with subcontractors to ensure awareness and participation.
- c. Description of the regular meetings to be held to address waste management.
- d. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas on site and equipment to be used for processing, sorting, and temporary storage of wastes.
- e. Characterization, including estimated types and quantities, of the waste to be generated.
- f. Name of landfill and/or incinerator to be used and the estimated costs for use, assuming that there would be no salvage or recycling on the project.
- g. Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and organizations that accept used materials such as materials exchange networks and Habitat for Humanity. Include the name, location, and phone number for each reuse facility to be used, and provide a copy of the permit or license for each facility.
- h. List of specific waste materials that will be salvaged for resale, salvaged and reused on the current project, salvaged and stored for reuse on a future project, or recycled. Identify the recycling facilities by name, location, and phone number, including a copy of the permit or license for each facility.

- i. Identification of materials that cannot be recycled/reused with an explanation or justification, to be approved by the Contracting Officer.
- j. Description of the means by which any waste materials identified in item (h) above will be protected from contamination.
- k. Description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site).
- l. Anticipated net cost savings determined by subtracting Contractor program management costs and the cost of disposal from the revenue generated by sale of the materials and the incineration and/or landfill cost avoidance.

Revise and resubmit Plan as required by the Contracting Officer. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations or meeting project cumulative waste diversion requirement. Distribute copies of the Waste Management Plan to each subcontractor, the Quality Control Manager, and the Contracting Officer.

1.6 RECORDS

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Make the records available to the Contracting Officer during construction, and deliver to the Contracting Officer upon completion of the construction a copy of the records.

Demolition accomplished by other parties on this project site count toward the project's total waste diversion for sustainability requirements. Information on the quantity and disposition of these materials will be provided by the Contracting Officer. Include this data in records, annotated to indicate that it was accomplished by another party.

1.7 COLLECTION

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

1.7.1 Source Separated Method.

Separate waste products and materials that are recyclable from trash and sorted as described below into appropriately marked separate containers and then transported to the respective recycling facility for further processing. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process). Separate materials into the following category types as appropriate to the project waste and to the available recycling and reuse programs in the project area:

- a. Land clearing debris.
- b. Asphalt.
- c. Concrete and masonry.
- d. Metal (e.g. banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, lead brass, bronze).
 - (1) Ferrous.
 - (2) Non-ferrous.
- e. Wood (nails and staples allowed).
- f. Debris.
- g. Glass (colored glass allowed).
- h. Paper.
 - (1) Bond.
 - (2) Newsprint.
 - (3) Cardboard and paper packaging materials.
- i. Plastic.

Type	
1	Polyethylene Terephthalate (PET, PETE)
2	High Density Polyethylene (HDPE)
3	Vinyl (Polyvinyl Chloride or PVC)
4	Low Density Polyethylene (LDPE)
5	Polypropylene (PP)
6	Polystyrene (PS)

Type	
7	Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

- j. Gypsum.
- k. Non-hazardous paint and paint cans.
- l. Carpet.
- m. Ceiling tiles.
- n. Insulation.
- o. Beverage containers.

1.7.2 Co-Mingled Method.

Place waste products and recyclable materials into a single container and then transport to a recycling facility where the recyclable materials are sorted and processed.

1.7.3 Other Methods.

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

1.8 DISPOSAL

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

1.8.1 Reuse.

Give first consideration to salvage for reuse since little or no re-processing is necessary for this method, and less pollution is created when items are reused in their original form. Coordinate reuse with the Contracting Officer. Consider sale or donation of waste suitable for reuse.

1.8.2 Recycle.

Recycle waste materials not suitable for reuse, but having value as being recyclable. Recycle all fluorescent lamps, HID lamps, and mercury-containing thermostats removed from the site. Arrange for timely pickups from the site or deliveries to recycling facilities in order to prevent contamination of recyclable materials.

1.8.3 Waste.

Dispose of materials with no practical use or economic benefit to waste-to-energy plants where available. As the last choice, dispose of materials at a landfill or incinerator.

1.8.4 Return

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

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used. -- End of Section --

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SECTION 01 78 00

CLOSEOUT SUBMITTALS

08/11

PART 1 GENERAL

1.1 SUBMITTALS

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

SD-03 Product Data

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

SD-08 Manufacturer's Instructions

- Preventative Maintenance
- Condition Monitoring (Predictive Testing)
- Inspection
- Posted Instructions

SD-10 Operation and Maintenance Data

- Operation and Maintenance Manuals

SD-11 Closeout Submittals

- Record Drawings
- Certification of EPA Designated Items; G

1.2 PROJECT RECORD DOCUMENTS

1.2.1 Record Drawings

Drawings showing final as-built conditions of the project. This paragraph covers record drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working record drawings" and "final record drawings" refer to contract drawings which are revised to be used for final record drawings showing as-built conditions. The final CAD record drawings must consist of one set of electronic CAD drawing files in the specified format, 2 sets of prints, and one set of the approved working Record drawings.

1.2.1.1 Government Furnished Materials

One set of electronic CADD files in the specified software and format revised to reflect all bid amendments will be provided by the Government at the preconstruction conference for projects requiring CADD file record drawings.

1.2.1.2 Working Record and Final Record Drawings

Revise 2 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. Keep these working as-built marked drawings current on a weekly basis and at least one set available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction must be accurately and neatly recorded as they occur by means of details and notes. Prepare final record (as-built) drawings after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working as-built marked prints and final record (as-built) drawings will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor prior to submission of each monthly pay estimate. If the Contractor fails to maintain the working and final record drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the record drawings. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of updated drawings. Show on the working and final record drawings , but not limited to, the following information:

- a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.
- b. The location and dimensions of any changes within the building structure.
- c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.
- d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.
- e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.
- f. Changes or modifications which result from the final inspection.
- g. Where contract drawings or specifications present options, show only the option selected for construction on the final as-built prints.
- h. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.

- i. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.
- j. Modifications (include within change order price the cost to change working and final record drawings to reflect modifications) and compliance with the following procedures.
 - (1) Follow directions in the modification for posting descriptive changes.
 - (2) Place a Modification Delta at the location of each deletion.
 - (3) For new details or sections which are added to a drawing, place a Modification Delta by the detail or section title.
 - (4) For minor changes, place a Modification Delta by the area changed on the drawing (each location).
 - (5) For major changes to a drawing, place a Modification Delta by the title of the affected plan, section, or detail at each location.
 - (6) For changes to schedules or drawings, place a Modification Delta either by the schedule heading or by the change in the schedule.
 - (7) The Modification Delta size shall be 1/2 inch diameter unless the area where the circle is to be placed is crowded. Smaller size circle shall be used for crowded areas.

1.2.1.3 Drawing Preparation

Modify the record drawings as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract set into agreement with approved working as-built prints, and adding such additional drawings as may be necessary. These working as-built marked prints must be neat, legible and accurate. These drawings are part of the permanent records of this project and must be returned to the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor must be satisfactorily replaced by the Contractor at no expense to the Government.

1.2.1.4 Computer Aided Design and Drafting (CADD) Drawings

Only employ personnel proficient in the preparation of CADD drawings to modify the contract drawings or prepare additional new drawings. Additions and corrections to the contract drawings must be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols must be the same as the original line colors, line weights, lettering, layering conventions, and symbols. If additional drawings are required, prepare them using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final record drawings must be identical to that used on the contract drawings. Accomplish additions and corrections to the contract drawings using CADD files. The Contractor will be furnished "as-designed" drawings in AutoCad format compatible with a Windows operating system. The electronic files will be supplied on optical disk. Provide all program files and hardware necessary to prepare final record drawings. The Contracting Officer will review final record drawings for accuracy and

return them to the Contractor for required corrections, changes, additions, and deletions.

- a. Provide CADD "base" colors of red, green, and blue. Color code for changes as follows:
 - (1) Deletions (Red) - Over-strike deleted graphic items (lines), lettering in notes and leaders.
 - (2) Additions (Green) - Added items, lettering in notes and leaders.
 - (3) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes.
- b. Rename the Contract Drawing files in a manner related to the contract number (i.e., 98-C-10.DGN) as instructed in the Pre-Construction conference. Use only those renamed files for the Marked-up changes. All changes shall be made on the layer/level as the original item.
- c. When final revisions have been completed, show the wording "RECORD DRAWINGS / AS-BUILT CONDITIONS" followed by the name of the Contractor in letters at least 3/16 inch high on the cover sheet drawing. Mark all other contract drawings either "Record" drawing denoting no revisions on the sheet or "Revised Record" denoting one or more revisions. Date original contract drawings in the revision block.
- d. Within 10 days for contracts less than \$5 million 20 days for contracts \$5 million and above after Government approval of all of the working record drawings for a phase of work, prepare the final CADD record drawings for that phase of work and submit two sets of blue-lined prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 7 days for contracts less than \$5 million 10 days for contracts \$5 million and above revise the CADD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 10 days for contracts less than \$5 million of substantial completion of all phases of work, submit the final record drawing package for the entire project. Submit one set of electronic files on optical disk, one set of mylars, two sets of blue-line prints and one set of the approved working record drawings. They must be complete in all details and identical in form and function to the contract drawing files supplied by the Government. Any transactions or adjustments necessary to accomplish this is the responsibility of the Contractor. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CADD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final record drawing files and marked prints as specified will be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final record drawings must be accomplished before final payment is made to the Contractor.

1.2.1.5 Payment

No separate payment will be made for record drawings required under this contract, and all costs accrued in connection with such drawings are considered a subsidiary obligation of the Contractor.

1.2.2 As-Built Record of Equipment and Materials

Furnish two copies of preliminary record of equipment and materials used on the project 15 days prior to final inspection. This preliminary submittal will be reviewed and returned 5 days after final inspection with Government comments. Submit Two sets of final record of equipment and materials 10 days after final inspection. Key the designations to the related area depicted on the contract drawings. List the following data:

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

1.2.3 Final Approved Shop Drawings

Furnish final approved project shop drawings 30 days after transfer of the completed facility.

1.2.4 Construction Contract Specifications

Furnish final record (as-built) construction contract specifications, including modifications thereto, 30 days after transfer of the completed facility.

1.2.5 Real Property Equipment

Furnish a list of installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. In the "EQUIPMENT-IN-PLACE LIST" include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. Furnish a draft list at time of transfer. Furnish the final list 30 days after transfer of the completed facility.

1.3 SPARE PARTS DATA

Submit two copies of the Spare Parts Data list.

- a. Indicate manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair. List those items that may be standard to the normal maintenance of the system.
- b. Supply items of each part for spare parts inventory. Provision of spare parts does not relieve the Contractor of responsibilities listed under the contract guarantee provisions.

1.4 PREVENTATIVE MAINTENANCE

Submit Preventative Maintenance, Condition Monitoring (Predictive Testing) and Inspection schedules with instructions that state when systems should be retested.

- a. Define the anticipated length of each test, test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a signoff blank for the Contractor and Contracting Officer for each test feature; e.g., *gpm*, *rpm*, *psi*. Include a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventative maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.
- b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

1.5 CERTIFICATION OF EPA DESIGNATED ITEMS

Submit the [Certification of EPA Designated Items](#) as required by FAR 52.223-9, "Certification and Estimate of Percentage of Recovered Material Content for EPA Designated Items". Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification will read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content. The following exemptions may apply to the non-procurement of recycled/recovered content materials: 1) The product does not meet appropriate performance standards; 2) The product is not available within a reasonable time frame; 3) The product is not available competitively (from two or more sources); 4) The product is only available at an unreasonable price (compared with a comparable non-recycled content product)." exemptions (1, 2, 3, or 4, as indicated), and comments. Recycled content values may be determined by weight or volume percent, but must be consistent throughout.

1.6 WARRANTY MANAGEMENT

1.6.1 [Warranty Management Plan](#)

Develop a warranty management plan which contains information relevant to the clause Warranty of Construction in writing. At least 30 days before the planned pre-warranty conference, submit two sets of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase must be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period will begin on the date of project acceptance and continue for the full product warranty period. A joint 4 month and 9 month warranty inspection will be conducted, measured from time of acceptance, by the

Contractor, Contracting Officer and the Customer Representative. Include within the warranty management plan , but not limited to, the following:

- a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.
- b. Furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.
- c. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.
- d. A list for each warranted equipment, item, feature of construction or system indicating:
 - (1) Name of item.
 - (2) Model and serial numbers.
 - (3) Location where installed.
 - (4) Name and phone numbers of manufacturers or suppliers.
 - (5) Names, addresses and telephone numbers of sources of spare parts.
 - (6) Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have extended warranties must be indicated with separate warranty expiration dates.
 - (7) Cross-reference to warranty certificates as applicable.
 - (8) Starting point and duration of warranty period.
 - (9) Summary of maintenance procedures required to continue the warranty in force.
 - (10) Cross-reference to specific pertinent Operation and Maintenance manuals.
 - (11) Organization, names and phone numbers of persons to call for warranty service.
 - (12) Typical response time and repair time expected for various warranted equipment.
- e. The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.
- f. Procedure and status of tagging of all equipment covered by extended warranties.
- g. Copies of [instructions](#) to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

1.6.2 Performance Bond

The Contractor's Performance Bond must remain effective throughout the construction period.

- a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited

to administrative expenses.

- b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.
- c. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

1.6.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty will be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, be continuously available, and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

1.6.4 Warranty Tags

At the time of installation, tag each warranted item with a durable, oil and water resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also, submit two record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

Type of product/material	
Model number	
Serial number	
Contract number	
Warranty period from/to	
Inspector's signature	

Construction Contractor	
Address	
Telephone number	
Warranty contact	
Address	
Telephone number	
Warranty response time priority code	
WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.	

1.7 OPERATION AND MAINTENANCE MANUALS

Submit 4 copies of the project operation and maintenance manuals 30 calendar days prior to testing the system involved. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

1.7.1 Configuration

Operation and Maintenance Manuals must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Bind information in manual format and grouped by technical sections. Test data must be legible and of good quality. Light-sensitive reproduction techniques are acceptable provided finished pages are clear, legible, and not subject to fading. Pages for vendor data and manuals must have 0.3937-inch holes and be bound in 3-ring, loose-leaf binders. Organize data by separate index and tabbed sheets, in a loose-leaf binder. Binder must lie flat with printed sheets that are easy to read. Caution and warning indications must be clearly labeled.

1.7.2 Training and Instruction

Submit classroom and field instructions in the operation and maintenance of systems equipment where required by the technical provisions. These services must be directed by the Contractor, using the manufacturer's factory-trained personnel or qualified representatives. Contracting Officer will be given 7 calendar days written notice of scheduled instructional services. Instructional materials belonging to the manufacturer or vendor, such as lists, static exhibits, and visual aids, must be made available to the Contracting Officer.

1.8 CLEANUP

Leave premises "broom clean." Clean exterior surfaces exposed to view; remove temporary labels, stains and foreign substances. Clean debris from drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities

from the site.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

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05/10

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SECTION 02 41 00

DEMOLITION
05/10

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.6 (2006) Safety Requirements for Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

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

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

40 CFR 61 National Emission Standards for Hazardous Air Pollutants

1.2 PROJECT DESCRIPTION

1.2.1 Demolition Plan

Prepare a [Demolition Plan](#) and submit proposed salvage, demolition, and removal procedures for approval before work is started. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Coordinate with Waste Management Plan. Provide procedures for safe conduct of the work in accordance with [EM 385-1-1](#). Plan shall be approved by Contracting Officer prior to work beginning.

1.2.2 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.. The work includes demolition of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with [EM 385-1-1](#), Section 23, Demolition, and other applicable Sections.

1.3 ITEMS TO REMAIN IN PLACE

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload elements to remain. Provide new supports and reinforcement for existing construction weakened by demolition, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove dust, dirt, and debris from work areas daily.

1.3.2 Trees

Protect trees within the project site which might be damaged during demolition and which are indicated to be left in place, by a 6 foot high fence. Erect and secure fence a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Contracting Officer.

1.3.3 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition operations. Prior to start of work, the Government on-base shops will disconnect and seal utilities serving each area of alteration or removal upon written request from the Contractor.

1.3.4 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.4 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted. Where burning is permitted, adhere to federal, state, and local regulations.

1.5 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be available in accordance with the areas of work indicated in drawings.

1.6 SUBMITTALS

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

SD-01 Preconstruction Submittals

Demolition Plan; G
Existing Conditions

SD-07 Certificates

Notification of Demolition

1.7 QUALITY ASSURANCE

Submit timely notification of demolition projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the State's environmental protection agency, local air pollution control district/agency and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSE/SAFE A10.6. Comply with the Environmental Protection Agency requirements specified.

1.7.1 Dust and Debris Control

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to flooding or pollution. Sweep and dust the work area as often as necessary to control the spread of debris.

Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to aircraft.

1.8 PROTECTION

1.8.1 Traffic Control Signs

Where pedestrian, driver, or aircraft safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor barricades in a manner to prevent displacement by wind, jet or prop blast. Notify the Contracting Officer prior to beginning such work.

1.8.2 Protection of Personnel

Before, during and after the demolition work take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient

bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.9 FOREIGN OBJECT DAMAGE (FOD)

Aircraft and aircraft engines are subject to FOD from debris and waste material lying on airfield pavements. Remove all such materials that may appear on operational aircraft pavements due to the Contractor's operations. If necessary, the Contracting Officer may require the Contractor to install a temporary barricade at the Contractor's expense to control the spread of FOD potential debris. The barricade shall include a fence covered with a fabric designed to stop the spread of debris. Anchor the fence and fabric to prevent displacement by winds or jet/prop blasts. Remove barricade when no longer required.

1.10 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair or replace items to be relocated which are damaged by the Contractor with new undamaged items as approved by the Contracting Officer.

1.11 EXISTING CONDITIONS

Before beginning any demolition work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results.

PART 2 PRODUCTS

Not Use

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures onsite for reuse. Existing construction scheduled to be removed for reuse shall be disassembled. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified. Materials shall be designated for reuse onsite whenever possible.

3.1.1 Structures

- a. Remove existing structures indicated to be removed to extent and elevation indicated in drawings.

3.1.2 Utilities and Related Equipment

3.1.2.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.2.2 Disconnecting Existing Utilities

Remove existing utilities and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered but are not indicated on the drawings, notify the Contracting Officer prior to further work in that area.

3.1.3 Chain Link Fencing

Remove chain link fencing, gates and other related salvaged items scheduled for removal and transport to designated areas. Remove gates as whole units. Cut chain link fabric to 25 foot lengths and store in rolls off the ground.

3.1.4 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs including aggregate base as indicated. Provide neat sawcuts at limits of pavement removal as indicated. Pavement and slabs designated to be recycled and utilized in this project shall be moved, ground and stored as directed by the Contracting Officer. Pavement and slabs not to be used in this project shall be removed from the Installation at Contractor's expense.

3.1.5 Masonry

Sawcut and remove masonry so as to prevent damage to surfaces to remain. Where new masonry adjoins existing, the new work shall abut or tie into the existing construction as indicated and as specified for the new work. Provide square, straight edges and corners where existing masonry adjoins new work and other locations.

3.1.6 Concrete

Saw concrete along straight lines to a depth of a minimum 2 inch. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete. Salvage removed concrete where not tested positive for ACM content.

3.1.7 Structural Steel

Dismantle structural steel at field connections and in a manner that will prevent bending or damage.

3.1.8 Miscellaneous Metal

Scrap metal shall become the Contractor's property. Recycle scrap metal as part of demolition operations. Provide separate containers to collect scrap metal and transport to a scrap metal collection or recycling facility, in accordance with the Waste Management Plan.

3.1.9 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated, and shall include:

- a. Concrete and Masonry: Completely fill holes and depressions, left as a result of removals in existing masonry walls to remain, with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.

3.2 DISPOSITION OF MATERIAL

3.2.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition, and removal procedures, and authorization by the Contracting Officer to begin demolition. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.2.2 Unsalvageable and Non-Recyclable Material

Dispose of unsalvageable and non-recyclable noncombustible material and non-recyclable combustible material off the site per Federal, State and Local regulations.

3.3 CLEANUP

Remove debris and rubbish from excavations. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.4 DISPOSAL OF REMOVED MATERIALS

3.4.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified in the Waste Management Plan.

Storage of removed materials on the project site is prohibited.

3.4.2 Burning on Government Property

Burning of materials removed from demolished structures will not be permitted on Government property.

3.4.3 Removal from Government Property

Transport waste materials removed from demolished structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

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05/14

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SECTION 03 30 53

MISCELLANEOUS CAST-IN-PLACE CONCRETE
05/14

PART 1 GENERAL

1.1 SUMMARY

Perform all work in accordance with ACI 318.

1.2 UNIT PRICES

1.2.1 Concrete Payment

Payment will cover all costs associated with furnishing, delivering, placing, finishing, and curing of concrete for the various items of the schedule, including the cost of all formwork. Payment for concrete, for which payment is made as a lump sum, is to be included in this unit price payment item. Payment for grout, preformed expansion joints, field-molded sealants, waterstops, reinforcing steel bars or wire reinforcement is to be included in this unit price payment item.

1.2.2 Measurement

Concrete will be measured for payment on the basis of the actual volume of concrete within the pay lines of the structures as indicated. Measurement of concrete placed against the sides of any excavation without the use of intervening forms will be made only within the pay lines of the structure. No deductions will be made for rounded or beveled edge, for space occupied by metal work, for electrical conduits or timber, or for voids or embedded items that are either less than 5 cubic feet in volume or 1 square foot in cross section.

1.2.3 Unit of Measure

Unit of measure: cubic yard.

1.3 REFERENCES

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

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 301	(2016) Specifications for Structural Concrete
ACI 304R	(2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete

ACI 305R	(2010) Guide to Hot Weather Concreting
ACI 306R	(2016) Guide to Cold Weather Concreting
ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016) Building Code Requirements for Structural Concrete and Commentary
ACI 347	(2004; Errata 2008; Errata 2012) Guide to Formwork for Concrete
ACI SP-66	(2004) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM A1064/A1064M	(2016b) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A615/A615M	(2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C1064/C1064M	(2011) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1157/C1157M	(2011) Standard Specification for Hydraulic Cement
ASTM C1260	(2014) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C143/C143M	(2015) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2016; E 2016) 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	(2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231/C231M	(2014) Standard Test Method for Air Content of Freshly Mixed Concrete by the

Pressure Method

ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C31/C31M	(2015a; E 2016) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2016) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2016b) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C494/C494M	(2016) Standard Specification for Chemical Admixtures for Concrete
ASTM C595/C595M	(2016) Standard Specification for Blended Hydraulic Cements
ASTM C618	(2012a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C685/C685M	(2014) Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C920	(2014a) Standard Specification for Elastomeric Joint Sealants
ASTM C94/C94M	(2016a) Standard Specification for Ready-Mixed Concrete
ASTM C989/C989M	(2014) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM D1752	(2004a; R 2013) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D471	(2016a) Standard Test Method for Rubber Property - Effect of Liquids
ASTM D75/D75M	(2014) Standard Practice for Sampling Aggregates
ASTM D98	(2015) Calcium Chloride

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 513 (1974) Corps of Engineers Specifications
for Rubber Waterstops

COE CRD-C 572 (1974) Corps of Engineers Specifications
for Polyvinylchloride Waterstops

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

40 CFR 247 Comprehensive Procurement Guideline for
Products Containing Recovered Materials

1.4 SUBMITTALS

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

SD-02 Shop Drawings

Installation Drawings; G

SD-03 Product Data

Air-Entraining Admixture
Accelerating Admixture
Water-Reducing or Retarding Admixture
Curing Materials
Expansion Joint Filler Strips, Premolded
Joint Sealants - Field Molded Sealants
Waterstops
Chemical Floor Hardener
Batching and Mixing Equipment
Conveying and Placing Concrete
Formwork
Mix Design Data; G
Ready-Mix Concrete
Curing Compound
Mechanical Reinforcing Bar Connectors

SD-06 Test Reports

Aggregates
Concrete Mixture Proportions; G
Compressive Strength Testing; G
Slump; G
Air Content
Water

SD-07 Certificates

Cementitious Materials
Pozzolan
CPG for recycled materials or appropriate Waiver Form
Aggregates
Delivery Tickets

SD-08 Manufacturer's Instructions

Chemical Floor Hardener
Curing Compound

1.5 QUALITY ASSURANCE

Indicate specific locations of Concrete Placement Forms, Steel Reinforcement, Control Joints on [installation drawings](#) and include, but not be limited to, square feet of concrete placements, thicknesses and widths, plan dimensions, and arrangement of cast-in-place concrete section.

1.5.1 Regulatory Requirements

The state statutory and regulatory requirements: Shall form a part of this specification to the extent referenced. Submit [CPG for recycled materials or appropriate Waiver Form](#).

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

The Government retains the option to sample and test joint sealer, joint filler material, waterstop, aggregates and concrete to determine compliance with the specifications. Provide facilities and labor as may be necessary to assist the Government in procurement of representative test samples. Obtain samples of aggregates at the point of batching in accordance with [ASTM D75/D75M](#). Sample concrete in accordance with [ASTM C172/C172M](#). Determine slump and air content in accordance with [ASTM C143/C143M](#) and [ASTM C231/C231M](#), respectively, when cylinders are molded. Prepare, cure, and transport compression test specimens in accordance with [ASTM C31/C31M](#). Test compression test specimens in accordance with [ASTM C39/C39M](#). Take samples for strength tests not less than once each shift in which concrete is produced from each strength of concrete required. Provide a minimum of five specimens from each sample; two to be tested at 28 days (90 days if pozzolan is used) for acceptance, two will be tested at 7 days for information and one held in reserve.

2.1.1 Strength

Acceptance test results are the average strengths of two specimens tested at 28 days (90 days if pozzolan is used). The strength of the concrete is considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength, f'_c , but not more than 20 percent, and no individual acceptance test result falls below f'_c by more than 500 psi.

2.1.2 Construction Tolerances

Apply a Class "C" finish to all surfaces except those specified to receive a Class "D" finish. Apply a Class "D" finish to all post-construction surfaces which will be permanently concealed. Surface requirements for the classes of finish required are as specified in [ACI 117](#).

2.1.3 Concrete Mixture Proportions

Concrete mixture proportions are the responsibility of the Contractor. Mixture proportions must include the dry weights of cementitious

material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per yard of concrete. Provide materials included in the mixture proportions of the same type and from the same source as will be used on the project. The specified compressive strength f'_c is 3,000 psi at 28 days (90 days if pozzolan is used). The maximum nominal size coarse aggregate is 3/4 inch, in accordance with ACI 304R. The air content must be between 4.5 and 7.5 percent with a slump between 2 and 5 inches. The maximum water-cementitious material ratio is 0.50. Submit the applicable test reports and mixture proportions that will produce concrete of the quality required, ten days prior to placement of concrete.

2.2 MATERIALS

Submit manufacturer's literature from suppliers which demonstrates compliance with applicable specifications for the specified materials.

2.2.1 Cementitious Materials

Submit Manufacturer's certificates of compliance, accompanied by mill test reports, attesting that the concrete materials meet the requirements of the specifications in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Also, certificates for all material conforming to EPA's Comprehensive Procurement Guidelines (CPG), in accordance with 40 CFR 247. Provide cementitious materials that conform to the appropriate specifications listed:

2.2.1.1 Portland Cement

ASTM C150/C150M, Type II, low alkali with tri-calcium aluminates (C3A) content less than 10 percent and a maximum cement-alkali content of 0.80 percent Na₂Oe (sodium oxide) equivalent.

2.2.1.2 Blended Hydraulic Cement

Provide blended cement conforming to ASTM C595/C595M and ASTM C1157/C1157M, Type IP or IS, including the optional requirement for mortar expansion and consist of a mixture of ASTM C150/C150M Type I, or Type II cement and a complementary cementing material. The slag added to the Type IS blend must be ASTM C989/C989M ground granulated blast-furnace slag. The pozzolan added to the Type IP blend must be ASTM C618 Class F, interground with the cement clinker. Provide the manufacturer's written statement that the amount of pozzolan in the finished cement will not vary more than plus or minus 5 mass percent of the finished cement from lot-to-lot or within a lot. Do not change the percentage and type of mineral admixture used in the blend from that submitted for the aggregate evaluation and mixture proportioning.

2.2.1.3 Pozzolan

Provide pozzolan that conforms to ASTM C618, Class F, including requirements of Tables 1A and 2A.

2.2.2 Aggregates

For fine and coarse aggregates meet the quality and grading requirements of ASTM C33/C33M and test and evaluate for alkali-aggregate reactivity in accordance with ASTM C1260. Perform evaluation of fine and coarse

aggregates separately and in combination, matching the proposed mix design proportioning. All results of the separate and combination testing must have a measured expansion less than 0.08 percent at 28 days after casting. If the test data indicates an expansion of 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. Submit certificates of compliance and test reports for aggregates showing the material(s) meets the quality and grading requirements of the specifications under which it is furnished.

2.2.3 Admixtures

Provide admixtures, when required or approved, in compliance with the appropriate specification listed. Retest chemical admixtures that have been in storage at the project site, for longer than 6 months or that have been subjected to freezing, at the expense of the Contractor at the request of the Contracting Officer and will be rejected if test results are not satisfactory.

2.2.3.1 Air-Entraining Admixture

Provide air-entraining admixture that meets the requirements of [ASTM C260/C260M](#).

2.2.3.2 Accelerating Admixture

Provide calcium chloride meeting the requirements of [ASTM D98](#). Other accelerators must meet the requirements of [ASTM C494/C494M](#), Type C or E.

2.2.3.3 Water-Reducing or Retarding Admixture

Provide water-reducing or retarding admixture meeting the requirements of [ASTM C494/C494M](#), Type A, B, or D.

2.2.4 Water

Mixing and curing water in compliance with the requirements of [ASTM C1602/C1602M](#); potable, and free of injurious amounts of oil, acid, salt, or alkali. Submit test report showing water complies with [ASTM C1602/C1602M](#).

2.2.5 Reinforcing Steel

Provide reinforcing bars conforming to the requirements of [ASTM A615/A615M](#), Grade 60, deformed. Provide welded steel wire reinforcement conforming to the requirements of [ASTM A1064/A1064M](#). Detail reinforcement not indicated in accordance with [ACI 301](#) and [ACI SP-66](#). Provide [mechanical reinforcing bar connectors](#) in accordance with [ACI 301](#) and provide 125 percent minimum yield strength of the reinforcement bar.

2.2.6 Expansion Joint Filler Strips, Premolded

Expansion joint filler strips, premolded of sponge rubber conforming to [ASTM D1752](#), Type I.

2.2.7 Joint Sealants - Field Molded Sealants

Conform to [ASTM C920](#), Type M, Grade NS, Class 25, use NT for vertical joints and Type M, Grade P, Class 25, use T for horizontal joints. Provide polyethylene tape, coated paper, metal foil, or similar type bond breaker materials. The backup material needs to be compressible, nonshrink, nonreactive with the sealant, and a nonabsorptive material such as extruded butyl or polychloroprene foam rubber. Immediately prior to installation of field-molded sealants, clean the joint of all debris and further cleaned using water, chemical solvents, or other means as recommended by the sealant manufacturer or directed.

2.2.8 Formwork

Design and engineer the formwork as well as its construction in accordance with [ACI 301](#) Section 2 and 5 and [ACI 347](#). Fabricate of wood, steel, or other approved material. Submit formwork design prior to the first concrete placement.

2.2.9 Form Coatings

Provide form coating in accordance with [ACI 301](#).

2.2.10 Curing Materials

Provide curing materials in accordance with [ACI 301](#), Section 5.

2.3 READY-MIX CONCRETE

Provide ready-mix concrete with [mix design data](#) conforming to [ACI 301](#) Part 2. Submit [delivery tickets](#) in accordance with [ASTM C94/C94M](#) for each ready-mix concrete delivery, include the following additional information: .

- a. Type and brand cement
- b. Cement content in [94-pound](#) bags per cubic [yard](#) of concrete
- c. Maximum size of aggregate
- d. Amount and brand name of admixture
- e. Total water content expressed by water cementitious material ratio

2.4 ACCESSORIES

2.4.1 Waterstops

2.4.1.1 PVC Waterstop

Polyvinylchloride waterstops conforming to [COE CRD-C 572](#).

2.4.1.2 Rubber Waterstop

Rubber waterstops conforming to [COE CRD-C 513](#).

2.4.1.3 Thermoplastic Elastomeric Rubber Waterstop

Thermoplastic elastomeric rubber waterstops conforming to [ASTM D471](#).

2.4.1.4 Hydrophilic Waterstop

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water conforming to [ASTM D412](#) as follows: Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum. Minimum hardness of 50 on the type A durometer and the volumetric expansion ratio in distilled water at 70 degrees F; 3 to 1 minimum.

2.4.2 Chemical Floor Hardener

Provide hardener which is a colorless aqueous solution containing a blend of inorganic silicate or silicate material and proprietary components combined with a wetting agent; that penetrates, hardens, and densifies concrete surfaces. Submit manufactures instructions for placement of liquid chemical floor hardener.

2.4.3 Curing Compound

Provide curing compound conforming to [ASTM C309](#). Submit manufactures instructions for placing curing compound.

PART 3 EXECUTION

3.1 PREPARATION

Prepare construction joints to expose coarse aggregate. The surface must be clean, damp, and free of laitance. Construct ramps and walkways, as necessary, to allow safe and expeditious access for concrete and workmen. Remove snow, ice, standing or flowing water, loose particles, debris, and foreign matter. Satisfactorily compact earth foundations. Make spare vibrators available. Placement cannot begin until the entire preparation has been accepted by the Government.

3.1.1 Embedded Items

Secure reinforcement in place after joints, anchors, and other embedded items have been positioned. Arrange internal ties so that when the forms are removed the metal part of the tie is not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Prepare embedded items so they are be free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete is permitted only when specifically authorized or directed. Provide all equipment needed to place, consolidate, protect, and cure the concrete at the placement site and in good operating condition.

3.1.2 Formwork Installation

Forms must be properly aligned, adequately supported, and mortar-tight. Provide smooth form surfaces, free from irregularities, dents, sags, or holes when used for permanently exposed faces. Chamfer all exposed joints and edges , unless otherwise indicated.

3.1.3 Production of Concrete

3.1.3.1 Ready-Mixed Concrete

Provide ready-mixed concrete conforming to [ASTM C94/C94M](#) except as otherwise specified.

3.1.3.2 Concrete Made by Volumetric Batching and Continuous Mixing

Conform to [ASTM C685/C685M](#).

3.1.3.3 Batching and Mixing Equipment

The option of using an on-site batching and mixing facility is available. The facility must provide sufficient batching and mixing equipment capacity to prevent cold joints. Submit the method of measuring materials, batching operation, and mixer for review, and manufacturer's data for batching and mixing equipment demonstrating compliance with the applicable specifications.

3.1.4 Waterstops

Install and splice waterstops as directed by the manufacturer.

3.2 CONVEYING AND PLACING CONCRETE

Convey and place concrete in accordance with [ACI 301](#), Section 5.

3.2.1 Cold-Weather Requirements

Place concrete in cold weather in accordance with [ACI 306R](#)

3.2.2 Hot-Weather Requirements

Place concrete in hot weather in accordance with [ACI 305R](#)

3.3 FINISHING

3.3.1 Temperature Requirement

Do not finish or repair concrete when either the concrete or the ambient temperature is below [50 degrees F](#).

3.3.2 Finishing Formed Surfaces

Remove all fins and loose materials , and surface defects including filling of tie holes. Repair all honeycomb areas and other defects. Remove all unsound concrete from areas to be repaired. Ream or chip surface defects greater than [1/2 inch](#) in diameter and holes left by removal of tie rods in all surfaces not to receive additional concrete and fill with dry-pack mortar. Brush-coat the prepared area with an approved epoxy resin or latex bonding compound or with a neat cement grout after dampening and filling with mortar or concrete. Use a blend of portland cement and white cement in mortar or concrete for repairs to all surfaces permanently exposed to view shall be so that the final color when cured is the same as adjacent concrete.

3.3.3 Finishing Unformed Surfaces

Finish unformed surfaces in accordance with [ACI 301](#), Section 5.

FINISH	LOCATION
Float	
Trowel	
Broom or Belt	

3.3.3.1 Expansion and Contraction Joints

Make expansion and contraction joints in accordance with the details shown or as otherwise specified. Provide 1/2 inch thick transverse expansion joints where new work abuts an existing concrete. Provide expansion joints at a maximum spacing of 30 feet on center in sidewalks unless otherwise indicated. Provide contraction joints at a maximum spacing of 6 linear feet in sidewalks and at a maximum spacing of 15 feet in slabs, unless otherwise indicated. Cut contraction joints at a minimum of 1 inch deep with a jointing tool after the surface has been finished.

3.4 CURING AND PROTECTION

Cure and protect in accordance with ACI 301, Section 5.

3.5 FORM WORK

Provide form work in accordance with ACI 301, Section 2 and Section 5.

3.5.1 Removal of Forms

Remove forms in accordance with ACI 301, Section 2.

3.6 STEEL REINFORCING

Reinforcement must be free from loose, flaky rust and scale, and free from oil, grease, or other coating which might destroy or reduce the reinforcement's bond with the concrete.

3.6.1 Fabrication

Shop fabricate steel reinforcement in accordance with ACI 318 and ACI SP-66. Provide shop details and bending in accordance with ACI 318 and ACI SP-66.

3.6.2 Splicing

Perform splices in accordance with ACI 318 and ACI SP-66.

3.6.3 Supports

Secure reinforcement in place by the use of metal or concrete supports, spacers, or ties.

3.7 EMBEDDED ITEMS

Before placing concrete, take care to determine that all embedded items are firmly and securely fastened in place. Provide embedded items free of oil and other foreign matter, such as loose coatings of rust, paint and scale. Embedding of wood in concrete is permitted only when specifically authorized or directed.

3.8 CHEMICAL FLOOR HARDENER

Apply Chemical Floor Hardener where indicated, after curing and drying concrete surface. Dilute liquid hardener with water and apply in three coats. First coat is one-third strength, second coat one-half strength, and third coat two-thirds strength. Apply each coat evenly and allow it to dry 24 hours before applying next coat. Apply proprietary chemical hardeners in accordance with manufacturer's printed directions.

3.9 TESTING AND INSPECTING

Report the results of all tests and inspections conducted at the project site informally at the end of each shift. Submit written reports weekly. Deliver within three days after the end of each weekly reporting period.

3.9.1 Field Testing Technicians

The individuals who sample and test concrete must have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

3.9.2 Preparations for Placing

Inspect foundation or construction joints, forms, and embedded items in sufficient time prior to each concrete placement to certify that it is ready to receive concrete.

3.9.3 Sampling and Testing

- a. Obtain samples and test concrete for quality control during placement. Sample fresh concrete for testing in accordance with [ASTM C172/C172M](#). Make six test cylinders.
- b. Test concrete for compressive strength at 7 and 28 days for each design mix and for every [100 cubic yards](#) of concrete. Test two cylinders at 7 days; two cylinders at 28 days; and hold two cylinders in reserve. Conform test specimens to [ASTM C31/C31M](#). Perform [compressive strength testing](#) conforming to [ASTM C39/C39M](#).
- c. Test [slump](#) at the plant for each design mix in accordance with [ASTM C143/C143M](#). Check slump once during each shift that concrete is produced for each strength of concrete required.
- d. Test [air content](#) for air-entrained concrete in accordance with [ASTM C231/C231M](#). Test concrete using lightweight or extremely porous aggregates in accordance with [ASTM C173/C173M](#). Check air content at least once during each shift that concrete is placed for each strength of concrete required.
- e. Determine temperature of concrete at time of placement in accordance with [ASTM C1064/C1064M](#). Check concrete temperature at least once during each shift that concrete is placed for each strength of concrete required.

3.9.4 Action Required

3.9.4.1 Placing

Do not begin placement until the availability of an adequate number of acceptable vibrators, which are in working order and have competent operators, has been verified. Discontinue placing if any lift is inadequately consolidated.

3.9.4.2 Air Content

Whenever an air content test result is outside the specification limits, adjust the dosage of the air-entrainment admixture prior to delivery of concrete to forms.

3.9.4.3 Slump

Whenever a slump test result is outside the specification limits, adjust the batch weights of water and fine aggregate prior to delivery of concrete to the forms. Make the adjustments so that the water-cementitious material ratio does not exceed that specified in the submitted concrete mixture proportion and the required concrete strength is still met.

-- End of Section --

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07/06

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SECTION 26 00 00.00 20

BASIC ELECTRICAL MATERIALS AND METHODS
07/06

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM D709 (2016) Standard Specification for
Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2017) National Electrical Safety Code

IEEE Std 100 (2000) The Authoritative Dictionary of
IEEE Standards Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2014) Enclosures for Electrical Equipment
(1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017) National Electrical Code

UNIFIED FACILITIES CRITERIA (UFC)

UFC 3-520-01 (2010) Interior Electrical Systems

NFPA 820 (2016) Standard for Fire Protection in
Wastewater Treatment and Collection
Facilities

1.2 RELATED REQUIREMENTS

This section applies to certain sections of Divisions 22 and 23, PLUMBING and HEATING VENTILATING AND AIR CONDITIONING. This section applies to all sections of Division 26 and 33, ELECTRICAL and UTILITIES, of this project specification unless specified otherwise in the individual sections.

1.3 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.
- b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and

equipment operations and that refer to this section for detailed description of submittal types.

- c. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.4 ADDITIONAL SUBMITTALS INFORMATION

Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.

1.4.1 Shop Drawings (SD-02)

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.4.2 Product Data (SD-03)

Submittal shall include performance and characteristic curves.

1.5 QUALITY ASSURANCE

1.5.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 and UFC 3-520-01 unless more stringent requirements are specified or indicated.

1.5.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

1.5.2.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than

6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.2.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.6 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.7 POSTED OPERATING INSTRUCTIONS

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

- a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
- b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
- c. Safety precautions.
- d. The procedure in the event of equipment failure.
- e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.8 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.9 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

1.10 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, NFPA 820, and requirements specified herein.

1.11 INSTRUCTION TO GOVERNMENT PERSONNEL

Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section.

PART 2 PRODUCTS

2.1 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 EXECUTION

3.1 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

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SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM

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PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

- ASTM B1 (2013) Standard Specification for Hard-Drawn Copper Wire
- ASTM B8 (2011) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- ASTM D709 (2016) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
- IEEE 81 (2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
- IEEE C2 (2017) National Electrical Safety Code

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

- NETA ATS (2013) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- ANSI C80.1 (2005) American National Standard for Electrical Rigid Steel Conduit (ERSC)
- ANSI C80.3 (2015) American National Standard for Electrical Metallic Tubing (EMT)
- ANSI C80.5 (2015) American National Standard for Electrical Rigid Aluminum Conduit
- NEMA 250 (2014) Enclosures for Electrical Equipment (1000 Volts Maximum)
- NEMA FU 1 (2012) Low Voltage Cartridge Fuses

NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2015) Terminal Blocks
NEMA ICS 6	(1993; R 2011) Industrial Control and Systems: Enclosures
NEMA KS 1	(2013) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)
NEMA MG 1	(2016) Motors and Generators
NEMA MG 10	(2013) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA MG 11	(1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors
NEMA RN 1	(2005; R 2013) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA ST 20	(1992; R 1997) Standard for Dry-Type Transformers for General Applications
NEMA TC 14	(2002) Standard for Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
NEMA TC 2	(2013) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2015) Standard for Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
NEMA WD 1	(1999; R 2015) Standard for General Color Requirements for Wiring Devices
NEMA WD 6	(2016) Wiring Devices Dimensions Specifications
NEMA Z535.4	(2011) American National Standard for Product Safety Signs and Labels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017) National Electrical Code
NFPA 70E	(2015; ERTA 1 2015) Standard for

Electrical Safety in the Workplace

NFPA 820

(2016) Standard for Fire Protection in
Wastewater Treatment and Collection
Facilities

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-607

(2011b) Generic Telecommunications Bonding
and Grounding (Earthing) for Customer
Premises

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

29 CFR 1910.147

Control of Hazardous Energy (Lock Out/Tag
Out)

UNDERWRITERS LABORATORIES (UL)

UL 1

(2005; Reprint Jul 2012) Standard for
Flexible Metal Conduit

UL 1063

(2006; Reprint Jul 2012) Machine-Tool
Wires and Cables

UL 1203

(2013; Reprint Apr 2015) UL Standard for
Safety Explosion-Proof and
Dust-Ignition-Proof Electrical Equipment
for Use in Hazardous (Classified) Locations

UL 1242

(2006; Reprint Mar 2014) Standard for
Electrical Intermediate Metal Conduit --
Steel

UL 1449

(2014; Reprint Mar 2016) UL Standard for
Safety Surge Protective Devices

UL 1660

(2014) Liquid-Tight Flexible Nonmetallic
Conduit

UL 198M

(2003; Reprint Feb 2013) Standard for
Mine-Duty Fuses

UL 360

(2013; Reprint Jan 2015) Liquid-Tight
Flexible Steel Conduit

UL 4248-1

(2007; Reprint Oct 2013) UL Standard for
Safety Fuseholders - Part 1: General
Requirements

UL 4248-12

(2007; Reprint Dec 2012) UL Standard for
Safety Fuseholders - Part 12: Class R

UL 44

(2014; Reprint Feb 2015)
Thermoset-Insulated Wires and Cables

UL 486A-486B

(2013; Reprint Jan 2016) Wire Connectors

UL 486C

(2013; Reprint Jan 2016) Splicing Wire

Connectors

UL 498	(2012; Reprint Jul 2016) UL Standard for Safety Attachment Plugs and Receptacles
UL 5	(2016) UL Standard for Safety Surface Metal Raceways and Fittings
UL 508	(1999; Reprint Oct 2013) Industrial Control Equipment
UL 510	(2005; Reprint Jul 2013) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2013) Metallic Outlet Boxes
UL 514B	(2012; Reprint Nov 2014) Conduit, Tubing and Cable Fittings
UL 514C	(2014; Reprint Dec 2014) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 5A	(2015) Nonmetallic Surface Raceways and Fittings
UL 6	(2007; Reprint Nov 2014) Electrical Rigid Metal Conduit-Steel
UL 651	(2011; Reprint Jun 2016) UL Standard for Safety Schedule 40 and 80 Rigid PVC Conduit and Fittings
UL 674	(2011; Reprint Jul 2013) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations
UL 6A	(2008; Reprint Nov 2014) Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel
UL 797	(2007; Reprint Dec 2012) Electrical Metallic Tubing -- Steel
UL 83	(2014) Thermoplastic-Insulated Wires and Cables
UL 854	(2004; Reprint Nov 2014) Standard for Service-Entrance Cables
UL 870	(2016) UL Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings
UL 943	(2016) UL Standard for Safety Ground-Fault Circuit-Interrupters
UL 984	(1996; Reprint Sep 2005) Hermetic Refrigerant Motor-Compressors

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE 100.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Switches

Motor controllers; G

Surge protective devices; G

SD-06 Test Reports

600-volt wiring test; G

Grounding system test; G

Transformer tests; G

Ground-fault receptacle test; G

SD-07 Certificates

Fuses; G

SD-10 Operation and Maintenance Data

Electrical Systems; G

Submit operation and maintenance data in accordance with Section 01 78 00, CLOSEOUT PROCEDURES.

1.4 QUALITY ASSURANCE

1.4.1 Fuses

Submit coordination data as specified in paragraph, FUSES of this section.

1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" or "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and:

- a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.
- b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.
- c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable.

1.5 MAINTENANCE

1.5.1 Electrical Systems

Submit operation and maintenance manuals for electrical systems that provide basic data relating to the design, operation, and maintenance of the electrical distribution system for the building. Include the following:

- a. Single line diagram of the "as-built" building electrical system.
- b. Schematic diagram of electrical control system (other than HVAC, covered elsewhere).
- c. Manufacturers' operating and maintenance manuals on active electrical equipment.

1.6 WARRANTY

Provide equipment items supported by service organizations that are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

As a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70 and NFPA 820 for all

materials, equipment, and devices.

2.2 CONDUIT AND FITTINGS

Conform to the following:

2.2.1 Rigid Metallic Conduit

2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit

ANSI C80.1, UL 6.

2.2.1.2 Rigid Aluminum Conduit

ANSI C80.5, UL 6A.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40, and EPC-80 in accordance with NEMA TC 2, UL 651, or fiberglass conduit, in accordance with NEMA TC 14.

2.2.3 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

2.2.4 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, ANSI C80.3.

2.2.5 Plastic-Coated Rigid Steel and IMC Conduit

NEMA RN 1, Type 40 (40 mils thick).

2.2.6 Flexible Metal Conduit

UL 1.

2.2.6.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

2.2.7 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings: cadmium- or zinc-coated in accordance with UL 514B.

2.2.7.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.7.2 Fittings for EMT

Die Cast or Steel compression type.

2.2.8 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3 for PVC, and UL 514B.

2.2.9 Liquid-Tight Flexible Nonmetallic Conduit

UL 1660.

2.3 SURFACE RACEWAY

2.3.1 Surface Metal Raceway

UL 5, two-piece painted steel, totally enclosed, snap-cover type. Provide multiple outlet-type raceway with grounding-type receptacle where indicated. Provide receptacles as specified herein, spaced a minimum of one every 18 inches. Wire alternate receptacles on different circuits.

2.3.2 Surface Nonmetallic Raceway

UL 5A, nonmetallic totally enclosed, snap-cover type. Provide multiple outlet-type raceway with grounding-type receptacle where indicated. Provide receptacles as specified herein, spaced a minimum of one every 18 inches. Wire alternate receptacles on different circuits.

2.4 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

2.5 WIRES AND CABLES

Provide wires and cables in accordance applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Do not use wires and cables manufactured more than 12 months prior to date of delivery to site.

2.5.1 Conductors

Provide the following:

- a. Conductor sizes and capacities shown are based on copper, unless indicated otherwise.
- b. Conductors No. 8 AWG and larger diameter: stranded.
- c. Conductors No. 10 AWG and smaller diameter: solid.
- d. Conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3: stranded unless specifically indicated otherwise.
- e. All conductors: copper.

2.5.1.1 Minimum Conductor Sizes

Provide minimum conductor size in accordance with the following:

- a. Branch circuits: No. 12 AWG.
- b. Class 1 remote-control and signal circuits: No. 14 AWG.
- c. Class 2 low-energy, remote-control and signal circuits: No. 16 AWG.
- d. Class 3 low-energy, remote-control, alarm and signal circuits: No. 22

AWG.

2.5.2 Color Coding

Provide color coding for service, feeder, branch, control, and signaling circuit conductors.

2.5.2.1 Ground and Neutral Conductors

Provide color coding of ground and neutral conductors as follows:

- a. Grounding conductors: Green.
- b. Neutral conductors: White.
- c. Exception, where neutrals of more than one system are installed in same raceway or box, other neutrals color coding: white with a different colored (not green) stripe for each.

2.5.2.2 Ungrounded Conductors

Provide color coding of ungrounded conductors in different voltage systems as follows:

- a. 208/120 volt, three-phase
 - (1) Phase A - black
 - (2) Phase B - red
 - (3) Phase C - blue
- b. 480/277 volt, three-phase
 - (1) Phase A - brown
 - (2) Phase B - orange
 - (3) Phase C - yellow
- c. 120/240 volt, single phase: Black and red

2.5.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, provide power and lighting wires rated for 600-volts, Type THWN/THHN conforming to UL 44, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits: Type TW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.5.4 Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.5.5 Service Entrance Cables

Service Entrance (SE) and Underground Service Entrance (USE) Cables, [UL 854](#).

2.6 SPLICES AND TERMINATION COMPONENTS

[UL 486A-486B](#) for wire connectors and [UL 510](#) for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires: insulated, pressure-type in accordance with [UL 486A-486B](#) or [UL 486C](#) (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.7 SWITCHES

2.7.1 Disconnect Switches

[NEMA KS 1](#). Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Utilize Class R fuseholders and fuses for fused switches, unless indicated otherwise. Provide horsepower rated for switches serving as the motor-disconnect means. Provide switches in [NEMA 1 4X](#), enclosure as indicated per [NEMA ICS 6](#).

2.8 FUSES

[NEMA FU 1](#). Provide complete set of fuses for each fusible switch. Provide fuses with a voltage rating not less than circuit voltage.

2.8.1 Fuseholders

Provide in accordance with [UL 4248-1](#).

2.8.2 Cartridge Fuses, Current Limiting Type (Class R)

[UL 198M](#), Class RK-1, RK-5 or time-delay type. Provide only Class R associated fuseholders in accordance with [UL 4248-12](#).

2.8.3 Cartridge Fuses, High-Interrupting Capacity, Current Limiting Type (Classes J, L, and CC)

[UL 198M](#), Class J for zero to 600 amperes, Class L for 601 to 6,000 amperes, and Class CC for zero to 30 amperes.

2.8.4 Cartridge Fuses, Current Limiting Type (Class T)

[UL 198M](#), Class T for zero to 1,200 amperes, 300 volts; and zero to 800 amperes, 600 volts.

2.9 RECEPTACLES

Provide the following:

- a. [UL 498](#), hard use (also designated heavy-duty), grounding-type.
- b. Ratings and configurations: as indicated.
- c. Bodies: white, ivory or brown as per [NEMA WD 1](#).
- d. Face and body: thermoplastic supported on a metal mounting strap.

- e. Dimensional requirements: per NEMA WD 6.
- f. Screw-type, side-wired wiring terminals or of the solderless pressure type having suitable conductor-release arrangement.
- g. Grounding pole connected to mounting strap.
- h. The receptacle: containing triple-wire power contacts and double or triple-wire ground contacts.

2.9.1 Weatherproof Receptacles

Provide receptacles, UL listed for use in "wet locations". Include cast metal box with gasketed, hinged, lockable and weatherproof while-in-use, polycarbonate, UV resistant/stabilized cover plate.

2.9.2 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Provide device capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of UL 943 for Class A ground-fault circuit interrupter devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

2.10 MOTORS

Provide motors in accordance with the following:

- a. NEMA MG 1.
- b. Hermetic-type sealed motor compressors: Also comply with UL 984.
- c. Provide the size in terms of HP, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified.
- d. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters.
- e. Rate motors for operation on 208-volt, 3-phase circuits with a terminal voltage rating of 200 volts, and those for operation on 480-volt, 3-phase circuits with a terminal voltage rating of 460 volts.
- f. Use motors designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating.
- g. Unless otherwise indicated, use continuous duty type motors if rated 1 HP and above.
- h. Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated.

2.10.1 High Efficiency Single-Phase Motors

Single-phase fractional-horsepower alternating-current motors: high efficiency types corresponding to the applications listed in NEMA MG 11. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to

meet the overall system rating indicated.

2.10.2 Premium Efficiency Polyphase Motors

Select polyphase motors based on high efficiency characteristics relative to typical characteristics and applications as listed in [NEMA MG 10](#). In addition, continuous rated, polyphase squirrel-cage medium induction motors must meet the requirements for premium efficiency electric motors in accordance with [NEMA MG 1](#), including the NEMA full load efficiency ratings. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.10.3 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

2.10.4 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment, and motor control equipment forming part of motor control centers or switchgear assemblies, the conduit and wiring connecting such centers, assemblies, or other power sources to equipment as specified herein. Power wiring and conduit: conform to the requirements specified herein. Control wiring: provided under, and conform to, the requirements of the section specifying the associated equipment.

2.11 MOTOR CONTROLLERS

Provide motor controllers in accordance with the following:

- a. [UL 508](#), [NEMA ICS 1](#), and [NEMA ICS 2](#).
- b. Provide controllers with thermal overload protection in each phase, and one spare normally open auxiliary contact, and one spare normally closed auxiliary contact.
- c. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage.
- d. Provide protection for motors from immediate restart by a time adjustable restart relay.
- e. When used with pressure, float, or similar automatic-type or maintained-contact switch, provide a hand/off/automatic selector switch with the controller.
- f. Connections to selector switch: wired such that only normal automatic regulatory control devices are bypassed when switch is in "hand"

position.

- g. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices: connected in motor control circuit in "hand" and "automatic" positions.
- h. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device: made in accordance with indicated or manufacturer's approved wiring diagram.
- i. Provide selector switch with the means for locking in any position.
- j. Provide a disconnecting means, capable of being locked in the open position, for the motor that is located in sight from the motor location and the driven machinery location. As an alternative, provide a motor controller disconnect, capable of being locked in the open position, to serve as the disconnecting means for the motor if it is in sight from the motor location and the driven machinery location.
- l. Overload protective devices: provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case.
- m. Cover of combination motor controller and manual switch or circuit breaker: interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position.

2.11.1 Control Wiring

Provide control wiring in accordance with the following:

- a. All control wire: stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type SIS meeting [UL 44](#), or Type MTW meeting [UL 1063](#), and passing the VW-1 flame tests included in those standards.
- b. Hinge wire: Class K stranding.
- c. Current transformer secondary leads: not smaller than No. 10 AWG.
- d. Control wire minimum size: No. 14 AWG.
- e. Power wiring for 480-volt circuits and below: the same type as control wiring with No. 12 AWG minimum size.
- f. Provide wiring and terminal arrangement on the terminal blocks to permit the individual conductors of each external cable to be terminated on adjacent terminal points.

2.11.2 Control Circuit Terminal Blocks

Provide control circuit terminal blocks in accordance with the following:

- a. [NEMA ICS 4](#).
- b. Control circuit terminal blocks for control wiring: molded or fabricated type with barriers, rated not less than 600 volts.

- c. Provide terminals with removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts.
- d. Terminals: not less than No. 10 in size with sufficient length and space for connecting at least two indented terminals for 10 AWG conductors to each terminal.
- e. Terminal arrangement: subject to the approval of the Contracting Officer with not less than four (4) spare terminals or 10 percent, whichever is greater, provided on each block or group of blocks.
- f. Modular, pull apart, terminal blocks are acceptable provided they are of the channel or rail-mounted type.
- g. Submit data showing that any proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

2.11.2.1 Types of Terminal Blocks

- a. Short-Circuiting Type: Short-circuiting type terminal blocks: furnished for all current transformer secondary leads with provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks: comply with the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS above.
- b. Load Type: Load terminal blocks rated not less than 600 volts and of adequate capacity: provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits, except those for feeder tap units. Provide terminals of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, provide screws with hexagonal heads. Conducting parts between connected terminals must have adequate contact surface and cross-section to operate without overheating. Provide each connected terminal with the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

2.11.3 Control Circuits

Control circuits: maximum voltage of 120 volts derived from a separate control source. Provide terminals and terminal boards. Provide separate control disconnect switch within controller. Provide one fused secondary lead with the other lead grounded.

2.11.4 Enclosures for Motor Controllers

NEMA ICS 6.

2.11.5 Multiple-Speed Motor Controllers and Reversible Motor Controllers

Across-the-line-type, electrically and mechanically interlocked.
Multiple-speed controllers: include compelling relays and multiple-button, station-type with pilot lights for each speed.

2.11.6 Pushbutton Stations

Provide with "start/stop" momentary contacts having one normally open and one normally closed set of contacts, and red lights to indicate when motor is running. Stations: heavy duty, oil-tight design.

2.11.7 Pilot and Indicating Lights

Provide LED cluster lamps.

2.12 LOCKOUT REQUIREMENTS

Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147. Comply with requirements of Division 23, "Mechanical" for mechanical isolation of machines and other equipment.

2.13 HAZARDOUS LOCATIONS

Electrical materials, equipment, and devices for installation in hazardous locations, as defined by NFPA 70: specifically approved by Underwriters' Laboratories, Inc., or Factory Mutual for particular "Class," "Division," and "Group" of hazardous locations involved. Boundaries and classifications of hazardous locations: as indicated. Equipment in hazardous locations: comply with UL 1203 for electrical equipment and industrial controls and UL 674 for motors. Collection system shall be provided with fire protection for the fire hazards as outlined in NFPA 820.

2.14 MANUFACTURER'S NAMEPLATE

Provide on each item of equipment a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.15 FIELD FABRICATED NAMEPLATES

Provide field fabricated nameplates in accordance with the following:

- a. ASTM D709.
- b. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings.
- c. Each nameplate inscription: identify the function and, when applicable, the position.
- d. Nameplates: melamine plastic, 0.125 inch thick, white with black center core.
- e. Surface: matte finish. Corners: square. Accurately align lettering and engrave into the core.
- f. Minimum size of nameplates: one by 2.5 inches.
- g. Lettering size and style: a minimum of 0.25 inch high normal block style.

2.16 WARNING SIGNS

Provide warning signs for flash protection in accordance with [NFPA 70E](#) and [NEMA Z535.4](#) for switchboards, panelboards, industrial control panels, and motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized. Provide field installed signs to warn qualified persons of potential electric arc flash hazards when warning signs are not provided by the manufacturer. Provide marking that is clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2.17 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations.

2.18 WIREWAYS

[UL 870](#). Material: steel galvanized 16 gauge for heights and depths up to 6 by 6 inches, and 14 gauge for heights and depths up to 12 by 12 inches. Provide in length required for the application with screw-cover NEMA 1 enclosure per [NEMA ICS 6](#).

2.19 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices (SPD) which comply with [UL 1449](#) at the service entrance, load centers, panelboards, MCC. Provide surge protectors in a NEMA 1 enclosure per [NEMA ICS 6](#). Use Type 1 or Type 2 SPD and connect on the load side of a dedicated circuit breaker.

Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS-

Phase to phase (L-L)
Each phase to neutral (L-N)
Neutral to ground (N-G)

SPDs at the service entrance: provide with a minimum surge current rating of 80,000 amperes for L-L mode minimum and 40,000 amperes for other modes (L-N, L-G, and N-G) and downstream SPDs rated 40,000 amperes for L-L mode minimum and 20,000 amperes for other modes (L-N, L-G, and N-G).

Provide SPDs. Maximum L-N, L-G, and N-G Voltage Protection Rating:

700V for 120V, single phase system
700V for 120/240V, single phase system
700V for 208Y/120V, three phase system
1,200V for 480Y/277V, three phase system

Maximum L-L Voltage Protection Rating:

1,200V for 120V, single phase system
1,200V for 120/240V, single phase system
1,200V for 208Y/120V, three phase system
2,000V for 480Y/277V, three phase system

The minimum MCOV (Maximum Continuous Operating Voltage) rating for L-N and L-G modes of operation: 120% of nominal voltage for 240 volts and below;

115% of nominal voltage above 240 volts to 480 volts.

2.20 FACTORY APPLIED FINISH

Provide factory-applied finish on electrical equipment in accordance with the following:

- a. **NEMA 250** corrosion-resistance test and the additional requirements as specified herein.
- b. Interior and exterior steel surfaces of equipment enclosures: thoroughly cleaned followed by a rust-inhibitive phosphatizing or equivalent treatment prior to painting.
- c. Exterior surfaces: free from holes, seams, dents, weld marks, loose scale or other imperfections.
- d. Interior surfaces: receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice.
- e. Exterior surfaces: primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish.
- f. Equipment located indoors: ANSI Light Gray, and equipment located outdoors: ANSI Light Gray Dark Gray.
- g. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

2.21 SOURCE QUALITY CONTROL

2.21.1 Transformer Factory Tests

Submittal: include routine **NEMA ST 20** transformer test results on each transformer and also provide the results of NEMA "design" and "prototype" tests that were made on transformers electrically and mechanically equal to those specified.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces: conform to requirements of **NFPA 70** and **IEEE C2** and to requirements specified herein.

3.1.1 Underground Service

Underground service conductors and associated conduit: continuous from service entrance equipment to outdoor power system connection.

3.1.2 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures: labeled and identified as such.

3.1.2.1 Labels

Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by NFPA 70, label each enclosure, new and existing, as one of several enclosures containing service entrance disconnect devices. Label, at minimum: indicate number of service disconnect devices housed by enclosure and indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels conforming to paragraph FIELD FABRICATED NAMEPLATES. Use lettering of at least 0.25 inch in height, and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure: provided only as permitted by NFPA 70.

3.1.3 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor: separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Shared neutral, or multi-wire branch circuits, are not permitted with arc-fault circuit interrupters. Minimum conduit size: 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings: made with metal conduit in fire-rated shafts, with metal conduit extending through shafts for minimum distance of 6 inches. Firestop conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors.

3.1.3.1 Pull Wire

Install pull wires in empty conduits. Pull wire: plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

3.1.4 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project.

3.1.4.1 Restrictions Applicable to Aluminum Conduit

- a. Do not install underground or encase in concrete or masonry.
- b. Do not use brass or bronze fittings.
- c. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.2 Restrictions Applicable to EMT

- a. Do not install underground.
- b. Do not encase in concrete, mortar, grout, or other cementitious materials.

- c. Do not use in areas subject to severe physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.
- d. Do not use in hazardous areas.
- e. Do not use outdoors.
- f. Do not use in fire pump rooms.
- g. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.3 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.4 Underground Conduit

Plastic-coated rigid steel; plastic-coated steel IMC; PVC, Type EPC-40.
Plastic coating: extend minimum 6 inches above floor.

3.1.4.5 Conduit for Circuits Rated Greater Than 600 Volts

Rigid metal conduit or IMC only.

3.1.4.6 Conduit Through Floor Slabs

Where conduits rise through floor slabs, do not allow curved portion of bends to be visible above finished slab.

3.1.4.7 Conduit Installed in Concrete Floor Slabs

Rigid steel; steel IMC; fiberglass, or PVC, Type EPC-40. PVC, Type EPC-40, unless indicated otherwise. Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Do not stack conduits. Do not stack conduits more than two diameters high with minimum vertical separation of 3 inches. Space conduits horizontally not closer than three diameters, except at cabinet locations. Curved portions of bends must not be visible above finish slab. Increase slab thickness as necessary to provide minimum one inch cover over conduit. Where embedded conduits cross building and/or expansion joints, provide suitable watertight expansion/deflection fittings and bonding jumpers. Expansion/deflection fittings must allow horizontal and vertical movement of raceway. Conduit larger than one inch trade size: installed parallel with or at right angles to main reinforcement; when at right angles to reinforcement, install conduit close to one of supports of slab. Where nonmetallic conduit is used, convert raceway to plastic coated rigid steel or plastic coated steel IMC before rising above floor, unless specifically indicated.

3.1.4.8 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inches

above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.4.9 Conduit Support

Support conduit by pipe straps, wall brackets, threaded rod conduit hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Do not exceed one-fourth proof test load for load applied to fasteners. Provide vibration resistant and shock-resistant fasteners attached to concrete ceiling. Do not cut main reinforcing bars for any holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems: supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Do not share supporting means between electrical raceways and mechanical piping or ducts. Coordinate installation with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Where conduit crosses building expansion joints, provide suitable watertight expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.4.10 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.4.11 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Provide locknuts with sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

3.1.4.12 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size: 1/2 inch diameter. Provide liquidtight flexible conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections.

3.1.5 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways: cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, when surface mounted on interior walls exposed up to 7 feet above floors and walkways, and when specifically indicated. Boxes in other locations: sheet steel, except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit system. Provide each box with volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures: minimum 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls: square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; provide readily removable fixtures for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. Threaded studs driven in by powder charge and provided with lockwashers and nuts or nail-type nylon anchors may be used in lieu of wood screws, expansion shields, or machine screws. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.5.1 Boxes

Boxes for use with raceway systems: minimum 1 1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets: minimum 4 inches square, except that 4 by 2 inch boxes may be used where only one raceway enters outlet. Mount outlet boxes flush in finished walls.

3.1.5.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of code-gauge aluminum or galvanized sheet steel, and compatible with nonmetallic raceway systems, except where cast-metal boxes are required in locations specified herein. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

3.1.6 Mounting Heights

Mount panelboards, enclosed circuit breakers, motor controller and disconnecting switches so height of operating handle at its highest position is maximum 78 inches above floor. Mount lighting switches 48 inches above finished floor. Mount receptacles 18 inches above finished

floor, unless otherwise indicated. Mount other devices as indicated. Measure mounting heights of wiring devices and outlets in non-hazardous areas to center of device or outlet.

3.1.7 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, provide color coding by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, provide color coding by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves.

3.1.7.1 Marking Strips

Provide marking strips in accordance with the following:

- a. Provide white or other light-colored plastic marking strips, fastened by screws to each terminal block, for wire designations.
- b. Use permanent ink for the wire numbers
- c. Provide reversible marking strips to permit marking both sides, or provide two marking strips with each block.
- d. Size marking strips to accommodate the two sets of wire numbers.
- e. Assign a device designation in accordance with [NEMA ICS 1](#) to each device to which a connection is made. Mark each device terminal to which a connection is made with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams.
- f. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, provide additional wire and cable designations for identification of remote (external) circuits for the Government's wire designations.
- g. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

3.1.8 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.9 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of $1/16$ inch. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

3.1.10 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings.

3.1.11 Grounding and Bonding

Provide in accordance with NFPA 70. Ground exposed, non-current-carrying metallic parts of electrical metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, and neutral conductor of wiring systems. Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70. Make ground connection to driven ground rods on exterior of building. Interconnect all grounding media in or on the structure to provide a common ground potential. This includes lightning protection, electrical service, telecommunications system grounds, as well as underground metallic piping systems. Make interconnection to the gas line on the customer's side of the meter. Use main size lightning conductors for interconnecting these grounding systems to the lightning protection system. In addition to the requirements specified herein, provide telecommunications grounding in accordance with TIA-607. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.11.1 Ground Rods

Provide cone pointed ground rods. Measure the resistance to ground using the fall-of-potential method described in IEEE 81. Do not exceed 25 ohms under normally dry conditions for the maximum resistance of a driven ground. If this resistance cannot be obtained with a single rod, install 2 additional rods, spaced on center, not less than twice the distance of the length of the rod. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, notify the Contracting Officer who will decide on the number of ground rods to add.

3.1.11.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible by exothermic weld or compression connector.

- a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.
- b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Provide tools and dies as recommended by the manufacturer. Use an embossing die code or other standard method to provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.11.3 Ground Bus

Provide a copper ground bus in the electrical equipment rooms as indicated. Noncurrent-carrying metal parts of transformer neutrals and other electrical equipment: effectively grounded by bonding to the ground bus. Bond the ground bus to both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 4 inches above the floor. Make connections and splices of the brazed, welded, bolted, or pressure-connector type, except use pressure connectors or bolted connections for connections to removable equipment.

3.1.11.4 Resistance

Maximum resistance-to-ground of grounding system: do not exceed 25 ohms under dry conditions. Where resistance obtained exceeds 25 ohms, contact Contracting Officer for further instructions.

3.1.12 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications and are provided under the section specifying the associated equipment.

3.1.13 Repair of Existing Work

Perform repair of existing work, demolition, and modification of existing electrical distribution systems as follows:

3.1.13.1 Workmanship

Lay out work in advance. Exercise care where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to buildings, piping, and equipment using skilled craftsmen of trades involved.

3.1.13.2 Existing Concealed Wiring to be Removed

Disconnect existing concealed wiring to be removed from its source. Remove conductors; cut conduit flush with floor, underside of floor, and through walls; and seal openings.

3.1.13.3 Continuation of Service

Maintain continuity of existing circuits of equipment to remain. Maintain existing circuits of equipment energized. Restore circuits wiring and power which are to remain but were disturbed during demolition back to original condition.

3.1.14 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible. Maximum allowed lead length is 3 feet.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with [NFPA 70E](#).

3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Where field painting of enclosures for panelboards, load centers or the like is specified to match adjacent surfaces, to correct damage to the manufacturer's factory applied coatings, or to meet the indicated or specified safety criteria, provide manufacturer's recommended coatings and apply in accordance to manufacturer's instructions.

3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test.

3.5.1 Devices Subject to Manual Operation

Operate each device subject to manual operation at least five times, demonstrating satisfactory operation each time.

3.5.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance: 250,000 ohms.

3.5.3 Transformer Tests

Perform the standard, not optional, tests in accordance with the Inspection and Test Procedures for transformers, dry type, air-cooled, 600 volt and below; as specified in [NETA ATS](#). Measure primary and secondary voltages for proper tap settings. Tests need not be performed by a recognized independent testing firm or independent electrical consulting firm.

3.5.4 Ground-Fault Receptacle Test

Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed.

3.5.5 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test

to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

-- End of Section --

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SECTION 31 00 00

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08/08

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SECTION 31 00 00

EARTHWORK

08/08

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO T 180 (2015) Standard Method of Test for
Moisture-Density Relations of Soils Using
a 4.54-kg (10-lb) Rammer and a 457-mm
(18-in.) Drop

AASHTO T 224 (2010) Standard Method of Test for
Correction for Coarse Particles in the
Soil Compaction Test

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600 (2010) Installation of Ductile-Iron Water
Mains and Their Appurtenances

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016)
Structural Welding Code - Steel

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA C2 (2003) Lumber, Timber, Bridge Ties and
Mine Ties - Preservative Treatment by
Pressure Processes

AWPA P5 (2015) Standard for Waterborne
Preservatives

ASTM INTERNATIONAL (ASTM)

ASTM A139/A139M (2016) Standard Specification for
Electric-Fusion (ARC)-Welded Steel Pipe
(NPS 4 and over)

ASTM A252 (2010) Standard Specification for Welded
and Seamless Steel Pipe Piles

ASTM C136 (2006) Standard Test Method for Sieve
Analysis of Fine and Coarse Aggregates

ASTM D1140	(2014) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³) (2700 kN-m/m ³)
ASTM D2487	(2011) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2937	(2010) Density of Soil in Place by the Drive-Cylinder Method
ASTM D422	(1963; R 2007; E 2014; E 2014) Particle-Size Analysis of Soils
ASTM D4318	(2010; E 2014) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	(2015) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D698	(2012; E 2014; E 2015) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by [ASTM D2487](#) as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP. Satisfactory materials for grading comprise stones less than **8 inches**, except for fill material for pavements and railroads which comprise stones less than **3 inches** in any dimension.

1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials.

1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in [ASTM D2487](#) as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with [ASTM D4318](#), [ASTM C136](#),

ASTM D422, and ASTM D1140.

1.2.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 180 and corrected with AASHTO T 224. To maintain the same percentage of coarse material, use the "remove and replace" procedure as described in NOTE 8 of Paragraph 7.2 in AASHTO T 180.

1.2.5 Overhaul

Overhaul is the authorized transportation of satisfactory excavation or borrow materials in excess of the free-haul limit of 10 miles stations. Overhaul is the product of the quantity of materials hauled beyond the free-haul limit, and the distance such materials are hauled beyond the free-haul limit, expressed in station yards.

1.2.6 Topsoil

Material suitable for topsoils obtained from offsite areas is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

1.2.7 Hard/Unyielding Materials

Hard/Unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than 3 inch in any dimension or as defined by the pipe manufacturer, whichever is smaller. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.2.8 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.2.9 Unstable Material

Unstable material are too wet to properly support the utility pipe, conduit, or appurtenant structure.

1.2.10 Select Granular Material

1.2.10.1 General Requirements

Select granular material consist of materials classified as FDOT #57 stone.

1.2.11 Initial Backfill Material

Initial backfill consists of select granular material or satisfactory materials free from rocks 3 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, free the initial backfill material of stones larger than 3 inches in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

1.2.12 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than 35 when tested in accordance with ASTM D4318.

1.3 DEWATERING WORK PLAN

Submit procedures for accomplishing dewatering work.

1.4 SUBMITTALS

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

SD-01 Preconstruction Submittals

Shoring

Dewatering Work Plan

Submit 15 days prior to starting work.

SD-06 Test Reports

Testing

Within 24 hours of conclusion of physical tests, 3 copies of test results, including calibration curves and results of calibration tests. Results of testing at the borrow site.

SD-07 Certificates

Testing

Qualifications of the Corps validated commercial testing laboratory or the Contractor's validated testing facilities.

PART 2 PRODUCTS

2.1 BURIED WARNING AND IDENTIFICATION TAPE

Provide polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended

utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

Warning Tape Color Codes

Red:	Electric
Yellow:	Gas, Oil; Dangerous Materials
Orange:	Telephone and Other Communications
Blue:	Water Systems
Green:	Sewer Systems
White:	Steam Systems
Gray:	Compressed Air

2.1.1 Detectable Warning Tape for Non-Metallic Piping

Provide polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.004 inch, and a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Manufacture tape with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.2 DETECTION WIRE FOR NON-METALLIC PIPING

Insulate a single strand, solid copper detection wire with a minimum of 12 AWG.

2.3 PIPE CASING

2.3.1 Casing Pipe

ASTM A139/A139M, Grade B, or ASTM A252, Grade 2, smooth wall pipe. Match casing size to the outside diameter and wall thickness as indicated on drawings. Protective coating is not required on casing pipe.

2.3.2 Wood Supports

Locally available, rough, structural grade. Provide wood with nonleaching water-borne pressure preservative (ACA or CCA) and treatment conforming to AWPA P5 and AWPA C2, respectively. Secure wood supports to carrier pipe with stainless steel or zinc-coated steel bands.

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, strip topsoil to a depth of 4 inch. Spread topsoil on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inch in diameter, and other materials that would interfere with planting and maintenance operations. Stockpile any surplus of topsoil from excavations and gradings.

3.2 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.2.1 Drainage Structures

Make excavations to the lines, grades, and elevations shown, or as directed. Provide trenches and foundation pits of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or other hard foundation material of loose debris and cut to a firm, level, stepped, or serrated surface. Remove loose disintegrated rock and thin strata. Do not disturb the bottom of the excavation when concrete or masonry is to be placed in an excavated area. Do not excavate to the final grade level until just before the concrete or masonry is to be placed. Where pile foundations are to be used, stop the excavation of each pit at an elevation **1 foot** above the base of the footing, as specified, before piles are driven. After the pile driving has been completed, remove loose and displaced material and complete excavation, leaving a smooth, solid, undisturbed surface to receive the concrete or masonry.

3.2.2 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.2.3 Dewatering

Control groundwater flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. Take control measures by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, maintain the water level continuously, at least **2 feet** below the working level. Operate dewatering system continuously until construction work below existing water levels is complete. Submit

performance records weekly. Relieve hydrostatic head in previous zones below subgrade elevation in layered soils to prevent uplift.

3.2.4 Trench Excavation Requirements

Excavate the trench as recommended by the manufacturer of the pipe to be installed. Slope trench walls below the top of the pipe, or make vertical, and of such width as recommended in the manufacturer's printed installation manual. Provide vertical trench walls where no manufacturer's printed installation manual is available. Shore trench walls more than 5 feet high, cut back to a stable slope, or provide with equivalent means of protection for employees who may be exposed to moving ground or cave in. Shore vertical trench walls more than 5 feet high. Excavate trench walls which are cut back to at least the angle of repose of the soil. Give special attention to slopes which may be adversely affected by weather or moisture content. Do not exceed the trench width below the pipe top of 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inch inside diameter, and do not exceed 36 inch plus pipe outside diameter for sizes larger than 24 inch inside diameter. Where recommended trench widths are exceeded, provide redesign, stronger pipe, or special installation procedures by the Contractor. The Contractor is responsible for the cost of redesign, stronger pipe, or special installation procedures without any additional cost to the Government.

3.2.4.1 Bottom Preparation

Grade the bottoms of trenches accurately to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing. Remove stones of 3 inch or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, to avoid point bearing.

3.2.4.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, remove such material 6 inch below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.2.4.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Government.

3.2.4.4 Jacking, Boring, and Tunneling

Unless otherwise indicated, provide excavation by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

3.2.5 Underground Utilities

The Contractor is responsible for movement of construction machinery and

equipment over pipes and utilities during construction. Excavation made with power-driven equipment is not permitted within **two feet** of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.3 SELECTION OF BORROW MATERIAL

Select borrow material to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Obtain borrow material from the borrow areas from approved private sources. Unless otherwise provided in the contract, the Contractor is responsible for obtaining the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling from the owners. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, do not obtain borrow within the limits of the project site without prior written approval. Consider necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon related operations to the borrow excavation.

3.4 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

Notify the Contracting Officer sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, excavate borrow pits and other excavation areas providing adequate drainage. Transport overburden and other spoil material to designated spoil areas or otherwise dispose of as directed. Provide neatly trimmed and drained borrow pits after the excavation is completed. Ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.5 SHORING

3.5.1 General Requirements

Submit a Shoring and Sheet piling plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheet piling of excavations. Finish shoring, including sheet piling, and install as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Remove shoring, bracing, and sheet piling as excavations are backfilled, in a manner to prevent caving.

3.5.2 Geotechnical Engineer

Hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer is responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer is responsible for updating the excavation, sheet piling and dewatering plans as construction progresses to reflect

changing conditions and submit an updated plan if necessary. Submit a monthly written report, informing the Contractor and Contracting Officer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Contracting Officer is responsible for arranging meetings with the Geotechnical Engineer at any time throughout the contract duration.

3.6 GRADING AREAS

Where indicated, divide work into grading areas within which satisfactory excavated material will be placed in embankments, fills, and required backfills. Do not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing. Place and grade stockpiles of satisfactory and wasted materials as specified. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources.

3.7 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Do not excavate to final grade until just before concrete is to be placed. Only use excavation methods that will leave the foundation rock in a solid and unshattered condition. Roughen the level surfaces, and cut the sloped surfaces, as indicated, into rough steps or benches to provide a satisfactory bond. Protect shales from slaking and all surfaces from erosion resulting from ponding or water flow.

3.8 GROUND SURFACE PREPARATION

3.8.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Contracting Officer, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 6 inch before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of 6 inch, pulverizing, and compacting to the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inch and compact it as specified for the adjacent fill.

3.9 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials removing from excavations into designated waste disposal or spoil areas. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Do not waste any satisfactory excavated material without specific written authorization. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas as directed. Clear and grub newly designated waste areas on Government-controlled land before disposal of

waste material thereon. Stockpile and use coarse rock from excavations for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.10 BURIED TAPE AND DETECTION WIRE

3.10.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape **12 inch** below finished grade; under pavements and slabs, bury tape **6 inch** below top of subgrade.

3.10.2 Buried Detection Wire

Bury detection wire directly above non-metallic piping at a distance not to exceed **12 inch** above the top of pipe. Extend the wire continuously and unbroken, from manhole to manhole. Terminate the ends of the wire inside the manholes at each end of the pipe, with a minimum of **3 feet** of wire, coiled, remaining accessible in each manhole. Furnish insulated wire over it's entire length. Install wires at manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, terminate the wire in the valve pit at the pump station end of the pipe.

3.11 BACKFILLING AND COMPACTION

Place backfill adjacent to any and all types of structures, and compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials, to prevent wedging action or eccentric loading upon or against the structure. Prepare ground surface on which backfill is to be placed as specified in paragraph GROUND SURFACE PREPARATION. Provide compaction requirements for backfill materials in conformance with the applicable portions of paragraphs GROUND SURFACE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.11.1 Trench Backfill

Backfill trenches to match existing grades and slopes. Backfill the trench to perform the required pressure tests.

3.11.1.1 Replacement of Unyielding Material

Replace unyielding material removed from the bottom of the trench with select granular material or initial backfill material.

3.11.1.2 Replacement of Unstable Material

Replace unstable material removed from the bottom of the trench or excavation with select granular material placed in layers not exceeding **6 inch** loose thickness.

3.11.1.3 Bedding and Initial Backfill

Place initial backfill material and compact it with approved tampers to a

height of at least one foot above the utility pipe or conduit. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Compact backfill to top of pipe to 95 percent of ASTM D698 maximum density. Provide plastic piping with bedding to spring line of pipe.

3.11.1.4 Final Backfill

Fill the remainder of the trench, except for special materials for roadways, railroads and airfields, with satisfactory material. Place backfill material and compact as follows:

- a. Roadways, Railroads, and Airfields: Place backfill up to the required elevation as specified. Do not permit water flooding or jetting methods of compaction.
- b. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas: Deposit backfill in layers of a maximum of 12 inch loose thickness, and compact it to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Apply this requirement to all other areas not specifically designated above.

3.12 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.12.1 Water Lines

Excavate trenches to a depth that provides a minimum cover of 3 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

3.12.2 Pipeline Casing

Provide new smooth wall steel pipeline casing under existing pavement. Provide each new pipeline casing, where indicated and to the lengths and dimensions shown, complete and suitable for use with the new piped utility as indicated.

3.12.2.1 Bore Holes

Mechanically bore holes and case through the soil with a cutting head on a continuous auger mounted inside the casing pipe. Weld lengths of pipe together in accordance with AWS D1.1/D1.1M. Do not use water or other fluids in connection with the boring operation.

3.12.2.2 Cleaning

Clean inside of the pipeline casing of dirt, weld splatters, and other foreign matter which would interfere with insertion of the piped utilities by attaching a pipe cleaning plug to the boring rig and passing it through the pipe.

3.12.2.3 End Seals

After installation of piped utilities in pipeline casing, provide watertight end seals at each end of pipeline casing between pipeline casing and piping utilities. Provide watertight end seals as indicated.

3.13 SUBGRADE PREPARATION

3.13.1 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, disking, and any moistening or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with satisfactory excavated material or other approved material as directed. Excavate rock encountered in the cut section to a depth of 6 inch below finished grade for the subgrade. Bring up low areas resulting from removal of unsatisfactory material or excavation of rock to required grade with satisfactory materials, and shape the entire subgrade to line, grade, and cross section and compact as specified. After rolling, do not show deviations for the surface of the subgrade for airfields greater than 1/2 inch when tested with a 12 foot straightedge applied both parallel and at right angles to the centerline of the area. Do not vary the elevation of the finish subgrade more than 0.05 foot from the established grade and cross section.

3.13.2 Compaction

Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, compact each layer of the embankment to at least 95 percent of laboratory maximum density.

3.13.2.1 Subgrade for Pavements

Compact subgrade for pavements to at least 98 percentage laboratory maximum density for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, thoroughly blend, reshape, and compact the top 12 inch of subgrade.

3.13.2.2 Subgrade for Shoulders

Compact subgrade for shoulders to at least 98 percentage laboratory maximum density for the full depth of the shoulder.

3.13.2.3 Subgrade for Airfield Pavements

Compact top 24 inch below finished pavement or top 12 inch of subgrades, whichever is greater, to 100 percent of ASTM D1557; compact fill and backfill material to 100 percent of ASTM D1557.

3.14 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from

settlement or washing to a smoothness suitable for the application of turbing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.14.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do not disturb the finished subgrade by traffic or other operation. Protect and maintain the finished subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, or frozen subgrade.

3.14.2 Capillary Water Barrier

Place a capillary water barrier under concrete floor and area-way slabs grade directly on the subgrade and compact with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.14.3 Grading Around Structures

Construct areas within 5 feet outside of each building and structure line true-to-grade, shape to drain, and maintain free of trash and debris until final inspection has been completed and the work has been accepted.

3.15 TESTING

Perform testing by a Corps validated commercial testing laboratory or the Contractor's validated testing facility. If the Contractor elects to establish testing facilities, do not permit work requiring testing until the Contractor's facilities have been inspected, Corps validated and approved by the Contracting Officer. Determine field in-place density in accordance with ASTM D2937. ASTM D2937, use the Drive Cylinder Method only for soft, fine-grained, cohesive soils. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, remove the material, replace and recompact to meet specification requirements. Perform tests on recompacted areas to determine conformance with specification requirements. Appoint a registered professional civil engineer to certify inspections and test results. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.15.1 In-Place Densities

One test per 50 linear feet, or fraction thereof, of each lift of embankment or backfill for roads and airfields.

3.15.2 Check Tests on In-Place Densities

If ASTM D6938 is used, check in-place densities by ASTM D1556 as follows:

One check test per lift for each 50 linear feet, or fraction thereof,

of embankment or backfill for roads and airfields.

3.15.3 Moisture Contents

In the stockpile, excavation, or borrow areas, perform a minimum of two tests per day per type of material or source of material being placed during stable weather conditions. During unstable weather, perform tests as dictated by local conditions and approved by the Contracting Officer.

3.15.4 Optimum Moisture and Laboratory Maximum Density

Perform tests for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values.

3.15.5 Tolerance Tests for Subgrades

Perform continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION during construction of the subgrades.

3.16 DISPOSITION OF SURPLUS MATERIAL

Provide surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber as removed from Government property as directed by the Contracting Officer.

-- End of Section --

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HOT MIX BITUMINOUS PAVEMENT
04/08

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 156 (2013) Standard Specification for
Requirements for Mixing Plants for
Hot-Mixed, Hot-Laid Bituminous Paving
Mixtures

AASHTO M 320 (2016) Standard Specification for
Performance-Graded Asphalt Binder

ASPHALT INSTITUTE (AI)

AI MS-2 (2015) Asphalt Mix Design Methods

ASTM INTERNATIONAL (ASTM)

ASTM C117 (2013) Standard Test Method for Materials
Finer than 75-um (No. 200) Sieve in
Mineral Aggregates by Washing

ASTM C127 (2015) Standard Test Method for Density,
Relative Density (Specific Gravity), and
Absorption of Coarse Aggregate

ASTM C128 (2015) Standard Test Method for Density,
Relative Density (Specific Gravity), and
Absorption of Fine Aggregate

ASTM C131/C131M (2014) Standard Test Method for Resistance
to Degradation of Small-Size Coarse
Aggregate by Abrasion and Impact in the
Los Angeles Machine

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

ASTM C188 (2016) Standard Test Method for Density of
Hydraulic Cement

ASTM C29/C29M (2016) Standard Test Method for Bulk
Density ("Unit Weight") and Voids in
Aggregate

ASTM C88	(2013) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D1073	(2016) Fine Aggregate for Bituminous Paving Mixtures
ASTM D1188	(2007; E 2010) Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
ASTM D140/D140M	(2016) Standard Practice for Sampling Asphalt Materials
ASTM D2041/D2041M	(2011) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D2172/D2172M	(2011) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D242/D242M	(2009; R 2014) Mineral Filler for Bituminous Paving Mixtures
ASTM D2726/D2726M	(2014) Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
ASTM D3666	(2016) Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D4867/D4867M	(2009; R 2014) Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D546	(2010) Sieve Analysis of Mineral Filler for Bituminous Paving Mixtures
ASTM D692/D692M	(2015) Coarse Aggregate for Bituminous Paving Mixtures
ASTM D6927	(2015) Standard Test Method for Marshall Stability and Flow of Bituminous Mixtures
ASTM D70	(2009; E 2009) Specific Gravity and Density of Semi-Solid Bituminous Materials (Pycnometer Method)
ASTM D75/D75M	(2014) Standard Practice for Sampling Aggregates
ASTM D854	(2014) Specific Gravity of Soil Solids by Water Pycnometer
ASTM D979/D979M	(2015) Sampling Bituminous Paving Mixtures

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-05 Design Data

Job-mix formula

Submit a job-mix formula, prepared specifically for this project within one year of submittal for roads, for approval by the Government prior to preparing and placing the bituminous mixture. Design mix using procedures contained in Chapter V, Marshall Method of Mix Design, of AI MS-2. Formulas shall indicate physical properties of the mixes as shown by tests made by a commercial laboratory approved by the Contracting Officer, using materials identical to those to be provided on this project. Submit formulas with material samples. Job-mix formula for each mixture shall be in effect until modified in writing by the Contractor and approved by the Contracting Officer. Provide a new job-mix formula for each source change. Submittal shall include all tests indicated in MIX DESIGN section of this specification.

ASPHALT CEMENT BINDER

MIX DESIGN

SD-06 Test Reports

Specific gravity test of asphalt

Coarse aggregate tests

Weight of slag test

Percent of crushed pieces in gravel

Fine aggregate tests

Specific gravity of mineral filler

Bituminous mixture tests

Aggregates tests

Bituminous mix tests

Pavement courses

1.3 QUALITY ASSURANCE

1.3.1 Safety Requirements

Provide adequate and safe stairways with handrails to the mixer platform, and safe and protected ladders or other means for accessibility to plant operations. Guard equipment and exposed steam or other high temperature lines or cover with a suitable type of insulation.

1.3.2 Required Data

Job-mix formula shall show the following:

- a. Source and proportions, percent by weight, of each ingredient of the mixture;
- b. Correct gradation, the percentages passing each size sieve listed in the specifications for the mixture to be used, for the aggregate and mineral filler from each separate source and from each different size to be used in the mixture and for the composite mixture;
- c. Amount of material passing the No. 200 sieve determined by dry sieving;
- d. Number of blows of hammer compaction per side of molded specimen;
- e. Temperature viscosity relationship of the asphalt cement;
- f. Stability, flow, percent voids in mineral aggregate, percent air voids, unit weight;
- g. Asphalt absorption by the aggregate;
- h. Effective asphalt content as percent by weight of total mix;
- i. Temperature of the mixture immediately upon completion of mixing;
- j. Asphalt performance grade viscosity grade penetration range; and
- k. Curves for the leveling binder and wearing courses.

1.3.3 Charts

Plot and submit, on a grain size chart, the specified aggregate gradation band, the job-mix gradation and the job-mix tolerance band.

1.3.4 Selection of Optimum Asphalt Content

Base selection on percent of total mix and the average of values at the following points on the curves for each mix:

- a. Stability: Peak
- b. Unit Weight: Peak
- c. Percent Air Voids: Median

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for damage and store with a minimum of handling. Store aggregates in such a manner as to prevent segregation, contamination, or intermixing of the different aggregate sizes.

1.5 ENVIRONMENTAL CONDITIONS

Place bituminous mixture only during dry weather and on dry surfaces. Place courses only when the surface temperature of the underlying course is greater than 45 degrees F for course thicknesses greater than one inch and 55 degrees F for course thicknesses one inch or less.

1.6 CONSTRUCTION EQUIPMENT

Calibrated equipment, such as scales, batching equipment, spreaders and similar equipment, shall have been recalibrated by a calibration laboratory approved by the Contracting Officer within 12 months of commencing work.

1.6.1 Mixing Plant

Design, coordinate, and operate the mixing plant to produce a mixture within the job-mix formula tolerances and to meet the requirements of AASHTO M 156, including additional plant requirements specified herein. The plant shall be a batch type, continuous mix type or drum-dryer mixer type, and shall have sufficient capacity to handle the new bituminous construction. Minimum plant capacity shall be 100 tons per hour. The mixing plant and equipment shall remain accessible at all times for inspecting operation, verifying weights, proportions and character of materials, and checking mixture temperatures. The plant and plant site shall meet the requirements of Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

1.6.1.1 Cold Aggregate Feeder

Provide plant with a feeder or feeders capable of delivering the maximum number of aggregate sizes required in their proper proportion. Provide adjustment for total and proportional feed and feeders capable of being locked in any position. When more than one cold elevator is used, feed each elevator as a separate unit and install individual controls integrated with a master control.

1.6.1.2 Dryer

Provide rotary drum-dryer which continuously agitates the mineral aggregate during the heating and drying process. When one dryer does not dry the aggregate to specified moisture requirements, provide additional dryers.

1.6.1.3 Plant Screens and Bins for Batch and Continuous Mix Plants

Use screen to obtain accurate gradation and allow no bin to contain more than 10 percent oversize or undersize. Inspect screens each day prior to commencing work for plugged, worn, or broken screens. Clean plugged screens and replace worn or broken screens with new screens prior to beginning operations. Divide hot aggregate bins into at least three compartments arranged to ensure separate and adequate storage of appropriate fractions of the aggregate.

1.6.1.4 Testing Laboratory

Provide a testing laboratory for control and acceptance testing functions during periods of mix production, sampling and testing, and whenever materials subject to the provisions of these specifications are being supplied or tested. The laboratory shall provide adequate equipment, space, and utilities as required for the performance of the specified tests.

1.6.1.5 Surge and Storage Bins

Use for temporary storage of hot bituminous mixtures will be permitted under the following conditions:

- a. When stored in surge bins for a period of time not to exceed 3 hours.
- b. When stored in insulated and heated storage bins for a period of time not to exceed 12 hours. If it is determined by the Contracting Officer that there is an excessive amount of heat loss, segregation and oxidation of the mixture due to temporary storage, discontinue use of surge bins or storage bins.

1.6.1.6 Drum-Dryer Mixer

Do not use drum-dryer mixer if specified requirements of the bituminous mixture or of the completed bituminous pavement course cannot be met. If drum-dryer mixer is prohibited, use either batch or continuous mix plants meeting the specifications and producing a satisfactory mix.

1.6.2 Paving Equipment

1.6.2.1 Spreading Equipment

Self-propelled electronically controlled type, unless other equipment is authorized by the Contracting Officer. Equip spreading equipment of the self-propelled electronically controlled type with hoppers, tamping or vibrating devices, distributing screws, electronically adjustable screeds, and equalizing devices. Capable of spreading hot bituminous mixtures without tearing, shoving, or gouging and to produce a finished surface of specified grade and smoothness. Operate spreaders, when laying mixture, at variable speeds between 5 and 45 feet per minute. Design spreader with a quick and efficient steering device; a forward and reverse traveling speed; and automatic devices to adjust to grade and confine the edges of the mixture to true lines. The use of a spreader that leaves indented areas or other objectionable irregularities in the fresh laid mix during operations is prohibited.

1.6.2.2 Rolling Equipment

Self-propelled pneumatic-tired rollers supplemented by three-wheel and tandem type steel wheel rollers. The number, type and weight of rollers shall be sufficient to compact the mixture to the required density without detrimentally affecting the compacted material. Rollers shall be suitable for rolling hot-mix bituminous pavements and capable of reversing without backlash. Pneumatic-tired rollers shall be capable of being operated both forward and backward without turning on the mat, and without loosening the surface being rolled. Equip rollers with suitable devices and apparatus to keep the rolling surfaces wet and prevent adherence of bituminous mixture. Vibratory rollers especially designed for bituminous concrete compaction may be used provided rollers do not impair stability of pavement structure and underlying layers. Repair depressions in pavement surfaces resulting from use of vibratory rollers. Rollers shall be self-propelled, single or dual vibrating drums, and steel drive wheels, as applicable; equipped with variable amplitude and separate controls for energy and propulsion.

1.6.2.3 Hand Tampers

Minimum weight of 25 pounds with a tamping face of not more than 50 square inches.

1.6.2.4 Mechanical Hand Tampers

Commercial type, operated by pneumatic pressure or by internal combustion.

PART 2 PRODUCTS

2.1 AGGREGATES

Grade and proportion aggregates and filler so that combined mineral aggregate conforms to specified grading.

2.1.1 Coarse Aggregates

ASTM D692/D692M, except as modified herein. At least 75 percent by weight of aggregate retained on the No. 4 sieve shall have two or more fractured faces. Percentage of wear, Los Angeles test, except for slag, shall not exceed 40 in accordance with ASTM C131/C131M. Weight of slag shall not be less than 70 pounds per cubic foot. Soundness test is required in accordance with ASTM C88; after 5 cycles, loss shall not be more than 12 percent when tested with sodium sulfate or 18 percent when tested with magnesium sulfate.

2.1.2 Fine Aggregate

ASTM D1073, except as modified herein. Fine aggregate shall be produced by crushing stone, slag or gravel that meets requirements for wear and soundness specified for coarse aggregate. Where necessary to obtain the gradation of aggregate blend or workability, natural sand may be used. Quantity of natural sand to be added shall be approved by the Contracting Officer and shall not exceed 15 percent of weight of coarse and fine aggregate and material passing the No. 200 sieve.

2.1.3 Mineral Filler

Nonplastic material meeting the requirements of ASTM D242/D242M.

2.1.4 Aggregate Gradation

The combined aggregate gradation shall conform to gradations specified in Table I, when tested in accordance with ASTM C136/C136M and ASTM C117, and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but grade uniformly from coarse to fine.

Table I. Aggregate Gradations			
	Gradation 1 SP-19.0	Gradation 2 SP-12.5	Gradation 3 SP-9.5
Sieve Size, inch	Percent Passing by Mass	Percent Passing by Mass	Percent Passing by Mass
1	100	---	---
3/4	90-100	100	---
1/2	89	90-100	100
3/8	---	69-89 -89	90-100
No. 4	45-67 ---	---	-89

Table I. Aggregate Gradations			
	Gradation 1 SP-19.0	Gradation 2 SP-12.5	Gradation 3 SP-9.5
Sieve Size, inch	Percent Passing by Mass	Percent Passing by Mass	Percent Passing by Mass
No. 8	32-54 23-49	28-58	32-67
No. 16	22-28	26-32	31-38
No. 30	16-21	19-23	23-28
No. 50	---	---	---
No. 100	---	---	---
No. 200	2-8	2-10	2-10

2.2 ASPHALT CEMENT BINDER

Asphalt cement binder shall conform to [AASHTO M 320](#) Performance Grade (PG) 67-22. Test data indicating grade certification shall be provided by the supplier at the time of delivery of each load to the mix plant. Copies of these certifications shall be submitted to the [Contracting Officer](#). The supplier is defined as the last source of any modification to the binder. The [Contracting Officer](#) may sample and test the binder at the mix plant at any time before or during mix production. Samples for this verification testing shall be obtained by the Contractor in accordance with [ASTM D140/D140M](#) and in the presence of the [Contracting Officer](#). These samples shall be furnished to the [Contracting Officer](#) for the verification testing, which shall be at no cost to the Contractor. Samples of the asphalt cement specified shall be submitted for approval not less than 14 days before start of the test section.

2.3 MIX DESIGN

The Contractor shall develop the mix design. The asphalt mix shall be composed of a mixture of well-graded aggregate, mineral filler if required, and asphalt material. The aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF). No hot-mix asphalt for payment shall be produced until a JMF has been approved. The hot-mix asphalt shall be designed using procedures contained in [AI MS-2](#) and the criteria shown in Table II. If the Tensile Strength Ratio (TSR) of the composite mixture, as determined by [ASTM D4867/D4867M](#) is less than 75, the aggregates shall be rejected or the asphalt mixture treated with an approved anti-stripping agent. The amount of anti-stripping agent added shall be sufficient to produce a TSR of not less than 75. If an antistrip agent is required, it shall be provided by the Contractor at no additional cost.

2.3.1 JMF Requirements

The job mix formula shall be submitted in writing by the Contractor for approval at least 14 days prior to the start of the test section and shall

include as a minimum:

- a. Percent passing each sieve size.
- b. Percent of asphalt cement.
- c. Percent of each aggregate and mineral filler to be used.
- d. Asphalt viscosity grade, penetration grade, or performance grade.
- e. Number of blows of hammer per side of molded specimen.
- f. Laboratory mixing temperature.
- g. Lab compaction temperature.
- h. Temperature-viscosity relationship of the asphalt cement.
- i. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.
- j. Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in [AI MS-2](#).
- k. Specific gravity and absorption of each aggregate.
- l. Percent natural sand.
- m. Percent particles with two or more fractured faces (in coarse aggregate).
- n. Fine aggregate angularity.
- o. Percent flat or elongated particles (in coarse aggregate).
- p. Tensile Strength Ratio.
- q. Antistrip agent (if required) and amount.
- r. List of all modifiers and amount.
- s. Percentage and properties (asphalt content, binder properties, and aggregate properties) of RAP in accordance with paragraph RECYCLED HOT-MIX ASPHALT, if RAP is used.

Table II. Marshall Design Criteria		
Test Property	75 Blow Mix	50 Blow Mix
Stability, pounds minimum	*2150	*1350
Flow, 0.01 inch	8-16	8-18

Table II. Marshall Design Criteria		
Test Property	75 Blow Mix	50 Blow Mix
Air voids, percent	3-5	3-5
Percent Voids in mineral aggregate (minimum)	See Table III	See Table III
TSR, minimum percent	75	75
* This is a minimum requirement. The average during construction shall be significantly higher than this number to ensure compliance with the specifications.		

Table III. Minimum Percent Voids in Mineral Aggregate (VMA) **	
Aggregate (See Table 2)	Minimum VMA, percent
Gradation 1	13.0
Gradation 2	14.0
Gradation 3	15.0
** Calculate VMA in accordance with AI MS-2, based on ASTM D2726/D2726M bulk specific gravity for the aggregate.	

2.3.2 Adjustments to JMF

The JMF for each mixture shall be in effect until a new formula is approved in writing by the Contracting Officer. Should a change in sources of any materials be made, a new mix design shall be performed and a new JMF approved before the new material is used. The Contractor will be allowed to adjust the JMF within the limits specified below to optimize mix volumetric properties. Adjustments to the JMF shall be limited to plus or minus 3 percent on the 1/2 inch, No. 4, and No. 8 sieves; plus or minus 1.0 percent on the No. 200 sieve; and plus or minus 0.40 percent binder content. If adjustments are needed that exceed these limits, a new mix design shall be developed. Tolerances given above may permit the aggregate grading to be outside the limits shown in Table I; this is acceptable.

2.4 RECYCLED HOT MIX ASPHALT

Recycled HMA shall consist of reclaimed asphalt pavement (RAP), coarse aggregate, fine aggregate, mineral filler, and asphalt cement. The RAP shall be of a consistent gradation and asphalt content and properties. When RAP is fed into the plant, the maximum RAP chunk size shall not exceed 2 inches. The recycled HMA mix shall be designed using procedures contained in AI MS-2. The job mix shall meet the requirements of paragraph

MIX DESIGN. RAP should only be used for shoulder surface course mixes and for any intermediate courses. The amount of RAP shall be limited to 30 percent.

2.4.1 RAP Aggregates and Asphalt Cement

The blend of aggregates used in the recycled mix shall meet the requirements of paragraph AGGREGATES. The percentage of asphalt in the RAP shall be established for the mixture design according to [ASTM D2172/D2172M](#) using the appropriate dust correction procedure.

2.4.2 RAP Mix

The blend of new asphalt cement and the RAP asphalt binder shall meet the dynamic shear rheometer at high temperature and bending beam at low temperature requirements in paragraph ASPHALT CEMENT BINDER. The virgin asphalt cement shall not be more than two standard asphalt material grades different than that specified in paragraph ASPHALT CEMENT BINDER.

2.5 SOURCE QUALITY CONTROL

Employ a commercial laboratory approved by the Contracting Officer to perform testing. The laboratory used to develop the JMF and the laboratory used to perform all sampling and testing shall meet the requirements of [ASTM D3666](#). A certification signed by the manager of the laboratory stating that it meets these requirements or clearly listing all deficiencies shall be submitted to the Contracting Officer prior to the start of construction. The certification shall contain as a minimum:

- a. Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.
- b. A listing of equipment to be used in developing the job mix.
- c. A copy of the laboratory's quality control system.
- d. Evidence of participation in the AASHTO Materials Reference Laboratory (AMRL) program.

2.5.1 Tests

Perform testing in accordance with the following:

- a. [Specific Gravity Test of Asphalt](#): [ASTM D70](#)
- b. [Coarse Aggregate Tests](#):
 - (1) Bulk Specific Gravity: [ASTM C127](#)
 - (2) Abrasion Loss: [ASTM C131/C131M](#)
 - (3) Soundness Loss: [ASTM C88](#)
- c. [Weight of Slag Test](#): [ASTM C29/C29M](#)
- d. [Percent of Crushed Pieces in Gravel](#): Count by observation and weight
- e. [Fine Aggregate Tests](#):

- (1) Bulk Specific Gravity: ASTM C128
- (2) Soundness Loss: ASTM C88
- f. Specific Gravity of Mineral Filler: ASTM C188 or ASTM D854
- g. Bituminous Mixture Tests:
 - (1) Bulk Specific Gravity: ASTM D1188 or ASTM D2726/D2726M
 - (2) Theoretical Maximum Specific Gravity: ASTM D2041/D2041M
 - (3) Tensile Strength Ratio: ASTM D4867/D4867M

2.5.2 Specimens

ASTM D6927 for the making and testing of bituminous specimens with the following exceptions:

- a. Compaction: Apply 75 blows of the hammer to each flat face of the specimens for mix numbers 1 and 2 and 50 blows for mix numbers 3.
- b. Curves: Plot curves for the leveling, binder, and wearing courses to show the effect on the test properties of at least four different percentages of asphalt on the unit weight, stability, flow, air voids, and voids in mineral aggregate; each point on the curves shall represent the average of at least four specimens.
- c. Cooling of Specimen: After compaction is completed, allow the specimen to cool in air to the same temperature approximately as that of the water, 77 degrees F, to be used in the specific gravity determination.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Preparation of Asphalt Binder Material

The asphalt cement material shall be heated avoiding local overheating and providing a continuous supply of the asphalt material to the mixer at a uniform temperature. The temperature of unmodified asphalts shall be no more than 160 degrees C 325 degrees F when added to the aggregates. Modified asphalts shall be no more than 174 degrees C 350 degrees F when added to the aggregate.

3.1.2 Preparation of Mineral Aggregates

Store different size aggregate in separate stockpiles so that different sizes will not mix. Stockpile different-sized aggregates in uniform layers by use of a clam shell or other approved method so as to prevent segregation. The use of bulldozers in stockpiling of aggregate or in feeding aggregate to the dryer is prohibited. Feed aggregates into the cold elevator by means of separate mechanical feeders so that aggregates are graded within requirements of the job-mix formulas and tolerances specified. Regulate rates of feed of the aggregates so that moisture content and temperature of aggregates are within tolerances specified herein. Dry and heat aggregates to the temperature necessary to achieve the mixture determined by the job mix formula within the job tolerance

specified. Provide adequate dry storage for mineral filler.

3.1.3 Preparation of Bituminous Mixture

Accurately weigh aggregates and dry mineral filler and convey into the mixer in the proportionate amounts of each aggregate size required to meet the job-mix formula. In batch mixing, after aggregates and mineral filler have been introduced into the mixer and mixed for not less than 15 seconds, add asphalt by spraying or other approved methods and continue mixing for a period of not less than 20 seconds, or as long as required to obtain a homogeneous mixture. The time required to add or spray asphalt into the mixer will not be added to the total wet-mixing time provided the operation does not exceed 10 seconds and a homogeneous mixture is obtained. When a continuous mixer is employed, mixing time shall be more than 35 seconds to obtain a homogeneous mixture. Additional mixing time, when required, will be as directed by the Contracting Officer. When mixture is prepared in a twin-pugmill mixer, volume of the aggregates, mineral filler, and asphalt shall not extend above tips of mixer blades when blades are in a vertical position. Overheated and carbonized mixtures, or mixtures that foam or show indication of free moisture, will be rejected. When free moisture is detected in batch or continuous mix plant produced mixtures, waste the mix and withdraw the aggregates in the hot bins immediately and return to the respective stockpiles; for drum-dryer mixer plants, waste the mix, including that in surge or storage bins that is affected by free moisture.

3.1.4 Transportation of Bituminous Mixtures

Transport bituminous material from the mixing plant to the paving site in trucks having tight, clean, smooth beds that have been coated with a minimum amount of concentrated solution of hydrated lime and water or other approved coating to prevent adhesion of the mixture to the truck. Petroleum products will not be permitted for coating truck. If air temperature is less than 60 degrees F or if haul time is greater than 30 minutes, cover each load with canvas or other approved material of ample size to protect the mixture from the loss of heat. Make deliveries so that the spreading and rolling of all the mixture prepared for one day's run can be completed during daylight, unless adequate approved artificial lighting is provided. Deliver mixture to area to be paved so that the temperature at the time of dumping into the spreader is within the range specified herein. Reject loads that are below minimum temperature, that have crusts of cold unworkable material, or that have been wet excessively by rain. Hauling over freshly laid material is prohibited.

3.1.5 Surface Preparation of Underlying Course

Prior to the laying of the asphalt concrete, clean underlying course of foreign or objectionable matter with power blowers or power brooms, supplemented by hand brooms and other cleaning methods where necessary. During the placement of multiple lifts of bituminous concrete, each succeeding lift of bituminous concrete shall have its underlying lift cleaned and provided with a bituminous tack coat if the time period between the placement of each lift of bituminous concrete exceeds 14 days, or the underlying bituminous concrete has become dirty. Remove grass and other vegetative growth from existing cracks and surfaces.

3.1.6 Spraying of Contact Surfaces

Spray contact surfaces of previously constructed pavement with a thin coat of bituminous materials to act as an anti-stripping agent. Paint contact

surfaces of structures with a thin coat of emulsion or other approved bituminous material prior to placing the bituminous mixture. Tack coat the previously placed primed coats on base courses when surface has become excessively dirty and cannot be cleaned or when primed surface has cured to the extent that it has lost all bonding effect.

3.2 PLACEMENT

3.2.1 Machine Spreading

The range of temperatures of the mixtures at the time of spreading shall be between 250 degrees F and 300 degrees F. Bituminous concrete having temperatures less than minimum spreading temperature when dumped into the spreader will be rejected. Adjust spreader and regulate speed so that the surface of the course is smooth and continuous without tears and pulling, and of such depth that, when compacted, the surface conforms with the cross section, grade, and contour indicated. Unless otherwise directed, begin the placing along the centerline of areas to be paved on a crowned section or on the high side of areas with a one-way slope. Place mixture in consecutive adjacent strips having a minimum width of 10 feet, except where the edge lanes require strips less than 10 feet to complete the area. Construct longitudinal joints and edges to true line markings. Establish lines parallel to the centerline of the area to be paved, and place string lines coinciding with the established lines for the spreading machine to follow. Provide the number and location of the lines needed to accomplish proper grade control. When specified grade and smoothness requirements can be met for initial lane construction by use of an approved long ski-type device of not less than 30 feet in length and for subsequent lane construction by use of a short ski or shoe, in-place string lines for grade control may be omitted. Place mixture as nearly continuous as possible and adjust the speed of placing as needed to permit proper rolling.

3.2.2 Shoveling, Raking, and Tamping After Machine-Spreading

Shovelers and rakers shall follow the spreading machine. Add or remove hot mixture and rake the mixture as required to obtain a course that when completed will conform to requirements specified herein. Broadcasting or fanning of mixture over areas being compacted is prohibited. When segregation occurs in the mixture during placing, suspend spreading operation until the cause is determined and corrected. Correct irregularities in alignment left by the spreader by trimming directly behind the machine. Immediately after trimming, compact edges of the course by tamping laterally with a metal lute or by other approved methods. Distortion of the course during tamping is prohibited.

3.2.3 Hand-Spreading in Lieu of Machine-Spreading

In areas where the use of machine spreading is impractical, spread mixture by hand. The range of temperatures of the mixtures when dumped onto the area to be paved shall be between 250 and 300 degrees F. Mixtures having temperatures less than minimum spreading temperature when dumped onto the area to be paved will be rejected. Spread hot mixture with rakes in a uniformly loose layer of a thickness that, when compacted, will conform to the required grade, thickness, and smoothness. During hand spreading, place each shovelful of mixture by turning the shovel over in a manner that will prevent segregation. Do not place mixture by throwing or broadcasting from a shovel. Do not dump loads any faster than can be properly handled by the shovelers and rakers.

3.3 COMPACTION OF MIXTURE

Compact mixture by rolling. Begin rolling as soon as placement of mixture will bear rollers. Delays in rolling freshly spread mixture shall not be permitted. Start rolling longitudinally at the extreme sides of the lanes and proceed toward center of pavement, or toward high side of pavement with a one-way slope. Operate rollers so that each trip overlaps the previous adjacent strip by at least **one foot**. Alternate trips of the roller shall be of slightly different lengths. Conduct tests for conformity with the specified crown, grade and smoothness immediately after initial rolling. Before continuing rolling, correct variations by removing or adding materials as necessary. If required, subject course to diagonal rolling with the steel wheeled roller crossing the lines of the previous rolling while mixture is hot and in a compactible condition. Speed of the rollers shall be slow enough to avoid displacement of hot mixture. Correct displacement of mixture immediately by use of rakes and fresh mixture, or remove and replace mixture as directed. Continue rolling until roller marks are eliminated and course has a density of at least 96 percent but not more than 100 percent of that attained in a laboratory specimen of the same mixture prepared in accordance with **ASTM D6927**. During rolling, moisten wheels of the rollers enough to prevent adhesion of mixture to wheels, but excessive water is prohibited. Operation of rollers shall be by competent and experienced operators. Provide sufficient rollers for each spreading machine in operation on the job and to handle plant output. In places not accessible to the rollers, compact mixture thoroughly with hot hand tampers. Skin patching of an area after compaction is prohibited. Remove mixture that becomes mixed with foreign materials or is defective and replace with fresh mixture compacted to the density specified herein. Roller shall pass over unprotected edge of the course only when laying of course is to be discontinued for such length of time as to permit mixture to become cold.

3.4 JOINTS

Joints shall present the same texture and smoothness as other portions of the course, except permissible density at the joint may be up to 2 percent less than the specified course density. Carefully make joints between old and new pavement or within new pavements in a manner to ensure a thorough and continuous bond between old and new sections of the course. Vertical contact surfaces of previously constructed sections that are coated with dust, sand, or other objectionable material shall be painted with a thin uniform coat of emulsion or other approved bituminous material just before placing fresh mixture.

3.4.1 Transverse

Roller shall pass over unprotected end of freshly laid mixture only when laying of course is to be discontinued. Except when an approved bulkhead is used, cut back the edge of previously laid course to expose an even, vertical surface for the full thickness of the course. When required, rake fresh mixture against joints, thoroughly tamp with hot tampers, smooth with hot smoothers, and roll. Transverse joints in adjacent lanes shall be offset a minimum of **2 feet**.

3.4.2 Longitudinal Joints

Space **6 inches** apart. Do not allow joints to coincide with joints of existing pavement or previously placed courses. Spreader screed shall overlap previously placed lanes **2 to 3 inches** and be of such height to

permit compaction to produce a smooth dense joint. With a lute, push back mixture placed on the surface of previous lanes to the joint edge. Do not scatter mix. Remove and waste excess material. When edges of longitudinal joints are irregular, honeycombed, or poorly compacted, cut back unsatisfactory sections of joint and expose an even vertical surface for the full thickness of the course. When required, rake fresh mixture against joint, thoroughly tamp with hot tampers, smooth with hot smoothers, and roll while hot.

3.5 FIELD QUALITY CONTROL

3.5.1 Sampling

3.5.1.1 Aggregates At Source

Prior to production and delivery of aggregates, take at least one initial sample in accordance with [ASTM D75/D75M](#) at the source. Collect each sample by taking three incremental samples at random from the source material to make a composite sample of not less than [50 pounds](#). Repeat the sampling when the material source changes or when testing reveals unacceptable deficiencies or variations from the specified grading of materials.

3.5.1.2 Cold Feed Aggregate Sampling

Take two samples daily from the belt conveying materials from the cold feed.

Collect materials in three increments at random to make a representative composite sample of not less than [50 pounds](#). Take samples in accordance with [ASTM D75/D75M](#).

3.5.1.3 Coarse and Fine Aggregates

Take a [50 pound](#) sample from the cold feed at least once daily for sieve analyses and specific gravity tests. Additional samples may be required to perform more frequent tests when analyses show deficiencies, or unacceptable variances or deviations. The method of sampling is as specified herein for aggregates.

3.5.1.4 Mineral Filler

[ASTM D546](#). Take samples large enough to provide ample material for testing.

3.5.1.5 Pavement and Mixture

Take plant samples for the determination of mix properties and field samples for thickness and density of the completed pavements. Furnish tools, labor and material for samples, and satisfactory replacement of pavement. Take samples and tests at not less than frequency specified hereinafter and at the beginning of plant operations; for each day's work as a minimum; each change in the mix or equipment; and as often as directed. Accomplish sampling in accordance with [ASTM D979/D979M](#).

3.5.2 Testing

3.5.2.1 Aggregates Tests

- a. Gradation: [ASTM C136/C136M](#).
- b. Mineral Filler Content: [ASTM D546](#).

- c. Abrasion: [ASTM C131/C131M](#) for wear (Los Angeles test). Perform one test initially prior to incorporation into the work and each time the source is changed.

3.5.2.2 Bituminous Mix Tests

Test one sample for each [500 tons](#), or fraction thereof, of the uncompacted mix for extraction in accordance with [ASTM D2172/D2172M](#); perform a sieve analysis on each extraction sample in accordance with [ASTM C136/C136M](#) and [ASTM C117](#). Test one sample for each [500 tons](#) or fraction thereof for stability and flow in accordance with [ASTM D6927](#). Test one sample for each material blend for Tensile Strength Ratio in accordance with [ASTM D4867/D4867M](#).

3.5.2.3 Pavement Courses

Perform the following tests:

- a. Density: For each [1000 tons](#) of bituminous mixture placed, determine the representative laboratory density by averaging the density of four laboratory specimens prepared in accordance with [ASTM D6927](#). Samples for laboratory specimens shall be taken from trucks delivering mixture to the site; record in a manner approved by the Contracting Officer the project areas represented by the laboratory densities. From each representative area recorded, determine field density of pavement by averaging densities of [4 inch](#) diameter cores obtained from wearing course; take one core for each [2000 square yards](#) or fraction thereof of course placed. Determine density of laboratory prepared specimens and cored samples in accordance with [ASTM D1188](#) or [ASTM D2726/D2726M](#), as applicable. Separate pavement layers by sawing or other approved means.
Maximum allowable deficiency at any point, excluding joints, shall not be more than 2 percent less than the specified density for any course. The average density of each course, excluding joints, shall be not less than the specified density. Joint densities shall not be more than 2 percent less than specified course densities and are not included when calculating average course densities. When the deficiency exceeds the specified tolerances, correct each such representative area or areas by removing the deficient pavement and replacing with new pavement.
- b. Thickness: Determine thickness of binder and wearing courses from samples taken for the field density test. The maximum allowable deficiency at any point shall not be more than [1/4 inch](#) less than the thickness for the indicated course. Average thickness of course or of combined courses shall be not less than the indicated thickness. Where a deficiency exceeds the specified tolerances, correct each such representative area or areas by removing the deficient pavement and replacing with new pavement.
- c. Smoothness: Straightedge test the compacted surface of leveling, binder, and wearing courses as work progresses. Apply straightedge parallel with and at right angles to the centerline after final rolling. Unevenness of leveling and binder courses shall not vary more than [1/4 inch in 10 feet](#); variations in the wearing course shall not vary more than [1/8 inch in 10 feet](#). Correct each portion of the pavement showing irregularities greater than that specified.
- d. Finished Grades: Finish grades of each course placed shall not vary from the finish elevations, profiles, and cross sections indicated by

more than $1/2$ inch. Finished surface of the final wearing course will be tested by running lines of levels at intervals of 25 feet longitudinally and transversely to determine elevations of completed pavement. Within 45 days after completion of final placement, perform a level survey at the specified grid spacing and plot the results on a plan drawn to the same scale as the drawings. Elevations not in conformance with the specified tolerance shall be noted on the plan in an approved manner. The survey shall be performed by a registered land surveyor. The Contracting Officer will inform the Contractor in writing of paved areas that fail to meet the final grades indicated within the specified tolerances. Correct deficient paved areas by removing existing work and replacing with new materials that meet the specifications. Skin patching for correcting low areas is prohibited.

- e. Finish Surface Texture of Wearing Course: Visually check final surface texture for uniformity and reasonable compactness and tightness. Final wearing course with a surface texture having undesirable irregularities such as segregation, cavities, pulls or tears, checking, excessive exposure of coarse aggregates, sand streaks, indentations, ripples, or lack of uniformity shall be removed and replaced with new materials.

3.6 PROTECTION

Do not permit vehicular and aircraft traffic, including heavy equipment, on pavement until surface temperature has cooled to at least 120 degrees F. Measure surface temperature by approved surface thermometers or other satisfactory methods.

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SECTION 32 16 13

CONCRETE SIDEWALKS AND CURBS AND GUTTERS

04/08

PART 1 GENERAL

1.1 MEASUREMENT FOR PAYMENT

1.1.1 Sidewalks

The quantities of sidewalks to be paid for will be the number of square yards of each depth of sidewalk constructed as indicated.

1.1.2 Curbs and Gutters

The quantities of curbs and gutters to be paid for will be the number of linear feet of each cross section constructed as indicated, measured along the face of the curb at the gutter line.

1.2 BASIS FOR PAYMENT

1.2.1 Sidewalks

Payment of the quantities of sidewalks measured as specified will be at the contract unit price per square yard of the thickness specified.

1.2.2 Curbs and Gutters

Payment of the quantities of curbs and gutters measured as specified will be at the contract unit price per linear foot of each cross section.

1.3 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 182 (2005; R 2012) Standard Specification for
Burlap Cloth Made from Jute or Kenaf and
Cotton Mats

ASTM INTERNATIONAL (ASTM)

ASTM A185/A185M (2007) Standard Specification for Steel
Welded Wire Reinforcement, Plain, for
Concrete

ASTM A615/A615M (2016) Standard Specification for Deformed
and Plain Carbon-Steel Bars for Concrete
Reinforcement

ASTM C143/C143M (2015) Standard Test Method for Slump of
Hydraulic-Cement Concrete

ASTM C171	(2016) Standard Specification for Sheet Materials for Curing Concrete
ASTM C172	(2010) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231	(2008c) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C31/C31M	(2015a; E 2016) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C920	(2014a) Standard Specification for Elastomeric Joint Sealants
ASTM D1751	(2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2004a; R 2013) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D5893	(2004) Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

1.4 SYSTEM DESCRIPTION

1.4.1 General Requirements

Provide plant, equipment, machines, and tools used in the work subject to approval and maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

1.4.2 Slip Form Equipment

Slip form paver or curb forming machine, will be approved based on trial use on the job and shall be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in 1 pass.

1.5 SUBMITTALS

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

SD-03 Product Data

Concrete

Copies of certified delivery tickets for all concrete used in the construction.

SD-06 Test Reports

Field Quality Control

Copies of all test reports within 24 hours of completion of the test.

1.6 ENVIRONMENTAL REQUIREMENTS

1.6.1 Placing During Cold Weather

Do not place concrete when the air temperature reaches 40 degrees F and is falling, or is already below that point. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

1.6.2 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. The placing temperature shall not exceed 95 degrees F at any time.

PART 2 PRODUCTS

2.1 CONCRETE

Concrete shall have a minimum compressive strength of 3000 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

2.1.1 Air Content

Mixtures shall have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

2.1.2 Slump

The concrete slump shall be 2 inches plus or minus 1 inch where determined in accordance with ASTM C143/C143M.

2.1.3 Reinforcement Steel

Reinforcement bars shall conform to ASTM A615/A615M. Wire mesh reinforcement shall conform to ASTM A185/A185M.

2.2 CONCRETE CURING MATERIALS

2.2.1 Impervious Sheet Materials

Impervious sheet materials shall conform to ASTM C171, type optional, except that polyethylene film, if used, shall be white opaque.

2.2.2 Burlap

Burlap shall conform to AASHTO M 182.

2.2.3 White Pigmented Membrane-Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to ASTM C309, Type 2.

2.3 CONCRETE PROTECTION MATERIALS

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the Contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

2.4 JOINT FILLER STRIPS

2.4.1 Contraction Joint Filler for Curb and Gutter

Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard.

2.4.2 Expansion Joint Filler, Premolded

Expansion joint filler, premolded, shall conform to ASTM D1751 or ASTM D1752, 1/2 inch thick, unless otherwise indicated.

2.5 JOINT SEALANTS

Joint sealant, cold-applied shall conform to ASTM C920 or ASTM D5893.

2.6 FORM WORK

Design and construct form work to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 2 inches nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 feet. Radius bends may be formed with 3/4 inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 10 feet with a minimum of 3 welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and

pointed tips designed for use with steel forms.

2.6.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

2.6.2 Curb and Gutter Forms

Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together. In lieu of inside forms for curbs, a curb "mule" may be used for forming and finishing this surface, provided the results are approved.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement. Subgrade shall be placed and compacted as directed in the drawings..

3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

3.1.2 Curb and Gutter Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement.

3.1.3 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected to produce a subgrade free from frost when the concrete is deposited.

3.2 FORM SETTING

Set forms to the indicated alignment, grade and dimensions. Hold forms rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to ensure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily

repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

3.2.1 Sidewalks

Set forms for sidewalks with the upper edge true to line and grade with an allowable tolerance of $\frac{1}{8}$ inch in any 10 foot long section. After forms are set, grade and alignment shall be checked with a 10 foot straightedge. Forms shall have a transverse slope of $\frac{1}{4}$ inch per foot with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

3.2.2 Curbs and Gutters

The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms back of curb shall remain in place until the face and top of the curb have been finished, as specified for concrete finishing. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

3.3.1 Formed Sidewalks

Place concrete in the forms in one layer. When consolidated and finished, the sidewalks shall be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a strike off.

3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, finish the surface with a wood float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished with an edger having a radius of $\frac{1}{8}$ inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than $\frac{5}{16}$ inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to $\frac{1}{4}$ inch.

3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

3.4.1 Formed Curb and Gutter

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators. Curve shaped gutters shall be finished with a standard curb "mule".

3.4.2 Curb and Gutter Finishing

Approved slipformed curb and gutter machines may be used in lieu of hand placement.

3.4.3 Concrete Finishing

Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes. The edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of $\frac{1}{2}$ inch. Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top. The top surface of gutter and entrance shall be finished to grade with a wood float.

3.4.4 Joint Finishing

Curb edges at formed joints shall be finished as indicated.

3.4.5 Surface and Thickness Tolerances

Finished surfaces shall not vary more than $\frac{1}{4}$ inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to $\frac{1}{4}$ inch.

3.5 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 5 feet on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 10 feet or more in width. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated. Expansion joints are not required between sidewalks and curb that abut the sidewalk longitudinally.

3.5.1 Sidewalk Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove

in the concrete with a 1/8 inch blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

3.5.2 Sidewalk Expansion Joints

Expansion joints shall be formed with 1/2 inch joint filler strips. Joint filler in expansion joints surrounding structures and features within the sidewalk may consist of preformed filler material conforming to ASTM D1752 or building paper. Joint filler shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be cleaned and filled with cold-applied joint sealant. Joint sealant shall be gray or stone in color. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing material shall not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.5.3 Reinforcement Steel Placement

Reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is placed.

3.6 CURB AND GUTTER JOINTS

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

3.6.1 Contraction Joints

Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 5 feet nor greater than 15 feet in length.

a. Contraction joints (except for slip forming) shall be constructed by means of 1/8 inch thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.

b. When slip forming is used, the contraction joints shall be cut in the top portion of the gutter/curb hardened concrete in a continuous cut across the curb and gutter, using a power-driven saw. The depth of cut shall be at least one-fourth of the gutter/curb depth and 1/8 inch in width.

3.6.2 Expansion Joints

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite

expansion joints of abutting portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least $1/2$ inch in width shall be provided at intervals not less than 30 feet nor greater than 120 feet. Expansion joints shall be provided in nonreinforced concrete gutter at locations indicated. Expansion joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit. Expansion joints and the top 1 inch depth of curb and gutter contraction-joints shall be sealed with joint sealant. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing material shall not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.7 CURING AND PROTECTION

3.7.1 General Requirements

Protect concrete against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

3.7.1.1 Mat Method

The entire exposed surface shall be covered with 2 or more layers of burlap. Mats shall overlap each other at least 6 inches. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

3.7.1.2 Impervious Sheeting Method

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used. The curing medium shall not be less than 18-inches wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

3.7.1.3 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a

fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet/gallon for the total of both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.7.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

3.7.3 Protection

Completed concrete shall be protected from damage until accepted. Repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

3.7.4 Protective Coating

Protective coating, of linseed oil mixture, shall be applied to the exposed-to-view concrete surface after the curing period, if concrete will be exposed to de-icing chemicals within 6 weeks after placement. Concrete to receive a protective coating shall be moist cured.

3.7.4.1 Application

Curing and backfilling operation shall be completed prior to applying two coats of protective coating. Concrete shall be surface dry and clean before each application. Coverage shall be by spray application at not more than 50 square yards/gallon for first application and not more than 70 square yards/gallon for second application, except that the number of

applications and coverage for each application for commercially prepared mixture shall be in accordance with the manufacturer's instructions. Coated surfaces shall be protected from vehicular and pedestrian traffic until dry.

3.7.4.2 Precautions

Protective coating shall not be heated by direct application of flame or electrical heaters and shall be protected from exposure to open flame, sparks, and fire adjacent to open containers or applicators. Material shall not be applied at ambient or material temperatures lower than 50 degrees F.

3.8 FIELD QUALITY CONTROL

3.8.1 General Requirements

Perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

3.8.2 Concrete Testing

3.8.2.1 Strength Testing

Provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 250 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C172. Cylinders for acceptance shall be molded in conformance with ASTM C31/C31M by an approved testing laboratory. Each strength test result shall be the average of 2 test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

3.8.2.2 Air Content

Determine air content in accordance with ASTM C173/C173M or ASTM C231. ASTM C231 shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly selected batches of each class of concrete placed during each shift. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

3.8.2.3 Slump Test

Two slump tests shall be made on randomly selected batches of each class of concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Additional tests shall be performed when excessive

variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.

3.8.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, the subgrade shall be true to grade prior to concrete placement and the thickness will be determined by measuring each edge of the completed slab.

3.8.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

3.9 SURFACE DEFICIENCIES AND CORRECTIONS

3.9.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than $\frac{1}{4}$ inch the deficient section will be removed, between regularly scheduled joints, and replaced.

3.9.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed $\frac{1}{4}$ inch. Pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

3.9.3 Appearance

Exposed surfaces of the finished work will be inspected by the Government and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

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04/06

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SECTION 32 92 23

SODDING
04/06

PART 1 GENERAL

1.1 REFERENCES

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

TURFGRASS PRODUCERS INTERNATIONAL (TPI)

TPI GSS (1995) Guideline Specifications to
Turfgrass Sodding

1.2 DEFINITIONS

1.2.1 Stand of Turf

100 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 31 00 00 EARTHWORK applies to this section for grading and fill requirements, with additions and modifications herein.

1.4 SUBMITTALS

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

SD-07 Certificates

Sod farm certification for sods. Indicate type of sod in
accordance with TPI GSS.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Sod Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.2 Storage

1.5.2.1 Sod Storage

Lightly sprinkle with water, cover with moist burlap, straw, or other approved covering; and protect from exposure to wind and direct sunlight until planted. Provide covering that will allow air to circulate so that internal heat will not develop. Do not store sod longer than 24 hours. Do not store directly on concrete or bituminous surfaces.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Sod

Place sod a maximum of thirty six hours after initial harvesting, in accordance with TPI GSS as modified herein.

PART 2 PRODUCTS

2.1 SODS

2.1.1 Classification

Nursery grown, certified as classified in the TPI GSS. Machine cut sod at a uniform thickness of 3/4 inch within a tolerance of 1/4 inch, excluding top growth and thatch. Each individual sod piece shall be strong enough to support its own weight when lifted by the ends. Broken pads, irregularly shaped pieces, and torn or uneven ends will be rejected. Wood pegs and wire staples for anchorage shall be as recommended by sod supplier.

2.1.2 Purity

Sod species shall be genetically pure, free of weeds, pests, and disease.

2.1.3 Composition

2.1.3.1 Proportion

Proportion grass species as follows.

Common Name:

Bahia

2.2 WATER

Source of water shall be approved by Contracting Officer and of suitable quality for irrigation containing no element toxic to plant life.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 EXTENT OF WORK

Provide sodding of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.2 SODDING

3.2.1 Finished Grade and Topsoil

Prior to the commencement of the sodding operation, the Contractor shall verify that finished grades are as indicated on drawings; the placing of topsoil, smooth grading, and compaction requirements have been completed in accordance with Section 31 00 00 EARTHWORK.

The prepared surface shall be a maximum 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove from the surface debris and stones over a minimum 5/8 inch in any dimension.

3.2.2 Placing

Place sod a maximum of 36 hours after initial harvesting, in accordance with TPI GSS as modified herein.

3.2.3 Sodding Slopes and Ditches

For slopes 2:1 and greater, lay sod with long edge perpendicular to the contour. For V-ditches and flat bottomed ditches, lay sod with long edge perpendicular to flow of water. Anchor each piece of sod with wood pegs or wire staples maximum 2 feet on center. On slope areas, start sodding at bottom of the slope.

3.2.4 Finishing

After completing sodding, blend edges of sodded area smoothly into surrounding area. Air pockets shall be eliminated and a true and even surface shall be provided. Frayed edges shall be trimmed and holes and missing corners shall be patched with sod.

3.2.5 Rolling

Immediately after sodding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds for each foot of roller width.

3.2.6 Watering

Start watering areas sodded as required by daily temperature and wind conditions. Apply water at a rate sufficient to ensure thorough wetting of soil to minimum depth of 6 inches for 14 continuous days after placement. Run-off, puddling, and wilting shall be prevented. Unless otherwise directed, watering trucks shall not be driven over turf areas. Watering of other adjacent areas or plant material shall be prevented.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

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11/13

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SECTION 33 05 23.13

UTILITY HORIZONTAL DIRECTIONAL DRILLING
11/13

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO T 180 (2015) Standard Method of Test for
Moisture-Density Relations of Soils Using
a 4.54-kg (10-lb) Rammer and a 457-mm
(18-in.) Drop

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

29 CFR 1926.652 Safety and Health Regulations for
Construction; Subpart P, Excavations;
Requirements for Protective Systems

1.2 SUBMITTALS

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

SD-01 Preconstruction Submittals

Statement of Qualifications and Records; G

SD-03 Product Data

Drilling Fluids; G

Additives; G

Mixtures; G

SD-05 Design Data

Material Safety Data Sheets; G

SD-07 Certificates

drill rod

SD-11 Closeout Submittals

record drawings

Complete Work Logs of Guided Directional Drill Operations; G

1.3 COMMENCEMENT, DELIVERY, STORAGE, AND HANDLING OF MATERIALS

Prior to commencement of the work, submit the following to the Engineer of Record for review and approval:

- a. Material Safety Data Sheets
- b. Statement of Qualifications and Records

Provide written documentation of conformance with AASHTO T 180. Submit a complete list of all drilling fluids, additives, and mixtures to be used along with Material Safety Data Sheets.

Inspect materials delivered to the site for damage. All materials found during inspection or during the progress of work to have cracks, flaws, surface abrasions, or other defects will be rejected. Remove defective materials from the job site.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

Ensure that Contractor and his field supervisor assigned to this project are experienced in work of this nature and have successfully completed similar projects of similar length, pipe type, pipe size, and soil type using directional drilling in the last three (3) years. As part of the bid submission, submit a description of such project(s) which include, at a minimum, a listing of the location(s), date of project(s), owner, pipe type, size installed, length of installation, type, and manufacturer of equipment used, and other information relevant to the successful completion of the project.

1.4.2 Safety

Include in directional drilling equipment machine safety requirements a common grounding system to prevent electrical shock in the event of underground electrical cable strike. Ensure the grounding system connects all pieces of interconnecting machinery; the drill, mud mixing system, drill power unit, drill rod trailer, operators booth, worker grounding mats, and any other interconnected equipment to a common ground. Equip the drill with an "electrical strike" audible and visual warning system that notifies the system operators of an electrical strike.

PART 2 PRODUCTS

2.1 EQUIPMENT

2.1.1 Drill Rod

Select the appropriate drill rod to be used. Submit certified statement that the drill rod has been inspected and is in satisfactory condition for its intended use.

2.2 MATERIALS

2.2.1 Drilling Fluids

Disposal of fluids is the responsibility of the Contractor. Dispose of

fluids in a manner that is in compliance with all permits and applicable Federal, State, and local regulations. The Contractor shall not dispose of the drilling fluids on land owned by the Government. Dispose of drilling fluids off PAFB property.

Use a high quality bentonite drilling fluid to ensure hole stability, cuttings transport, bit and electronics cooling, and hole lubrication to reduce drag on the drill pipe and the product pipe. Use only fluid with a composition which complies with all Federal, State, and local environmental regulations.

Mix the bentonite drilling fluid with potable water (of proper pH) to ensure no contamination is introduced into the soil during the drilling, reaming, or pipe installation process. The Contractor is responsible for any required pH adjustments.

Disposal of the drilling fluids is the responsibility of the Contractor. Conduct disposal in compliance with all relative environmental regulations, right-of-way and work space agreements, and permit requirements.

Collect drilling fluid returns in the entrance pit, exit pit, or spoils recovery pit. Immediately clean up any drilling fluid spills or overflows from these pits.

PART 3 EXECUTION

3.1 INSTALLATION

- a. Ensure all utilities are located and clearly marked prior to start of excavation or drilling.
- b. The HDD Contractor shall plan its reaming and back pulling operations carefully to insure that, once started, all remaining and back pulling operations can be completed without stopping and within the permitted work hours.

3.1.1 Drill Set-Up

Design and construct the drill entrance and exit pits.

3.1.2 Drill Entrance and Exit Pits

Drill entrance and exit pits are required. Maintain at minimum size to allow only the minimum amount of drilling fluid storage prior to transfer to mud recycling or processing system or removal from the site.

Do not allow drilling mud to flow freely on the site or around the entrance or exit pits. Remove spilled mud and restore ground to original condition. Provide shore pits in compliance with OSHA Standards, 29 CFR 1926.652.

When drilling near wetlands or water courses, provide secondary containment to prevent drilling fluids from entering the wetlands, and secure written approval of secondary containment plan from the Contracting Officer.

3.1.3 Drill Entrance and Exit Angle

Ensure entrance and exit angles and elevation profile maintains adequate cover to reduce risk of drilling fluid breakouts and ground exit occurs as

specified herein. Ensure that entrance and exit angles generate pullback forces that do not exceed 5 percent strain on the pvc pipe.

3.1.4 Pilot Hole

The type and size of the pilot string cutting head and the diameter of the drill pipe is at the Contractor's discretion.

Drill the pilot hole along the path shown on the plan and profile drawings. Pilot hole tolerances are as follows:

- a. Vertical Tolerance: Provide minimum cover below channel bottom as specified on the plans. Pilot hole may go deeper if necessary to prevent breakout.
- b. Horizontal Tolerance: Plus/minus - 60-inches from the centerline of the product pipe.
- c. Curve Radius: No curve is acceptable with a radius less than 1,000-feet.
- d. Entry Point Location: Make pilot hole entry point within plus/minus - 60-inches of the location shown on the drawings or as directed by the Contracting Officer in the field.
- e. Exit Point Location: Make the exit point location within plus/minus - 60-inches of the location shown on the drawings or as directed by the Contracting Officer in the field.
- f. Mandatory pipeline cover requirements are as shown on the drawings or as specified.

3.1.5 Guidance Systems

3.1.5.1 General

Use an electronic "walkover" tracking system or a Magnetic Guidance System (MGS) probe or proven (non-experimental) gyroscopic probe and interface for a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance system must be capable of tracking at all depths up to fifty feet and in any soil condition, including hard rock. It should enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The guidance system has to be accurate and calibrated to manufacturer's specifications of the vertical depth of the borehole at sensing position at depths up to fifty feet and accurate to 2-feet horizontally.

3.1.5.2 Components

Supply all components and materials to install, operate, and maintain the guidance system.

3.1.5.3 Operation

Set up and operate the Magnetic Guidance System (MGS) with personnel trained and experienced with the system. Be aware of any geo-magnetic anomalies and consider such influences in the operation of the guidance system.

The HDD Contractor shall calibrate its tracking and locating equipment at the beginning of each work day;

The HDD Contractor shall monitor and record the alignment and depth readings provided by the tracking system.

Every 25 to 30 feet (8 to 9 meters) for normal conditions;

Every 5 to 10 feet (2 to 3 meters) where precise alignment control is necessary.

The HDD Contractor shall attempt to maintain drilling fluid circulation throughout the HDD process;

During the initial pilot hole installation, and;

During the reaming and back pull process(es) (Do not out pull the fluid circulation rate).

The HDD Contractor shall at all times and for the entire length of the HDD alignment be able to demonstrate.

The horizontal and vertical position of the alignment,

The fluid volume used, return rates, and pressures.

The HDD Contractor shall inspect the work and surrounding area to insure that no construction-related damage has occurred;

Including heaving or humping of paved surfaces, and

Including drilling fluid fractures or releases.

3.1.6 Reaming

Conduct reaming operations at the Contractor's discretion. Determine the type of back reamer to be utilized by the type of subsurface soil conditions that are encountered during the pilot hole drilling operation. The reamer type is at the Contractor's discretion.

3.1.7 Pull Back

Fully assemble the entire pipeline to be installed via direction drill prior to commencement of pull back operations.

Support the pipeline during pullback operations in a manner to enable it to move freely and prevent damage. Install the pipeline in one continuous pull.

Minimize torsion stress by using a swivel to connect the pull section to the reaming assembly.

Maximum allowable tensile force imposed on the pull section is not to exceed 90 percent of the pipe manufacturer's safe pull (or tensile) strength. If the pull section is made up of multiple pipe size or materials, the lowest safe pull strength value governs and the maximum allowable tensile force is not to exceed 90 percent of this value.

Minimize external pressure during installation of the pullback section in

the reamed hole. Replace damaged pipe resulting from external pressure at no cost to the Government. Buoyancy modification is at the discretion of the Contractor.

3.1.8 Connection of Product Pipe to Pipeline

After the product pipe has been successfully installed, allow the product pipe to recover for 24 hours prior to connection of the pipeline. Ensure that a sufficient length of the product pipe has been pulled through the hole so that the pull-nose is not pulled back into bore hole due to stretch recovery of the product pipe.

3.1.9 Pipe Installation

HDD shall be installed with continuous insulated copper, 10 gauge or thicker wire for pipeline location purposes along the entire length of the pipe.

3.2 FIELD QUALITY CONTROL

Maintain drilling logs that accurately provide drill bit location (both horizontally and vertically) at least every 2-inches along the drill path. In addition, keep logs that record, as a minimum the following, every 15 minutes throughout each drill pass, back ream pass, or pipe installation pass:

- a. Drilling Fluid Pressure
- b. Drilling Fluid Flow Rate
- c. Drill Thrust Pressure
- d. Drill Pullback Pressure
- e. Drill Head Torque

Make all instrumentation, readings, and logs available to the Contracting Officer at all times during operation.

3.3 CLOSEOUT ACTIVITIES

Immediately upon completion of work, remove all rubbish and debris from the job site. Remove all construction equipment and implements of service leaving the entire area involved in a neat condition acceptable of the Contracting Officer.

Immediately clean "blow holes" or "breakouts" of drilling fluid to the surface and return the surface area to its original condition. Dispose of all drilling fluids, soils, and separated materials in compliance with Federal, State, and local environmental regulations.

Submit an electronic copy and three hard copies of the record drawings to the Contracting Officer within five days after completing the pull back. Include in the record drawings a plan, profile, and all information recorded during the progress of the work. Clearly tie the record drawings

to the project's survey control. Maintain and submit upon completion signed [complete work logs of guided directional drill operations](#).

3.4 As-Built Plan Requirements

The HDD Contractor shall keep records of the guidance system data during the actual HDD operation tied to the as-built survey horizontal and vertical datum.

HDD tracking data and operator logs shall be maintained daily and shall be provided to Contracting Officer. These field records and operator notes shall specify:

- Type of tracking equipment used,

- Length and depth of the HDD installation,

- Additional information that may include steering adjustments and other equipment performance parameters.

As-Built plans shall be derived from the tracking data and operator logs. At a minimum, the drawings shall indicate:

- Horizontal and vertical HDD alignment,

- Existing utility horizontal locations and depths at all exposed or potholed locations, and

- Existing utility horizontal locations where indicated with field locates.

-- End of Section --

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PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(2008) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105/A21.5	(2010) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2012) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115/A21.15	(2011) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151/A21.51	(2009) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C153/A21.53	(2006) Ductile-Iron Compact Fittings for Water Service
AWWA C504	(2006) Standard for Rubber-Seated Butterfly Valves
AWWA C508	(2009; Addenda A 2011) Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS
AWWA C509	(2015) Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C605	(2005) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA C900	(2016) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm)

AWWA M23 (2002; 2nd Ed) Manual: PVC Pipe - Design and Installation

ASME INTERNATIONAL (ASME)

ASTM A36 Standard Specification for Carbon Structural Steel

ASME B1.20.1 (1983; R 2006) Pipe Threads, General Purpose (Inch)

ASME B16.1 (2015) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

ASME B18.2.2 (2010) Standard for Square and Hex Nuts

ASME B18.5.2.1M (2006) Metric Round Head Short Square Neck Bolts

ASME B18.5.2.2M (1982; R 2005) Metric Round Head Square Neck Bolts

ASTM INTERNATIONAL (ASTM)

ASTM A 126 (2004) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM A 307 (2007b) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASTM A 47/A 47M (1999; R 2004) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process

ASTM A 48/A 48M (2003; R 2008) Standard Specification for Gray Iron Castings

ASTM A 536 (1984; R 2009) Standard Specification for Ductile Iron Castings

ASTM A 563 (2007a) Standard Specification for Carbon and Alloy Steel Nuts

ASTM A 746 (2003) Standard Specification for Ductile Iron Gravity Sewer Pipe

ASTM C 150 (2007) Standard Specification for Portland Cement

ASTM C 270 (2008a) Standard Specification for Mortar for Unit Masonry

ASTM C 443 (2005a) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

ASTM C 478	(2009) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 924	(2002) Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM C 94/C 94M	(2010) Standard Specification for Ready-Mixed Concrete
ASTM C 969	(2002) Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM D 1599	(2005) Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
ASTM D 1784	(2008) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(2005) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2321	(2005) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2412	(2002; R 2008) Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
ASTM D 2464	(2006) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2680	(2001; R 2009) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 2751	(2005) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings

ASTM D 3034	(2008) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3139	(1998; R 2005) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(2007) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3753	(2005e1) Glass-Fiber-Reinforced Polyester Manholes and Wetwells
ASTM D 4101	(2008) Standard Specification for Polypropylene Injection and Extrusion Materials
ASTM F 477	(2008) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 949	(2006a) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-60005	(Basic) Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole
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UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-6	(1998) Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe
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1.2 SUBMITTALS

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

SD-01 Preconstruction Submittals

Existing Conditions

Drawings of existing conditions, as specified.

SD-02 Shop Drawings

Drawings

Installation and As-Built drawings, as specified.

Precast concrete manhole

Metal items

Frames, covers, and gratings

Details, as specified.

SD-03 Product Data

Pipeline materials

Submit manufacturer's standard drawings or catalog cuts.

SD-06 Test Reports

Reports

Test and inspection reports, as specified.

SD-07 Certificates

Portland Cement

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

Gaskets

1.3 QUALITY ASSURANCE

1.3.1 Installer Qualifications

Install specified materials by a licensed underground utility Contractor licensed for such work in the state where the work is to be performed. Installing Contractor's License shall be current and be state certified or state registered.

1.3.2 Drawings

a. Submit Installation Drawings showing complete detail, both plan and side view details with proper layout and elevations.

b. Submit As-Built Drawings for the complete sanitary sewer system showing complete detail with all dimensions, both above and below grade, including invert elevation.

c. Sign and seal As-Built Drawings by a Professional Surveyor and Mapper. Include the following statement: "All potable water lines crossed by sanitary hazard mains are in accordance with the permitted utility separation requirements."

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

1.4.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.4.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.4.1.3 Cement, Aggregate, and Reinforcement

As specified in Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE.

1.4.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.

1.5 PROJECT/SITE CONDITIONS

Submit drawings of [existing conditions](#), after a thorough inspection of the area in the presence of the Contracting Officer. Details shall include the environmental conditions of the site and adjacent areas. Submit copies of the records for verification before starting work.

PART 2 PRODUCTS

2.1 PIPELINE MATERIALS

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Ductile Iron Gravity Sewer Pipe and Associated Fittings

2.1.1.1 Ductile Iron Gravity Pipe and Fittings

Ductile iron pipe shall conform to [ASTM A 746](#), Thickness Class 53. Fittings shall conform to [AWWA C110/A21.10](#) or [AWWA C153/A21.53](#). Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends. Fittings shall have strength at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the joints specified hereinafter. Pipe and fittings shall have cement-mortar lining conforming to [AWWA C104/A21.4](#), standard thickness.

2.1.1.2 Ductile Iron Gravity Joints and Jointing Materials

Pipe and fittings shall have push-on joints or mechanical joints, except as otherwise specified in this paragraph. Mechanical joints only shall be used where indicated. Push-on joint pipe ends and fitting ends, gaskets, and lubricant for joint assembly shall conform to [AWWA C111/A21.11](#). Mechanical joint requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to [AWWA C111/A21.11](#).

2.1.2 Ductile Iron Pressure Piping

2.1.2.1 Ductile Iron Pressure Pipe and Fittings

Ductile-iron pipe shall conform to [AWWA C151/A21.51](#), Thickness Class 53. Below grade fitting shall be mechanical joint Flanged pipe shall conform to

AWWA C115/A21.15. Fittings shall conform to AWWA C110/A21.10 or AWWA C153/A21.53. Fittings shall have pressure rating at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the joints specified hereinafter. Pipe and fittings shall have cement-mortar lining conforming to AWWA C104/A21.4, standard thickness.

2.1.2.2 Ductile Iron Pressure Joints and Jointing Materials

- a. Joints, general: Joints shall be mechanical-joints where indicated. Joints shall be flanged joints where indicated.
- b. Push-on joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly shall conform to AWWA C111/A21.11.
- c. Mechanical joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111/A21.11.
- d. Flanged joints: Bolts, nuts, and gaskets for flanged connections shall be as recommended in the Appendix to AWWA C115/A21.15. Flange for setscrewed flanges shall be of ductile iron, ASTM A 536, Grade 65-45-12, and shall conform to the applicable requirements of ASME B16.1, Class 250. Setscrews for setscrewed flanges shall be 190,000 psi tensile strength, heat treated, and zinc-coated steel. Gasket for setscrewed flanges shall conform to the applicable requirements for mechanical-joint gaskets specified in AWWA C111/A21.11. Design of setscrewed gasket shall provide for confinement and compression of gasket when joint to adjoining flange is made.
- e. Joints made with sleeve-type mechanical couplings: Couplings shall be designed to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. The coupling shall consist of one middle ring flared or beveled at each end to provide a gasket seat, two follower rings, two resilient tapered rubber gaskets, and bolts and nuts to draw the follower rings toward each other to compress the gaskets. The middle ring and the follower rings shall be true circular sections free from irregularities, flat spots, and surface defects; the design shall provide for confinement and compression of the gaskets. Middle ring shall be of cast-iron or steel, and the follower rings shall be of malleable iron or ductile iron. Cast iron shall conform to ASTM A 48/A 48M and shall be not less than Class 25. Malleable iron shall conform to ASTM A 47/A 47M. Ductile iron shall conform to ASTM A 536. Steel shall have a strength not less than that of the pipe. Gaskets shall be designed for long life and resistance to set after installation and shall meet the applicable requirements specified for gaskets for mechanical joint in AWWA C111/A21.11. Bolts shall be track-head type; bolts and nuts shall be either of the following: bolts conforming to the tensile requirements of ASTM A 307, Grade A, with nuts conforming to the tensile requirements of ASTM A 563, Grade A; or round-head square-neck type bolts conforming to ASME B18.5.2.1M and ASME B18.5.2.2M with hex nuts conforming to ASME B18.2.2. Bolt holes in follower rings shall be of a shape to hold fast the necks of the bolts used. Sleeve-type mechanical couplings shall not be used as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint.

2.1.3 PVC Plastic Gravity Sewer Piping

2.1.3.1 PVC Plastic Gravity Pipe and Fittings

ASTM D 3034, SDR 35, or ASTM F 949 with ends suitable for elastomeric gasket joints.

2.1.3.2 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to ASTM D 3212. Gaskets shall conform to ASTM F 477.

2.1.4 PVC Plastic Pressure Pipe and Associated Fittings

2.1.4.1 PVC Plastic Pressure Pipe and Fittings

a. Pipe and Fittings Less Than 4 inch Diameter: Pipe, couplings and fittings shall be manufactured of materials conforming to ASTM D 1784, Class 12454B.

(1) Screw-Joint: Pipe shall conform to dimensional requirements of ASTM D 1785, Schedule 80, with joints meeting requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified. Fittings for threaded pipe shall conform to requirements of ASTM D 2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings. Pipe couplings when used, shall be tested as required by ASTM D 2464.

(2) Push-On Joint: ASTM D 3139, with ASTM F 477 gaskets. Fittings for push-on joints shall be iron conforming to AWWA C110/A21.10 or AWWA C111/A21.11. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104/A21.4.

(3) Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure. Fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467.

b. Pipe and Fittings 4 inch Diameter to 12 inch: Pipe shall conform to AWWA C900 and shall be plain end or gasket bell end, Pressure Class 150 (DR 18), with cast-iron-pipe-equivalent OD. Fittings shall be gray-iron or ductile-iron conforming to AWWA C110/A21.10 or AWWA C153/A21.53 and shall have cement-mortar lining conforming to AWWA C104/A21.4, standard thickness. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that bell design shall be modified, as approved, for push-on joint suitable for use with the PVC plastic pressure pipe specified in this paragraph.

2.1.4.2 PVC Plastic Pressure Joints and Jointing Material

Joints for pipe, 4 inch to 12 inch diameter, shall be push-on joints as specified in ASTM D 3139. Joints between pipe and fittings shall be push-on joints as specified in ASTM D 3139 or shall be compression-type joints/mechanical-joints as respectively specified in ASTM D 3139 and AWWA C111/A21.11. Each joint connection shall be provided with an elastomeric gasket suitable for the bell or coupling with which it is to be

used. Gaskets for push-on joints for pipe shall conform to ASTM F 477. Gaskets for push-on joints and compression-type joints/mechanical-joints for joint connections between pipe and fittings shall be as specified in AWWA C111/A21.11, respectively, for push-on joints and mechanical-joints.

2.2 CONCRETE MATERIALS

2.2.1 Cement Mortar

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.2.2 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking.

2.2.3 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94/C 94M, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

2.2.4 Metallic Non-Shrink Mortar

All holes in sections used for their handling and the annular space between the wall and entering pipes shall be thoroughly plugged with an approved, non-shrinking mortar or grout, applied and cured in strict conformance with the manufacturer's recommendations, so that there will be zero leakage through openings and around pipes. The mortar shall be finished smooth and flush with the adjoining interior and exterior manhole wall surfaces.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Precast Concrete Structures

2.3.1.1 Materials

Manholes and lift station wet well bases, sections and miscellaneous structures shall conform to the requirements of ASTM C 478 (specification for precast concrete manhole sections and structures) except as modified herein. Cement shall meet the requirements of ASTM C 150 (specification for Portland cement, type II). Minimum wall thickness shall be 1/12 the inside diameter in inches plus 1 inch. Rings shall be custom-made with openings to meet indicated pipe alignment conditions and invert elevations. The Contractor shall submit shop drawings consisting of manufacturer's standard details of various sections, for approval, before placing order for structures. Precast concrete sections shall be set so vertical and with sections in true alignment. If not approved otherwise by Government, the construction schedule for setting base and riser sections shall be approved by a GOVERNMENT representative. The GOVERNMENT representative shall be present, on site, during this installation.

2.3.1.2 Base

Base for manhole and lift station wet well shall be cast integrally with

the bottom section. The base section shall be set in a 12 inch (minimum) leveling course of granular material (57 stone) as shown on the drawings. For concrete base and riser's the reinforcing steel shall be designed, signed and sealed by a Florida Registered Structural Engineer and shall be submitted with the shop drawings.

2.3.1.3 Lift Station Wet Well Corrosion Protection

The interior surfaces of each concrete lift station shall be lined with a protective barrier during the manufacturing process that will permanently isolate the concrete surface from the aggressive sanitary sewer environment. Interior **linings** shall be fiberglass reinforced polyester lining or approved equal.

The exterior surfaces of each concrete lift station and manhole, including adjusting rings, shall be given 2 coats of bitumastic coating. Total minimum dry film thickness shall be 12 mils. Each coat shall be applied at a rate not to exceed one gallon per 100 square feet. In lieu of a bitumastic coating, an acrylic polymer base coating may be applied on all areas listed above. Three coats of acrylic polymer base coating shall be used with a total dry film thickness of 3.5 mils. The waterproofing materials shall be applied by brush or spray and in accordance with the instructions of the manufacturer. Time shall be allowed between coats to permit sufficient drying so that the application of the additional coat has no effect on the previous coat. Field applications of coatings for precast structures are not acceptable, but are acceptable for applicable field repairs only.

2.3.1.4 Joints

Joint contact surfaces shall be formed with machined castings and shall be exactly parallel and specifically designed by a professional engineer. Joints shall be sealed with Government approved joint sealer over the entire joint surface, with joints pre-primed. Joints shall be water tight. Upon completion of installation, excess joint sealer shall be trimmed flush with inside and outside surface of structure.

2.3.1.5 Joint Sealant

A pre-formed plastic joint sealer such as "Ram-Nek" as manufactured by the K.T. Snyder Co., Inc., or approved equal shall be required. All exterior joints shall be sealed with portland type II cement after the setting of the Ramnek and placement of each manhole section to form a water-tight joint.

Wet well and manhole joints and ring and cover chimney shall be wrapped with adhesive polyolefin sheeting that is heat applied to the exterior of the structure. Upon cooling, the adhesive shall form a tough, elastomeric protective layer that shall effectively prevent the infiltration of groundwater through these areas. The overall thickness of the applied sleeve shall nominally be 2.5 mm. Wrap material shall be Wrapid Seal or approved equal.

OR

Wet well and manhole joints and ring and cover chimney shall be sealed with one 12 inch wide exterior joint sealant membrane centered on joint. The tape shall be capable of sealing joints against groundwater infiltration. The installation of the membrane shall be in conformance with the

recommendations of the manufacturer. Surface must be smooth, clean, dry and free of voids, loose aggregate, dirt or other matter that will hinder the adhesion of the membrane. A primer shall be used in accordance with the recommendations of the membrane manufacturer. If recommended by the manufacturer, heat shall be applied to all areas being sealed. The membrane shall be 12 inch wide "Rub-R-Nek tape, or approved equal.

2.3.1.6 Flexible Pipe Connector

A flexible pipe connector shall be used to connect the sewer influent pipe to the precast concrete wet well.

Material: The Neoprene-EPDM material the connector is manufactured from shall conform to [ASTM C 443](#) and shall be a minimum of 3/8 inches (9.4mm) thick or greater. The material shall be resistant to ozone, weathering, aging, and chemicals, including acids, alkalis, animal and vegetable fats, oils and petroleum products.

Bands: The stainless steel band and screw assembly shall be a totally non-magnetic series 304 stainless steel.

Connector: The connector shall be of a size specifically designed for the specified pipe material and size. The connector may be installed in the wet well wall by the precast manufacturer in strict accordance with the recommendations of the connector manufacturer. During the invert construction stage, the interior annular space between the exterior of the pipe and the interior of the connector shall be filled with a Type II lean cement grout by the Contractor

2.3.2 Metal Items

2.3.2.1 Frames, Covers, and Gratings for Manholes

[FS A-A-60005](#), cast iron; figure numbers shall be as follows:

- a. Traffic manhole: Provide in paved areas.

- Frame: Figure 1, Size 22A
 - Cover: Figure 8, Size 22A
 - Steps: Figure 19

- b. Non-traffic manhole:

- Frame: Figure 4, Size 22
 - Cover: Figure 12, Size 22
 - Steps: Figure 19

Frames and covers shall be cast iron, ductile iron or reinforced concrete. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than [400 pounds](#). Reinforced concrete frames and covers shall be as indicated or shall conform to [ASTM C 478](#). The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.3.2.2 Frame , Covers, and Grating for Lift Stations

Access frame and covers shall be suitable size for pumping units furnished and shall be constructed of skid-proof aluminum with a minimum load rating

of 300 lbs./sq. ft. or H-20 traffic loading as indicated. Frame and covers shall be furnished complete with stainless steel staple assembly (not recessed) for the locking mechanism, hold-open device, upper guide holder and cable holder. The locking mechanism shall be recessed type. Access covers shall be double door for duplex stations and triple door for triplex stations. Access covers shall be hinged to open as indicated on the drawings. Hatches shall be sized to provide a 4-inch minimum clearance between hatch and pump volute (measured from all sides and includes the pump and rail system). Minimum size total hatch opening shall be 36 inches by 48 inches for duplex stations and 36 inches by 96 inches for triplex stations. All hinges, fasteners and miscellaneous hardware shall be 316 stainless steel. For tamper proof and security purposes, the hinges shall be bolted to the door(s) with stainless steel carriage bolts and nuts. The nuts shall be welded to the bolts on both the door(s) and frame with 316L. GOVERNMENT will provide pad locks, as required.

2.3.2.3 Manhole Steps

Plastic or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D 4101, copolymer polypropylene. Rubber shall conform to ASTM C 443, except shore A durometer hardness shall be 70 plus or minus 5. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less 4 feet deep.

2.4 Fiberglass Wet Well

2.4.1 GENERAL

Fiberglass wet well shall be designed (signed and sealed) by a Florida Professional Engineer. The design shall include the operating conditions as noted on the drawings, a 24 inch (minimum) thick (12 inch thick inside the wet well and 12 inches thick outside the wet well) reinforced concrete hold-down base which extends 24 inches beyond the outside of the wet well, a 6 inch (minimum) thick reinforced concrete top slab, pump access frame and cover and other standard wet well features as shown on the drawings. Pumps shall be anchored to a 1 inch thick steel plate. The complete design (designed by a Florida Professional Engineer) must be submitted in the form of a shop drawing for GOVERNMENT's review and approval. Fiberglass reinforced polyester wet wells shall be manufactured from commercial grade unsaturated polyester resin with fiberglass reinforcements. Unless approved otherwise by Government, the wet well shall be a one piece unit.

2.4.2 MATERIALS

2.4.2.1 Resin

The resins used shall be commercial grade unsaturated polyester resins.

2.4.2.2 Reinforcing Materials

The reinforcing materials shall be a commercial Grade "E" type glass in the form of mat, continuous roving, chopped roving, roving fabric, or a combination of the above, having a coupling agent that will provide a suitable bond between the glass reinforcements and the resin.

2.4.2.3 Surfacing Materials

If reinforcing materials are used on the surface exposed to the contained substance, it shall be a commercial grade chemical-resistant glass that

will provide a suitable bond with the resin and leave a resin rich surface.

2.4.2.4 Fillers and Additives

Fillers, when used, shall be inert to the environment and wet well construction. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to be used. The resulting reinforced plastic material must meet the requirement of this specification.

2.4.3 FABRICATION

2.4.3.1 Exterior Surface

The exterior surface shall be relatively smooth with no sharp projections. Hand-work finish is acceptable if enough resin is present to eliminate fiber show. The exterior surface shall be free of blisters larger than 1/2 inch in diameter, delamination and fiber show.

2.4.3.2 Interior Surface

The interior surface shall be resin rich with no exposed fibers. The surface shall be free of crazing, delamination, blisters larger than 1/2 inch in diameter, and wrinkles of 1/8 inch or greater in depth. Surface pits shall be permitted if they are less than 3/4 inch in diameter and less than 1/16 inch deep.

2.4.3.2 Defects Not Permitted

- A) Exposed fibers: glass fibers not wet out with resin;
- B) Resin runs: runs of resin and sand on the surface;
- C) Dry areas: areas with glass not wet out with resin;
- D) Delamination: separation in the laminate;
- E) Blisters: light colored areas larger than 1/2 inch in diameter;
- F) Crazing: cracks caused by sharp objects;
- G) Pits or Voids: air pockets;
- H) Wrinkles: smooth irregularities in the surface; or
- I) Sharp Projection: fiber or resin projections necessitating gloves for handling.

2.4.3.3 Installation of Brackets

Manufacturer or manufacturer certified field personnel shall glass in all stainless steel fasteners and brackets, discharge piping brackets, etc. Manufacturer of wet well shall be responsible for integrity of all field glassing.

Marking and Identification, Each wet well shall be marked with the following information.

- A) Manufacturer's name or trademark;

- B) Manufacturing special number; and
- C) Total length and nominal diameter.

2.4.4 PHYSICAL REQUIREMENTS

2.4.4.1 Load Rating

The complete wet well shall have a minimum dynamic-load rating of 16,000 ft-lbs when tested in accordance with [ASTM D 3753](#), Section 8, test methods D 790 and D 695. To establish this rating the complete wet well shall not leak, crack, or suffer other damage when load tested to 40,000 ft-lbs and shall not deflect vertically downward more than 1/4 inch at the point of load application when loaded to 24,000 lbs.

XVII.4.2. Stiffness:

The wet well cylinder shall have a minimum pipe-stiffness value as shown in Table 1 (at a minimum) when tested in accordance with [ASTM D 3753](#), Section 8.

Table 1: Stiffness Requirements (Minimum)	
Length, Ft.	F/AY psi
10 to 20	2.01
21 to 30	3.02
31 to 40	5.24

Physical Properties:

		Hoop Direction	Axial Direction
a.	Tensile Strength (psi)	18,000	5,000
b.	Tensile Modulus (psi)	0.8 x 10 E6	0.7 x 10 E6
c.	Flexural Strength (psi)	26,000	4,500
d.	Flexural Modulus (psi) (no ribs - 48, 60, 72) (with ribs - 96, 144)	1.4 x 10 E6 0.7 x 10 E6	7.0 x 10 E6 0.7 x 10 E6

2.4.5 FIBERGLASS CONSTRUCTION METHODS

2.4.5.1 Handling

The wet well shall not be dropped or impacted. Wet wells shall be chocked if stored horizontally. If wet wells must be moved by rolling, the ground transverses shall be smooth and free of rocks, debris, etc.

FRP wet wells may be lifted by the installation of three lifting lugs as specified by the manufacturer on the outside surface near the top or by a

sling or "choker" connection around the center. Use of chains or cables in contact with the wet well surface is prohibited. Wet wells may be lifted horizontally using one support point.

Wet Well Installation

Bottom of excavation should be compacted to 95 percent Standard Proctor Density. Pour reinforced concrete base a minimum of one foot deep and at least two feet larger than the fiberglass wet well outside diameter. As soon as the concrete has set-up enough to support the fiberglass wet well, lower the wet well into place. (Wet wells with fiberglass bottoms, should have rebar inserted into bottom reinforcement.) Pour a minimum of one foot of reinforced concrete on the inside, also a minimum of one foot deep and two feet from the fiberglass wet well wall on the outside of the fiberglass wet well. Insert "RAMNEK" type sealant on the outside of the fiberglass wet well around the bottom where the fiberglass and concrete come together.

Wet Well Cutouts

Cutouts in wet well wall should be made with proper cutting tools such as jigsaw or hole saw. Do not use axe or other impact-type tools.

Pipe Installation

Make the cutout in the wet well wall equal to the outside diameter of pipe, plus 1/2 inch maximum. Grind the outside surface of the pipe and both the inside and the outside surfaces of the cutout in the wet well wall. Apply a priming agent to any PVC pipe that might be used before fiberglass lay-up. Insert the pipe through the cutout in the wall of the wet well. Apply fiberglass putty to the inside and the outside of the wet well wall cutout, filling openings between pipe and cutout. Make a good radius for the fiberglass lay-up. After putty has set-up, fiberglass the pipe into place. Use one layer of woven roving sandwiched between two layers of fiberglass mat. Allow fiberglass to completely set-up before backfilling. Manufacturer of wet well shall be responsible for integrity of field glassing.

2.4.6 DESIGN FEATURES

2.4.6.1 Top Slab Support

Pour reinforced concrete slab support a minimum of two feet outside of fiberglass wet well wall and minimum of six inches thick.

2.4.6.2 Design

Fiberglass wet well system to be designed, signed and sealed by a Professional Engineer registered in the State of Florida. Resistance to uplift and traffic loading requirements shall be addressed in the design.

2.4.6.3 Wet Well Top

Wet well top shall be concrete and designed for H-20 Traffic loading. Hatches shall be as specified in this specification and as detailed on the contract drawings. Bottom of top slab and around side of hatch opening

shall be fiberglass lined and shall meet all the requirements of this specification.

2.5 MISCELLANEOUS MATERIALS

2.5.1 Tapping Gate Valves

Buried tapping gate valves shall be iron body bronze mounted, all exterior mounted bolts and nuts shall be stainless steel, rubber or EDPM encapsulated, resilient seat, solid wedge, non-rising stem type with operating nuts and adjustable valve boxes and covers. Operating nuts shall be two inches square. Resilient seat or wedge type gate valves shall conform to applicable sections of [AWWA C509](#) (250 psi).

2.5.2 Plug Valves

All plug valves, unless specifically shown otherwise on the drawings, shall be of non-lubricated, eccentric plug type with Buna "N" neoprene, epoxy or fusion bonded, nylon faced plugs. Valve bodies shall be [ASTM A 126](#), Class B cast iron with all exterior mounted bolts and nuts to be stainless steel. Port areas of valves shall be at least 80 percent full pipe area. The valve seat material shall consist of either a welded in 1/8 inch overlay of 90 percent pure nickel, or 316 stainless steel screwed into the cast iron body. Upper and lower plug stem bearings shall be sleeve-type of a stainless steel or other non-corrosive bearing material. The packing shall be adjustable and the bonnet shall be bolted. All bolts, nuts and washers shall be 316 stainless steel for buried, non-buried, and pit installed service. All buried valves shall have mechanical joint ends with anchor follower glands and meet the requirements of [AWWA C110/A21.10](#). All above ground valves shall have flanged ends in accordance with [ASME B16.1](#), Class 125. The valves shall be rated for a minimum of 150 psi, non-shock cold W.O.G. and shall provide drip-tight shut off with this pressure in either direction. A 2" operation nut or hand wheel shall have an arrow cast in the metal indicating direction of opening. The valve manufacturer shall furnish certified copies of performance, leakage and hydrostatic testing as outlined in [AWWA C504](#). The interior of all plug valves shall be epoxy coated.

2.5.3 Check Valves

Check valves shall conform to the requirements of [AWWA C508](#). Check valves larger than 2 inch nominal size shall be iron body with stainless steel bolts and nuts, flanged ends, 316 stainless steel shaft connected to a steel outside lever and weight, swing-type with straight-away passageway of full pipe area. The valve shall have renewable bronze seat ring and rubber-faced disc. Check valves larger than 2 inches shall be 150 psi working pressure. Check valves 2 inches and smaller nominal size shall be all brass swing check valves, 200 psi working pressure.

2.5.4 Tapping Sleeve

The tapping sleeve shall be [ASTM A36](#) steel, epoxy coated to 10 mils (minimum), special flanged outlet to mate-up to valve, type 304 stainless steel bolts with SDC nuts, SBR gasket (360 degree seal) and heavy gauge type 304 S.S. armor plate.

2.5.5 Ball Valves

Ball valves shall be stainless steel, including the handle, rated at 1,000

psi WOG (minimum), threaded or flanged connections and TFI seats and seals.

2.5.6 Restrained Pipe Joints

Restrained joint water pipe shall be U.S. Pipe TR FLEX, U.S. Pipe field Loc Gasket, EBBA IRON "Mega-lug System," Griffin Snap Lock, Pacific State Lock Mechanical type, or approved equal. Restrained push-on joints for pipe shall be designed for a water working pressure of 250 psi and shall be capable of being deflected a minimum of 3 degrees per joint, after assembly.

2.5.7 Flange Adapter

Flanged adapters shall only be utilized if no other method is possible. Flange adapters shall be ductile iron manufactured to ASTM A 536 standards. Bolt circles and bolt holes shall meet ASME B16.1 for 125 pounds. Adapter flanges shall meet or exceed all test requirements of AWWA C900, ASTM D 2241 and ASTM D 1599.

2.6 REPORTS

Submit Test Reports. Compaction and density test shall be in accordance with Section 31 00 00 EARTHWORK. Submit Inspection Reports for daily activities during the installation of the sanitary system. Information in the report shall be detailed enough to describe location of work and amount of pipe laid in place, measured in linear feet.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

These general requirements apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 5 feet from the building, unless otherwise indicated. Where the location of the sewer is not clearly defined by dimensions on the drawings, do not lay sewer line closer horizontally than 10 feet to a water main or service line. Install pressure sewer lines beneath water lines only, with the top of the sewer line being at least 1.5 feet below bottom of water line. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 10 feet on each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 3 feet, horizontal distance, to the water line.

a. Sanitary piping installation parallel with water line:

1 Normal conditions: Sanitary piping or manholes shall be laid at least 10 feet horizontally from a water line whenever possible. The distance shall be measured edge-to-edge.

2 Unusual conditions: When local conditions prevent a horizontal separation of 10 feet, the sanitary piping or manhole may be laid closer to a water line provided that:

(aa) The top (crown) of the sanitary piping shall be at least 18 inches below the bottom (invert) of the water main.

(bb) Where this vertical separation cannot be obtained, the sanitary piping shall be constructed of AWWA-approved ductile iron water pipe pressure tested in place without leakage prior to backfilling.

(cc) The sewer manhole shall be of watertight construction and tested in place.

b. Installation of sanitary piping crossing a water line:

1 Normal conditions: Lay sanitary sewer piping by crossing under water lines to provide a separation of at least 18 inches between the top of the sanitary piping and the bottom of the water line whenever possible.

(2 Unusual conditions: When local conditions prevent a vertical separation described above, use the following construction:

(aa) Sanitary piping passing over or under water lines shall be constructed of AWWA-approved ductile iron water pipe, pressure tested in place without leakage prior to backfilling.

(bb) Sanitary piping passing over water lines shall, in addition, be protected by providing:

(1). A vertical separation of at least 18 inches between the bottom of the sanitary piping and the top of the water line.

(2). Adequate structural support for the sanitary piping to prevent excessive deflection of the joints and the settling on and breaking of the water line.

(3). That the length, minimum 20 feet, of the sanitary piping be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the water line.

c. Sanitary sewer manholes: No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 00 00 EARTHWORK.

3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are

as indicated. Laser beam method may be used in lieu of batterboards for the same purpose. Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of [ASTM D 2680](#); saddles for ABS pipe shall comply with Table 3 of [ASTM D 2751](#); and saddles for PVC pipe shall conform to Table 4 of [ASTM D 3034](#).

3.1.1.4 Connections to Existing Lines

Obtain approval from the Contracting Officer before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

3.1.2 Special Requirements

3.1.2.1 Installation of Ductile Iron Gravity Sewer Pipe

Unless otherwise specified, install pipe and associated fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of [AWWA C600](#) for pipe installation and joint assembly.

- a. Make push-on joints with the gaskets and lubricant specified for this type joint and assemble in accordance with the applicable requirements of [AWWA C600](#) for joint assembly. Make mechanical-joints with the gaskets, glands, bolts, and nuts specified for this type joint and assemble in accordance with the applicable requirements of [AWWA C600](#) for joint assembly and the recommendations of Appendix A to [AWWA C111/A21.11](#).
- b. Exterior protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet in accordance with [AWWA C105/A21.5](#), using Class A or Class C polyethylene film.

3.1.2.2 Installation of Ductile-Iron Pressure Lines

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of [AWWA C600](#) for pipe installation, joint assembly, and valve-and-fitting installation.

- a. Make push-on joints with the gaskets and lubricant specified for this type joint and assemble in accordance with the applicable requirements of [AWWA C600](#) for joint assembly. Make mechanical-joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of [AWWA C600](#) for joint assembly and the recommendations of Appendix A to [AWWA C111/A21.11](#). Make flanged joints with gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight, taking care to avoid undue strain on flanges, fittings, and other accessories. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. When flanged pipe or fittings have dimensions that do not allow the making of a proper flanged joint as specified, replace it by one of proper dimensions. Assemble joints made with sleeve-type mechanical couplings in accordance with the

recommendations of the coupling manufacturer, as approved.

b. Exterior protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet in accordance with [AWWA C105/A21.5](#), using Class A or Class C polyethylene film.

c. Pipe anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Size and position thrust blocks as indicated. Use concrete conforming to [ASTM C 94/C 94M](#) having a minimum compressive strength of 2,000 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

3.1.2.3 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of [ASTM D 2321](#) for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of [ASTM D 2321](#) for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.1.2.4 Installation of PVC Plastic Pressure Pipe and Fittings

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section; with the requirements of [AWWA C605](#) for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in [AWWA M23](#), Chapter 7, "Installation."

a. Pipe Less Than 4 Inch Diameter:

1 Threaded joints shall be made by wrapping the male threads with joint tape or by applying an approved thread lubricant, then threading the joining members together. The joints shall be tightened with strap wrenches which will not damage the pipe and fittings. The joint shall be tightened no more than 2 threads past hand-tight.

2 Push-On Joints: The ends of pipe for push-on joints shall be beveled to facilitate assembly. Pipe shall be marked to indicate when the pipe is fully seated. The gasket shall be lubricated to prevent displacement. Care shall be exercised to ensure that the gasket remains in proper position in the bell or coupling while making the joint.

b. Pipe 4 Inch Diameter Joints: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to fittings, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of [AWWA C605](#) for laying the pipe and the recommendations in [AWWA M23](#),

Chapter 7, "Installation," for pipe joint assembly. Assemble push-on joints for connection to fittings in accordance with the requirements of [AWWA C605](#) for joining PVC pipe to fittings and accessories and with the applicable requirements of [AWWA C600](#) for joint assembly. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners specified for this type joint and assemble in accordance with the requirements of [AWWA C605](#) for joining PVC pipe to fittings and accessories, with the applicable requirements of [AWWA C600](#) for joint assembly, and with the recommendations of Appendix A to [AWWA C111/A21.11](#). Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel.

c. Pipe anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Size and position thrust blocks as indicated. Use concrete conforming to [ASTM C 94/C 94M](#) having a minimum compressive strength of 2,000 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

3.1.3 Concrete Work

The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

3.1.4 Manhole Construction

Construct base slab of cast-in-place concrete or use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Cast-in-place concrete work shall be in accordance with the requirements specified under paragraph entitled "Concrete Work" of this section. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.

3.1.5 Miscellaneous Construction and Installation

3.1.5.1 Connecting to Existing Manholes

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the

diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

3.1.5.2 Metal Work

a. Workmanship and finish: Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.

b. Field painting: After installation, clean cast-iron frames, covers, gratings, and steps not buried in concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

3.1.6 Sewage Absorption Trench Construction

Grade pipe lines uniformly downward to the outlet. Lay perforated pipe with the perforations downward. Lay drain tile with 1/4 inch open joints. Cover open joints of drain tile with the cover material specified so that it extends not less than 100 degrees on each side of the vertical center line of the tile. Wire covering in place.

3.1.7 Installations of Wye Branches

Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. Perform field tests and provide labor, equipment, and incidentals required for testing, except that water needed for field tests. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.2.2 Tests for Nonpressure Lines

Check each straight run of pipeline for gross deficiencies by holding a

light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line. When pressure piping is used in a nonpressure line for nonpressure use, test this piping as specified for nonpressure pipe.

3.2.2.1 Leakage Tests

Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

a. Infiltration tests and exfiltration tests: Perform these tests for sewer lines made of the specified materials, not only concrete, in accordance with [ASTM C 969](#). Make calculations in accordance with the Appendix to [ASTM C 969](#).

b. Low-pressure air tests: Perform tests as follows:

1 Ductile-iron pipelines: Test in accordance with the applicable requirements of [ASTM C 924](#). Allowable pressure drop shall be as given in [ASTM C 924](#). Make calculations in accordance with the Appendix to [ASTM C 924](#).

2 PVC plastic pipelines: Test in accordance with [UBPPA UNI-B-6](#). Allowable pressure drop shall be as given in [UBPPA UNI-B-6](#). Make calculations in accordance with the Appendix to [UBPPA UNI-B-6](#).

3.2.2.2 Deflection Testing

Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads determined in accordance with [ASTM D 2412](#). Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection measuring device.

a. Pull-through device: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided the device meets the applicable requirements specified in this paragraph, including those for diameter of the device, and that the mandrel has a minimum of 9 arms. Ball, cylinder, or circular sections shall conform to the following:

1 A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.

2 Homogeneous material throughout, shall have a density greater

than 1.0 as related to water at 39.2 degrees F, and shall have a surface Brinell hardness of not less than 150.

3 Center bored and through-bolted with a 1/4 inch minimum diameter steel shaft having a yield strength of not less than 70,000 psi, with eyes or loops at each end for attaching pulling cables.

4 Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

b. Deflection measuring device: Sensitive to 1.0 percent of the diameter of the pipe being tested and shall be accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved prior to use.

c. Pull-through device procedure: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions.

d. Deflection measuring device procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, replace pipe which has excessive deflection and completely retest in same manner and under same conditions.

3.2.3 Tests for Pressure Lines

Test pressure lines in accordance with the applicable standard specified in this paragraph, except for test pressures. For hydrostatic pressure test, use a hydrostatic pressure 50 psi in excess of the maximum working pressure of the system, but not less than 100 psi, holding the pressure for a period of not less than one hour. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test. Test ductile-iron pressure lines in accordance with the requirements of AWWA C600 for hydrostatic testing. Leakage on ductile-iron pipelines with mechanical-joints or push-on joints shall not exceed the amounts given in AWWA C600; allow no leakage at joints made by other methods. Test PVC plastic pressure lines in accordance with the requirements of AWWA C605 for pressure and leakage tests, using the allowable leakage given therein.

3.2.4 Field Tests for Concrete

Field testing requirements are covered in Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE.

-- End of Section --

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PACKAGED SEWAGE LIFT STATIONS, WET WELL TYPE
11/14

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C500	(2009) Metal-Seated Gate Valves for Water Supply Service
AWWA C509	(2015) Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A126	(2004; R 2014) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel
ASTM A615/A615M	(2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C478	(2015a) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C478M	(2015a) Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C618	(2012a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C989/C989M	(2014) Standard Specification for Slag Cement for Use in Concrete and Mortars

HYDRAULIC INSTITUTE (HI)

HI M100 (2009) HI Pump Standards Set

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.11 (2012) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 1940-1 (2005) Mechanical Vibration - Balance Quality Requirements for Rotors in a Constant (Rigid) State - Part 1: Specification and Verification of Balance Tolerances

UNDERWRITERS LABORATORIES (UL)

UL 1449 (2014; Reprint Mar 2016) UL Standard for Safety Surge Protective Devices

1.2 SUBMITTALS

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

SD-01 Preconstruction Submittals

Material, Equipment, and Fixtures List; G

SD-02 Shop Drawings

Fabrication Drawings; G

Erection/Installation Drawings; G

SD-03 Product Data

Spare Parts Data; G

Manhole Chambers; G

EPA-CPG Compliance; G

Entrance Covers; G

Pumps; G

Pump Controls; G

Impellers; G

Couplings; G

Bearings; G

Stuffing Boxes; G

Gate Valves; G

Check Valves; G

Electric Motors; G

SD-05 Design Data

Motor/Pumps; G

SD-06 Test Reports

Pump Test; G

Hydrostatic Pressure Test; G

Pressure Sensor Test; G

Float Test; G

SD-07 Certificates

Listing of Product Installations; G

Recycled Material Content; G

Manhole Chambers; G

Entrance Covers; G

Pumps; G

Gate Valves; G

Check Valves; G

Electric Motors; G

SD-08 Manufacturer's Instructions

Manhole Chambers; G

Entrance Covers; G

Pumps; G

Pump Controls; G

Gate Valves; G

Check Valves; G

Electric Motors; G

Special Tools; G

Posted Instructions; G

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G

Preventative Maintenance and Inspection Procedure; G

SD-11 Closeout Submittals

Warranty; G

1.3 QUALITY CONTROL

Submit a [listing of product installations](#) similar to the package lift station being installed.

Verify conformance of materials and equipment for package lift station to the referenced publications or as specified. Verify that the manufacturer is regularly engaged in the manufacture of such products.

Submit manufacturer's data indicating percentage of [recycled material content](#) in packaged sewage lift stations to verify affirmative procurement compliance.

Fly ash is required as an admixture and is to conform to [ASTM C618](#), Class F. Fly ash replacement of cement is not to exceed 20 percent (maximum one part fly ash to four parts cement) by weight.

Ground granulated blast furnace slag used as an admixture and is to conform to [ASTM C989/C989M](#), Grade 120 with between 25 to 50 percent maximum cement replacement by weight. Submit certificate to verify [EPA-CPG compliance](#).

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves free of dirt and debris.

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.

1.5 WARRANTY

Provide a manufacturers' [warranty](#) for pumps, float switches, control panel. Create a list or reference all specific operation and maintenance procedures that are required to keep the warranty valid.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide each station with two pumps with controls capable of operating the pumps either simultaneously or individually, depending on the load

conditions.

Furnish and install each lift station as a complete unit with necessary appurtenances all designed for the following:

Service life - 15 years

Pump capacity - (as indicated on drawings) gallons per minute (gpm)

Total head - (as indicated on drawings) feet

Submit fabrication drawings after receiving tentative approval of the equipment and the materials list but before installation. Submit drawings covering necessary or recommended changes to accommodate the equipment offered. Show on the drawings the design of the chamber, with dimensions, types, and thicknesses of materials, and elevation levels with reference to those elevations indicated.

Submit erection/installation drawings for the manhole chamber with the required equipment and accessories. Provide precast reinforced concrete manhole sections conforming to ASTM C478M and ASTM C478. Show the design of the chamber, with dimensions, types, and thicknesses of materials, and elevation levels with reference to those elevations indicated.

Provide the following motor/pumps design information prior to final turnover - number of motor rotor bars and stator slots; number of cooling fan blades; RPM of motor; bearings, bearing manufacturer, bearing type, bearing style and number of balls/elements; number of commutator bars and commutator brushes; SCR firing frequencies; and number of pump impellers.

2.1.1.1 Design Requirements

2.1.1.1.1 Pump Construction

Fabricate castings in cast iron or steel free from injurious defects. Design castings to permit easy replacement of parts. Gasket all joints to prevent leakage. Design and install passageways to permit the smooth flow of sewage and free from sharp turns and projections. Provide pump castings with cleanout plates in the suction line and drain plugs.

a. Electric Motors

Provide 60-hertz, 3-phase motors.

b. Impellers

Fabricate impellers in cast iron, cast steel, or an alloy suitable for the service required. Provide free flowing impellers which permit objects in the sewage that enter the pump to pass into the discharge pipe. Provide each impeller keyed, splined, or threaded on the shaft and locked in such manner that lateral movement is prevented and reverse rotation can not cause loosening.

c. Couplings

Provide heavy-duty flexible type couplings, keyed to the shaft. Provide universal type couplings for vertical pumps.

d. Shaft Sleeves

Protect the shaft from the liquid being pumped, points in contact with the stuffing boxes, and other wearing parts with sleeves designed in bronze or a suitable alloy.

e. [Stuffing Boxes](#)

Grease-seal stuffing boxes with a seal ring, designed to ensure tight packing without excessive wear or friction on the shafts, and prevent the leakage of air or water. Provide split type glands which can be easily removed for repacking.

f. [Balance](#)

Balance rotating parts of the equipment mechanically and hydraulically to operate throughout the required range without excessive end thrust, vibration, and noise. Conform allowable vibration limits with [ISO 1940-1](#), Table 1. Existence of defects that cannot be eliminated by adjustment will be sufficient cause for rejection of the equipment.

g. [Shafts](#)

Provide high-grade steel shafts of a size and strength to perform the work required.

h. [Bearings](#)

Provide ball or roller type main bearings to withstand radial and end thrust. Pumps dependent upon hydraulic balance are prohibited.

i. [Lubrication](#)

Provide self lubricating, permanently sealed bearings.

2.2 COMPONENTS

Submit a [material, equipment, and fixtures list](#) of all major components including manufacturer's catalog numbers, specification and drawing reference number, warranty information, and fabrication site.

2.2.1 Wet Well Base Material

Provide crushed stone as indicated and specified in Section [31 00 00 EARTHWORK](#). Provide polyethylene vapor barrier as indicated and specified in Section [03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE](#).

2.2.1.1 Wet Well

Provide fiberglass reinforced polyester resin basin or concrete wet well with inside diameter as indicated. Precast structures may be provided in lieu of cast-in-place structures.

2.2.2 [Entrance Covers](#)

2.2.2.1 Access Hatch Cover

Provide aluminum access hatch cover as indicated. Include lifting mechanism, automatic hold open arm, slam lock with handle, and flush lift handle. Use automatic hold open arm that locks in the 90 degree position.

Use access hatch cover capable of withstanding a live load of 300 lbs./sq. ft. Provide stainless steel cylinder lock with two keys per lock. Key all the locks the same.

2.2.2.3 Manhole Chamber

Submit information on manhole chambers, including: base, entrance tube, air ducts, and similar structural parts, with steel conforming to ASTM A36/A36M, ASTM A615/A615M. Protect steel from corrosion by means of hot-dip galvanizing conforming to ASTM A123/A123M epoxy-resin coatings.

2.2.2.4 Pumps

Provide pumps of the nonclogging, centrifugal type designed to pump unscreened sewage. Provide pumps with a rated capacity as specified and is capable of passing 3-inch solids. Conform to the requirements of HI M100.

2.2.4.1 Alternator

Provide an alternator control switch to operate in connection with each float. Use an alternator control switch to alternate the operation of the pumps and operate both pumps if the water level rises above the second high water level. Incorporate time delay function and devices in the alternator controls such that both sewage pumps cannot be started simultaneously for an adjustable period of 10 to 120 seconds after shutdown. Use the delay function designed to operate in any condition of start-up in either normal or emergency operational mode.

2.2.2.5 Valves

2.2.5.1 Gate Valves in Valve Vault

Conform to AWWA C500 for gate valves with outside-screw-and-yoke rising-stem type with double disc gates and flanged ends. Conform to AWWA C509 for valves with outside-screw-and-yoke rising-stem type with flanged ends. Provide valves with handwheels that open by counterclockwise rotation of the valve stem. Bolt and construct stuffing boxes to permit easy removal of parts for repair. Use valves from one manufacturer.

2.2.5.2 Check Valves Less than 4-Inch Diameter

Provide neoprene ball check valve with integral hydraulic sealing flange, designed for a hydraulic working pressure of 175 psi.

2.2.5.3 Check Valves 4-Inch and Larger Diameter

Provide nonclogging swing check valve rated for not less than 175 psig working pressure capable of passing 3-inch diameter solids. Cast iron conforming to ASTM A126. Buna-N disc and integral seat. Flanged ends conforming to AWWA C110/A21.10.

Provide a positive horizontal, swing check type check valves. Provide valves that permit a free flow of sewage forward and a positive check against backflow. Provide iron body valves with a removable cover for inspection and removal of the gate assembly. Provide bronze gate, gate seats, shaft, studs, and nuts.

2.2.6 Piping

Provide force mains in accordance with Section 33 34 00 FORCE MAINS AND INVERTED SIPHONS; SEWER.

2.2.6.1 Piping Connections

Provide pump suction and discharge with flanged connections of the proper size for the pump type and capacity. Provide between pipes of dissimilar metals a rubber gasket or other approved type of insulating joint or dielectric coupling to effectively prevent metal-to-metal contact between adjacent sections of piping.

2.2.6.2 Accessories

Provide flanges, connecting pieces, transition glands, transition sleeves, and other adapters as required.

2.2.6.3 Flexible Flanged Coupling

Provide flexible flanged couplings applicable for sewage as indicated. Use flexible flanged coupling designed for a working pressure of 350 psi.

2.2.7 Nameplates

Provide the manufacturer's name or trademark on a corrosion-resistant identification plate or cast integrally, on each item of equipment, stamped, or otherwise permanently marked in a conspicuous place. Include on the pump identification plate the pump capacity in gpm, pump head in feet and speed of rotation. Cast on the body of the pump the direction of rotation.

2.2.8 Pump Controls

2.2.8.1 General

Pump operating controls provided by the pump supplier and are the automatic type including all necessary components to function reliably. Mount controls in a NEMA 4X rated stainless steel control panel. Ensure equipment subject to contact with sewage or sewage gases is corrosion-resistant metal. Provide an electronic controller that automatically activates and alternates the pump operation. If the liquid level continues to rise to the plans-specified level, the controller engages both pumps to operate simultaneously until both shut off at the specified low level. Provide hand-off-auto switches to choose the mode of operation for each pump. Provide controls with a 12 VDC powered float switch connected to the alarm contact of the battery charger to activate high-level alarms.

Protect pumping stations from lightning and transient voltage surges and equip with phase protection.

Provide the station with a three-wire, 4-pole (grounding) receptacle for a portable generator in case there is an external power outage.

Design the control system to operate two (2) pumps at power characteristics as shown on the plans. Ensure all controls and wiring meet or exceed the requirements of the National Electrical Code (NEC), Latest Edition.

For pumps specified as explosion proof, have pump power and control installation meets NEC requirements for Class 1, Division 1, Group D Hazardous Location, including intrinsically safe controls. Provide components that are UL listed or FM approved.

Require the control function to provide for the operation of the pumps under normal conditions and alternates the pumps on each pump down cycle.

In the event the incoming flow exceeds the pumping capacity of the lead pump, the offline pumps automatically start to handle the increased flow. As the flow decreases, the pumps cut off at the elevations set on the controller.

2.2.8.2 Enclosure

Provide a NEMA 4X rated enclosure manufactured from stainless steel. The enclosure is a wall mount type suitable for mounting on strut or channel with a minimum depth sized to adequately house all the components. Provide a rubber composition door gasket and assures a positive weatherproof seal. Provide a door that opens a minimum of 180 degrees and is equipped with a 3-point latch and padlockable handle.

Provide a dead front mounted in the panel to provide protection of personnel from live internal wiring. Install cutouts for breaker handles to allow operation of breakers without entering the compartment.

Mount all control switches, indicator pilot lights, elapsed time meters, duplex receptacle and other operational devices on the external surface of the dead front.

Ensure the dead front opens a minimum of 150 degrees to allow access to equipment for maintenance.

Manufacture the back plate from 12-gauge (minimum) steel and finished with a primer coat and two (2) coats of baked on white enamel. Mount all hardware to the subpanel with machine thread tapped holes. Sheet metal screws are not acceptable. Permanently identify all devices to match the schematic diagram.

Provide an enclosure ventilator located near the top of the enclosure on the opposite side of the generator receptacle. Provide a rain and vermin proof ventilator and made of fire retardant thermoplastic material.

2.2.8.3 Power Distribution

Provide a panel power distribution that includes all necessary components and is completely wired with stranded copper conductors rated at 194 degrees F. Install all conductor terminations as recommended by the device manufacturer.

Provide a main and emergency circuit breaker in the control panel. Provide a mechanical interlock between the main and emergency breakers to prevent simultaneous operation of both power sources.

Provide heavy duty thermal magnetic circuit breakers with a minimum of 10,000 amps interrupting capacity at 230 volts and 14,000 amps at 480 volts.

Size each motor breaker to meet the pump motor operating characteristics. Individually protect the control circuit and the duplex receptacle by

circuit breakers.

Install indicating type circuit breakers, providing "On/Off/Trip" positions of the operating handle. When the breaker is tripped automatically, the handle assumes a middle position indicating "Trip".

Provide quick-make and quick-break thermal magnetic breakers on manual and automatic operation and have inverse time characteristics secured through the use of bimetallic tripping elements supplemented by a magnetic trip for instantaneous protection. Design breakers so that an overload on one pole automatically trips and opens all legs. Field installed handle ties are not acceptable.

Ensure motor starters are open frame, across the line, full voltage, NEMA rated with individual overload protection for each phase. Ensure motor starter contact and coil is replaceable from the front of the starter without removing from its mounted position.

Provide motor overload protection via melting alloy type thermal overload relays. Provide overloads that are interchangeable and sized per NEC.

Provide control transformers for 120 VAC requirements in the control panel. Provide fused transformers and the secondaries grounded.

Provide incoming power with both lightning surge arresters (line side, [IEEE C62.11](#)) and transient voltage surge suppression (load side, [UL 1449](#)). Use solid state devices with LED indicator lights for power and protective status. As a minimum, rate devices for 50,000 amps per phase with response time less than 5nSec.

Install a line voltage rated, solid-state, adjustable, plug-in monitor to sense reversed or loss of a phase. Ensure the control circuit de-energizes upon sensing any of the faults and automatically restores service upon return to normal power.

2.2.8.4 Alarm System

Provide a weatherproof-shatterproof red strobe alarm light fixture rated at 100,000 peak candle power, 12 VDC, 80 flashes per minute to indicate alarm conditions.

Mount the alarm horn on the exterior of the cabinet. The alarm horn provides a signal of not less than 90db at [10 feet](#). Deactivate the alarm horn with an alarm silence switch, however, the alarm light flashes until the alarm condition ceases to exist. At that time the alarm reset function resets for normal operation.

The alarm circuitry is 12 VDC, powered by a battery operated alarm with charger with plug-in base, solid state circuitry and push to test switch. Battery is rated for 7.0 amp-hours minimum. Alarm horn and light are activated via the battery charger upon either loss of utility power or a high level condition in the wet well.

2.2.8.5 Control System

Provide a control system for the automatic and manual control and alternation of the pumps to maintain a pumped down condition of the wet well.

Provide control of duplex pumps by an electronic alternating controller with digital level display. For locations specified for explosion proof pumps, design system for installation in a Class 1, Division 1, Groups A, B, C, and D hazardous area and be intrinsically safe. Ensure submersible pressure transmitter sends a 4-20mA input to controller.

As the level in the wet well rises, the lead pump as determined by the alternator, starts and pump the station to the "off" position. In the event the incoming flow exceeds the capacity of the lead pump, the lag pump starts and both pumps run to the off level. The alternator switches when the off level is reached.

If the level continues to rise, alarm functions are activated via a high-level float switch (intrinsically safe for Class I, Division 1, hazardous installations).

Suspend the submersible level sensor on its cable, and run inside a 2-inch Schedule 40 PVC pipe, which is attached under the lid of the wet well by stainless steel(SS) clamps and SS unistrut. Ensure the pipe reaches to the bottom of the wet well. Perforate the bottom 12-inch of pipe with 3/8-inch holes spaced 1-inch apart. Suspend the high level float on its cable from the strut on the top.

2.2.8.6 Float Assembly Description

Use a direct acting float switch consisting of a normally-open mercury switch enclosed in a float. Use pipe mounted float assembly. Use float molded of rigid high-density polyurethane foam, color-coded and coated with a durable, water and corrosion-resistant jacket of clear urethane. Provide connecting cable and support pole in accordance with manufacturers recommendations. Provide a cast aluminum NEMA Type 4 junction box to connect float assembly. Use box with a gasketed cover with tapped float fitting and conduit entrance pipe threaded opening. Mount floats at fixed elevations as shown. Use floats designed to tilt and operate their switches causing sequential turn-on turn-off of the pump, when the liquid level being sensed rises or falls past the float.

2.2.8.7 Pressure Sensor Description

Provide the pump station with a submersible pressure type level sensor and an electronic pump controller. Sense levels by a 24 DVC, 1 Percent submersible pressure transmitter provided by controller manufacturer. Construct the system as follows:

- a. The pressure type level sensor is a submersible type, suspended on its cable.
- b. Install the sensor per manufacturer's instructions for wet well installations, including any recommended mounting accessories.
- c. The level sensor is as follows:
 - (1) Select the sensor range based on the wet well depth.
 - (2) The sensor output is 4-20mA proportional to water level, 2-wire type.
 - (3) Construct all exposed parts of 316 Stainless Steel

- (4) Fill the sensor with Silicon Oil
- (5) Power the Sensor by 24 VDC output from electronic pump controller.
- d. Mount the electronic pump controller in the starter panel enclosure, and be visible from the front of the swing-out panel, with the enclosure door opened. The electronic pump controller is as follows:
 - (1) Accept a 4-20 mA, 2 wire level signal, and indicate the wet well level digitally in direct engineering units (feet).
 - (2) Provide pump control outputs, with independent adjustment for each pump starting and stopping setpoint. Indicate each level setpoint digitally in direct engineering units.
 - (3) Power to the unit is 120 VAC.
 - (4) Equip controller with H.O.A. switches and pump on indicating lights (one each per pump).

2.2.8.8 Ancillary Equipment

The control system includes, but not be limited to:

- a. An elapsed time meter for each pump mounted on the dead front door. The meter operates on 120 VAC, and indicate run time in hours, have LCD Display and is not resettable.
- b. A weatherproof generator receptacle rated 100A is required.
- c. Control wire is a minimum 18 AWG. Route all control wires through a plastic wireway with snap on covers, bundled and tie wrapped to form a neat assembly.
- d. Provide a duplex, 15 amp, GFI receptacle providing 120 volts, 60 hertz, single phase power inside the panel on the deadfront door.
- e. 1-N/O and 1-N/C unpowered contact for high level, power/control power failure, and pump run indication wired to terminal strip.
- f. Identification plate engraved to show white letters on a black background. Letters are uppercase. Identification Plate to indicate "LIFT STATION CONTROL PANEL" system voltage (e.g. 208V, 3PH or 480V, 3PH), and power source.
- g. Pump seal failure indication.
- h. Time delay relay to prevent pumps from starting simultaneously.

2.3 PAINT

Treat and paint equipment in accordance with the manufacturer's standard practice for sewage resistance.

PART 3 EXECUTION

3.1 INSTALLATION

Install lift station as indicated, in accordance with drawings and the

manufacturer's instructions. Dampen and isolate equipment vibration.

3.1.1 Protection from Moving Parts

Locate guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts in accordance with applicable OSHA standards and so that personnel are properly protected from injury.

3.1.2 Valves

Install gate valves conforming to AWWA C500 in accordance with AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install gate valves conforming to AWWA C509 in accordance with AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509.

Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation, except as otherwise indicated. Make and assemble joints to gate valves and check valves as specified for making and assembling the same type joints between pipe and fittings.

3.1.3 Piping

Terminate discharge lines 5-feet outside the lift station in flanged connections. Include the pipe from the wet well manhole in the suction line.

3.1.4 Miscellaneous

Attach a final as built drawing, laminated in mylar, to the inside of the front door and shown on the as-built drawings. Include a list of all legends. Identify the pump nameplate data on the drawing and on the as-built plans.

Permanently mark all component parts in the control panel and identified as they are indicated on the drawing. Mark on the back plate adjacent to the component. Identify all control conductors with wire markers at each end as close as practical to the end of conductor.

3.2 FIELD QUALITY CONTROL

3.2.1 Tests

Perform tests, including hydrostatic pressure test of piping, under a test pressure equal to 50 percent more than the pump discharge pressure or total dynamic head, whichever is greater. Perform a pump test, pressure sensor test, float test. Submit the test results to the Contracting Officer.

Test all panels to the power requirements as shown on the plans to assure proper component operation. Activate each control function to check for proper operation and indication.

3.2.2 Field Representative

A representative of the lift station manufacturer is to direct the startup of the station and instruct representatives of the Government in startup

and operation procedures.

3.3 CLOSEOUT ACTIVITIES

3.3.1 Operation and Maintenance

Submit [preventative maintenance and inspection procedure](#) for package lift stations. Include in procedures the frequency of preventative maintenance, inspection, adjustment, lubrication, and cleaning necessary to minimize corrective maintenance and repair.

Supply [special tools](#) that are required for maintenance and testing of the package lift stations.

Submit [spare parts data](#), including a complete list of parts and supplies with current unit prices and source of supply. List parts and supplies that are either normally furnished at no extra cost with the purchase of equipment, or specified to be furnished as a part of the contract, and list additional items recommended by the manufacturer to ensure an efficient operation for a period of one year.

Install on or near the package lift stations, a complete package of [posted instructions](#), consisting of labels, signs, and templates of operating instructions.

Submit [operation and maintenance manuals](#) for package lift stations, including Equipment Description, Assembly and Installation Procedures, Adjustment and Alignment, Checkout Procedures, Procedures of Operation and Troubleshooting.

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SECTION 33 34 00

FORCE MAINS AND INVERTED SIPHONS; SEWER
04/08

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO HB-17 (2002; Errata 2003; Errata 2005, 17th Edition) Standard Specifications for Highway Bridges

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 6D (2014; Errata 1-2 2014; Errata 3-6 2015; ADD 1 2015; ADD 2 2016; Errata 7 2016; Errata 8 2016) Specification for Pipeline Valves

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C105/A21.5 (2010) Polyethylene Encasement for Ductile-Iron Pipe Systems

AWWA C110/A21.10 (2012) Ductile-Iron and Gray-Iron Fittings for Water

AWWA C111/A21.11 (2012) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

AWWA C115/A21.15 (2011) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges

AWWA C151/A21.51 (2009) Ductile-Iron Pipe, Centrifugally Cast, for Water

AWWA C200 (2012) Steel Water Pipe - 6 In. (150 mm) and Larger

AWWA C203 (2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

AWWA C207 (2013) Standard for Steel Pipe Flanges for Waterworks Service-Sizes 100 mm through 3600 mm 4 in. through 144 in.

AWWA C208 (2012) Standard for Dimensions for

Fabricated Steel Water Pipe Fittings

AWWA C210	(2007) Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
AWWA C500	(2009) Metal-Seated Gate Valves for Water Supply Service
AWWA C508	(2009; Addenda A 2011) Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS
AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C900	(2016) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm)
AWWA M23	(2002; 2nd Ed) Manual: PVC Pipe - Design and Installation

ASME INTERNATIONAL (ASME)

ASME B16.1	(2015) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM D1785	(2012) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2122	(2016) Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
ASTM D2241	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2464	(2015) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2564	(2012) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2657	(2007; R 2015) Heat Fusion Joining Polyolefin Pipe and Fittings

ASTM D2774	(2012) Underground Installation of Thermoplastic Pressure Piping
ASTM D3035	(2015) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3139	(1998; R 2011) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3308	(2012) PTFE Resin Skived Tape
ASTM D3350	(2012) Polyethylene Plastics Pipe and Fittings Materials
ASTM D4101	(2014; E 2016) Standard Specification for Polypropylene Injection and Extrusion Materials
ASTM D4161	(2014) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals
ASTM F477	(2014) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA TRD	(2006) Thrust Restraint Design for Ductile Iron Pipe
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MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-78	(2011) Cast Iron Plug Valves, Flanged and Threaded Ends
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1.2 SUBMITTALS

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

SD-06 Test Reports

Hydrostatic Tests.

1.3 DELIVERY, STORAGE, AND HANDLING

Do not damage pipe, fittings and accessories, and pipe coatings during delivery, handling, and storage.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

Piping for force mains less than 4 inches in diameter shall be galvanized steel, polyvinyl chloride (PVC) plastic, polyethylene (PE) plastic or polypropylene plastic. Piping for force mains 4 inches in diameter and larger shall be ductile iron, steel, PVC plastic piping 4 inches in diameter and larger inside pump stations shall be ductile iron or PVC pipe with bolted flange joints. Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 PE Pipe

ASTM D3350 and ASTM D3035, minimum pressure rating of 100 psi at 73.4 degrees F.

2.1.1.2 Polypropylene Pipe

ASTM D2122 and ASTM D4101.

2.1.1.3 PVC Pipe

a. PVC Pipe and Fittings Less Than 4 inches Diameter: ASTM D1785, Schedule 80 or ASTM D2241, SDR 21 with screw joints, push-on joints, or solvent weld joints.

b. PVC Pipe and Fittings 4 inches Diameter and Larger: ASTM D2241, SDR 21 or AWWA C900, Class 150 with push-on joints.

2.1.2 Ductile Iron Pipe

a. Ductile Iron Pipe: AWWA C151/A21.51, working pressure not less than 150 psi, unless otherwise shown or specified.

b. River Crossing Pipe: AWWA C151/A21.51, minimum thickness Class 54 with joints in compliance with applicable requirements of AWWA C110/A21.10.

c. Fittings, Mechanical: AWWA C110/A21.10, rated for 150 psi.

d. Fittings, Push-On: AWWA C110/A21.10 and AWWA C111/A21.11, rated for 150 psi.

2.1.3 Steel Pipe

a. Steel Pipe, 6 inches Diameter and Larger: AWWA C200.

b. Steel Pipe Less Than 6 inches Diameter: ASTM A53/A53M, standard weight, threaded end, galvanized.

c. Fittings, 6 inches Diameter and Larger: AWWA C200, fabricated in compliance with AWWA C208.

d. Fittings Less Than 6 inches Diameter: ASME B16.3, galvanized.

2.2 JOINTS

2.2.1 PE Piping

- a. Heat Fusion Joints: [ASTM D2657](#).
- b. Flanged Joints: [ASME B16.1](#) or [AWWA C207](#).
- c. Mechanical Joints: [ASME B16.1](#).

2.2.2 Polypropylene Piping

Heat Fusion Joints: [ASTM D2657](#).

2.2.3 PVC Piping

- a. Screw Joint Fittings: [ASTM D2464](#), Schedule 80.
- b. Push-On Joint Fittings: [ASTM D3139](#), with [ASTM F477](#) gaskets.
- c. Solvent Cement: [ASTM D2564](#).
- d. Couplings for use with plain end pipe shall have centering rings or stops to ensure the coupling is centered on the joint.

2.2.4 PVC Pipe

Joints shall conform to [ASTM D3139](#). Elastomeric gaskets shall conform to [ASTM F477](#).

2.2.5 Ductile Iron Piping

- a. Push-on Joints: [AWWA C111/A21.11](#).
- b. Mechanical Joints: [AWWA C111/A21.11](#) as modified by [AWWA C151/A21.51](#).
- c. Flanged Joints: [AWWA C115/A21.15](#).

2.2.6 Steel Piping

- a. Push-on Joints: [AWWA C200](#).
- b. Mechanical Joints: [AWWA C200](#).
- c. Flanged Joints: [AWWA C207](#).

2.2.7 RPMP Piping

Joints shall be bell and spigot gasket coupling utilizing an elastomeric gasket in accordance with [ASTM D4161](#) and [ASTM F477](#).

2.3 VALVES

2.3.1 Gate Valves

Gate valves 3 inches and larger shall comply with [AWWA C500](#). Valves for buried service shall be non-rising stem (NRS), 2 inch square nut operated with joints applicable to the pipe or installation. Buried valves shall be furnished with extension stems comprising socket, extension stem and

operating nut, and shall be of an appropriate length to bring operating nut to within 6 inches of grade. One 4 foot "T" handle valve wrench shall be furnished for each quantity of 6 buried valves. Gate valves that are exposed or installed inside shall be outside screw and yoke (OS&Y), handwheel operated with flange ends unless otherwise indicated. Gate valve operating nuts and handwheels shall have an arrow and the word "OPEN" cast in raised letters to indicate the direction of opening. Gate valves 14 inches and larger shall be equipped with gearing to reduce operating effort. Gate valves 14 inches and larger installed in horizontal lines in horizontal position with stems horizontal shall be equipped with bronze track, roller and scrapers to support the weight of the gate for its full length of travel. Gate valves 14 inches and larger installed in vertical pipe lines with stems horizontal shall be fitted with slides to assist the travel of the gate assembly.

2.3.2 Check Valves

Provide check valves that permit free flow of sewage forward and provide a positive check against backflow. Design check valves for a minimum working pressure of 150 psi or as indicated. The body shall be iron. The manufacturer's name, initials, or trademark and also the size of the valve, working pressure, and direction of flow shall be directly cast on the body.

- a. Ball Check Valves shall be iron body, shall have flanged ends, and shall be the non-slam type. Flanges shall be the 125 pound type complying with ASME B16.1. Ball shall be stainless steel unless otherwise specified.
- b. Swing Check Valves shall comply with AWWA C508 and shall be iron body, bronze mounted, and shall have flanged ends. Flanges shall be the 125 pound type complying with ASME B16.1.

2.3.3 Plug Valves

Cast iron valves shall comply with MSS SP-78. Steel plug valves shall comply with API Spec 6D.

2.3.4 Pinch Valves

Pinch valves shall be double acting, jam-proof type with unobstructed streamlined flows and built-in operator. The body shall be iron with a non-rising handwheel. The sleeve shall be of pure gum rubber, neoprene, Buna N or hypalon as required for service. The valve shall have flanged ends. Flanges shall be of the 125 pound type complying with ASME B16.1.

2.3.5 Air Release Valves

Air release valves shall be designed to permit release of air from an empty pipe during filling and shall be capable of discharging accumulated air in the line while the line is in operation and under pressure. Valves shall be attached by means of threaded pipe connections. Valves shall be vented to the atmosphere.

- a. Manual Air Release Valves: Manual air release valves shall consist of a 3 inch gate valve and 3 inch ductile iron pipe and fittings. The valve shall be installed with its line of flow in the horizontal position.
- b. Automatic Air Release Valve: Automatic air release valves shall be

of the compound lever type capable of withstanding operating pressures of 150 psi. The valves shall have a 1/2 inch outlet. The body and cover of the valve shall be of iron with a stainless steel float. All internal parts shall be stainless steel or bronze. The valve shall be specifically adapted for use with sewage. Each valve shall be complete with hose and blow-off valves to permit backflushing without dismantling the valve.

2.4 VALVE VAULTS

Cast iron or concrete, except design concrete vaults installed in locations subject to vehicular traffic to withstand the following H-20 AASHTO load designation as outlined in AASHTO HB-17.

2.5 MISCELLANEOUS MATERIALS

Miscellaneous materials shall comply with the following requirements:

2.5.1 Pipe Coatings and Linings

- a. Steel, interior: AWWA C203 or AWWA C210.
- b. Steel, exterior, buried: AWWA C203.
- c. Steel, exterior, exposed: AWWA C210.

2.5.2 Joint Lubricants

Joint lubricants shall be as recommended by the pipe manufacturer.

2.5.3 Bolts, Nuts and Glands

AWWA C111/A21.11.

2.5.4 Joint Compound

A stiff mixture of graphite and oil or inert filler and oil.

2.5.5 Joint Tape

ASTM D3308.

2.5.6 Bond Wire

Bond wire type RHW or USE, Size 1/0 AWG, neoprene jacketed copper conductor shaped to stand clear of the joint.

PART 3 EXECUTION

3.1 INSTALLATION

Pipe, pipe fittings, and appurtenances shall be installed at the locations indicated. Excavation, trenching, and backfilling shall be as specified in Section 31 00 00 EARTHWORK.

3.1.1 Adjacent Facilities

Installation of force mains and inverted siphons near adjacent facilities shall be as specified in Section 33 30 00 SANITARY SEWERS.

3.1.2 Cutting

Pipe shall be cut in a neat manner with mechanical cutters. Wheel cutters shall be used where practicable. Sharp and rough edges shall be ground smooth and loose material removed from the pipe before laying.

3.1.3 Laying

Except where otherwise authorized, pipe shall be laid with bells facing the direction of laying. Before lowering and while suspended, the pipe shall be inspected for defects. Defective material shall be rejected. Pipe shall be laid in compliance with the following:

- a. Ductile Iron: [AWWA C600](#).
- b. Steel: [AWWA C600](#).
- c. Polyvinyl Chloride: Manufacturer's instructions.
- d. Polyethylene: [ASTM D2774](#).
- e. Polypropylene: [ASTM D2774](#).

3.1.4 Jointing

3.1.4.1 Joints for PE Pipe

Heat fusion joints shall comply with the manufacturer's instructions concerning equipment, temperature, melt time, heat coat, and joining time. Flanged and mechanical joints shall be made in compliance with the manufacturer's instructions.

3.1.4.2 Joints for Polypropylene Pipe

Heat fusion joints shall comply with the manufacturer's instructions concerning equipment, temperature, melt time, heat coat, and joining time.

3.1.4.3 Joints for PVC Pipe

- a. Threaded joints shall be made by wrapping the male threads with joint tape or by applying an approved thread lubricant, then threading the joining members together. The joint shall be tightened with strap wrenches which will not damage the pipe and fittings. The joint shall be tightened no more than 2 threads past hand-tight.
- b. Push-on joints: The ends of pipe for push-on joints shall be beveled to facilitate assembly. Pipe shall be marked to indicate when the pipe is fully seated. The gasket shall be lubricated to prevent displacement. The gasket shall remain in proper position in the bell or coupling while the joint is made.
- c. Solvent-weld joints shall comply with the manufacturer's instructions.

3.1.4.4 Joints for Ductile Iron Pipe

Installation of mechanical and push-on type joints shall comply with [AWWA C600](#) and the manufacturer's instructions. Installation of flanged

joints shall comply with manufacturer's instructions.

3.1.4.5 Joints for Steel Pipe

Screw joints shall be made tight with joint tape or joint compound applied with a brush to the male threads only. Installation of mechanical joints, push-on joints, and flanged joints shall comply with the manufacturer's instructions.

3.1.5 Coating and Lining

Field coating of non-galvanized steel pipe shall comply with AWWA C203. The applied materials shall be tested by means of a spark-type electrical device in compliance with AWWA C203. Flaws and holidays in the coating or lining of the pipe and the pipe joints shall be repaired; the repaired areas shall be at least equal in thickness to the minimum required for the pipe.

3.1.6 PE Pipe Encasement

When installed underground, pipe shall be encased with 8 mil thick polyethylene in accordance with AWWA C105/A21.5.

3.1.7 Installation of Valves

Prior to installation, valves shall be cleaned of all foreign matter and inspected for damage. Valves shall be fully opened and closed to ensure that all parts are properly operating. Valves shall be installed with the stem in the vertical position.

3.1.8 Installation of Valve Boxes

Valve boxes shall be installed over each outside gate valve, unless otherwise indicated. Valve boxes shall be centered over the valve. Fill shall be carefully tamped around each valve box to a distance of 4 feet on all sides or to undisturbed trench face, if less than 4 feet.

3.1.9 Installation of Valve Vaults

Valve vaults shall be installed as indicated.

3.1.10 Drain Lines

Drain lines shall be installed where indicated. The drain line shall consist of a tee in the main line with a 4 inch diameter branch, a 4 inch diameter elbow, and a 4 inch gate valve.

3.1.11 Thrust Restraint

Plugs, caps, tees and bends deflecting 11-1/4 degrees or more, either vertically or horizontally, shall be provided with thrust restraint. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for ductile-iron and PVC pipes, restrained joints.

3.1.11.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than

2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.11.2 Restrained Joints

For ductile iron or PVC pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with DIPRA TRD or AWWA M23.

3.1.12 Grout

Grout for exterior joint protection on concrete pipes shall be a mix of 1 part portland cement, 2 parts sand, and of sufficient liquid consistency to flow into the joint recess beneath the diaper. Grout for interior joint protection shall be a mix of 1 part portland cement and 1 part sand. A polyurethane foam loop, impregnated with portland cement, may be substituted for grout for exterior joints.

3.1.13 Bonded Joints

Where indicated, a metallic bond shall be provided at each joint, including joints made with flexible couplings or rubber gaskets, of ferrous-metallic piping to effect continuous conductivity. The bond shall be of the thermal-weld type.

3.2 HYDROSTATIC TESTS

The pipeline shall be subjected to both a pressure test and a leakage test. The method proposed for disposal of waste water from hydrostatic tests shall be approved by the Contracting Officer. Testing is the responsibility of the Contractor. The Contracting Officer shall be notified at least 7 days in advance of equipment tests. The final test report shall be delivered to the Contracting Officer within 30 days of the test.

3.2.1 Pressure Test

After the pipe has been installed, joints completed, thrust blocks have been in place for at least five days, and the trench has been partially backfilled, leaving the joints exposed for examination, the pipe shall be filled with water to expel all air. The pipeline shall be subjected to a test pressure of 100 psi or 150 percent of the working pressure, whichever is greater, for a period of at least one hour. Each valve shall be opened and closed several times during the test. The exposed pipe, joints, fitting, and valves shall be examined for leaks. Visible leaks shall be stopped or the defective pipe, fitting, joints, or valve shall be replaced.

3.2.2 Leakage Test

The leakage test may be conducted subsequent to or concurrently with the pressure test. The amount of water permitted as leakage for the line shall be placed in a sealed container attached to the supply side of the test pump. No other source of supply will be permitted to be applied to the

pump or line under test. The water shall be pumped into the line by the test pump as required to maintain the specified test pressure as described for pressure test for a 2 hour period. Exhaustion of the supply or the inability to maintain the required pressure will be considered test failure. PE pipe can experience diametric expansion and pressure elongation during initial testing. The manufacturer shall be consulted prior to testing for special testing considerations. Allowable leakage shall be determined by the following I-P formula:

$L = NDP/K$ Where:

L = Allowable leakage in gallons per hour.

N = Number of joints in length of pipeline tested.

D = Nominal diameter of the pipe in inches.

P = Square root of the test pressure in psig.

K = 7400 for pipe materials.

At the conclusion of the test, the amount of water remaining in the container shall be measured and the results recorded in the test report.

3.2.3 Retesting

If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted until the results of the tests are within specified allowances, without additional cost to the Government.

-- End of Section --